A CRITICAL ANALYSIS OF THE FACTORS INFLUENCING ANTENATAL AND POSTNATAL SELF-REPORTED DIETS OF PRIMAGRAVID WOMEN

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ABSTRACT

The study examines the perceptions of diet and nutrition and measures the nutritional consumption of primagravid women, during pregnancy and post partum. The aim was to establish the nutritional knowledge and nutritional status of such women, based on self-reported diet diaries. Quantitative and qualitative data were collected from a sample of 39 primagravid women recruited from five general medical practices in Wiltshire, England, United Kingdom. Thirty-nine participants took part in the study during the first trimester of pregnancy and 37 continued in the study to six months post partum, keeping a self-reported diet diary for one week at the end of the first trimester, third trimester and six months post partum. At the same points in time, participants completed a Likert scale questionnaire based on the Theory of Planned Behaviour (Ajzen, 1985) that measured attitudes and intentions towards eating habits during pregnancy. Interviewer administered questionnaires were conducted at each time point to assess the participants socio-economic status and nutritional knowledge. The self-reported diet diaries were analysed using Dietplan software that measures nutritional intake based on Recommended Daily Allowances (RDAs). Results indicate that some women had under-consumption of a number of nutrients pre and post partum while some participants over-consumed a number of nutrients during their pregnancy. There were gaps in the nutritional knowledge of some participants, suggesting that revised nutritional educational policies should be introduced. Time was the major determinant of poor nutrition post partum, suggesting a need for time management and educational interventions for primagravid women. Small hospitals with Baby Friendly Accreditation were rated more positively than large general hospitals. These results suggest a need for larger hospitals to work towards Baby Friendly Accreditation. The study ascertained that there is a scarcity of research into the effects of over-consumption of nutrients during pregnancy and a recommendation is made to address this issue. A further recommendation is that modifications should be made to the Theory of Planned Behaviour (Ajzen, 1985) on the basis of the findings of this study which suggest that the model should be looked at in reverse, as the influence of a number of factors reduced over time. A modified model of the Theory of Planned Behaviour (Ajzen, 1985) is proposed.

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CONTENTS

List of tables

List of Figures

List of Appendices

List of Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ASSIA	Applied Social Sciences Index and Abstracts
ANOVA	Analysis of Variance
BMI	Body Mass Index
BPS	British Psychological Society
CHD	Coronary Heart Disease
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COMA	Committee on Medical Aspects of Food Policy
DHSS	Department of Health and Social Security
DoH	Department of Health
DRVs	Daily Recommended Values
EAR	Estimated Average Requirement
EFA	Essential Fatty Acids
FAE	Fetal Alcohol Effect
FAO	Food Agriculture Organisation
FAS	Fetal Alcohol Syndrome
GCSE	General Certificate of Secondary Education
GPs	General Practitioners
HBM	Health Belief Model
hCG	human chorion gonadotropin
HDN	Haemorrhagic Disease of the Newborn
HIV	Human Immunodeficiency Virus
IDD	Iodine Deficiency Disorder
IOM	Institute of Medicine
IQ	Intelligence Quotient
ISD	Information and Statistics Division. A Division of the Common Services Agency
LCPUFAs	Long-chain Polyunsaturated Fatty Acids
LREC	Local Research Ethics Committee
MAFF	Ministry of Agriculture, Fisheries and Food
MAS	Milk-alkali Syndrome
MIDIRS	Midwives Information and Resource Service

MRC	Medical Research Council
NACNE	National Advisory Committee on Nutritional Education
NCHS	National Center for Health Statistics (USA)
NESS	National Evaluation Sure Start
NHS	National Health Service
NTDs	Neural Tube Defects
NVP	Nausea and Vomiting in Pregnancy
ONS	Office for National Statistics
PMT	Protection Motivation Theory
RAF	Royal Air Force
RDA	Recommended Daily Allowance
RNI	Reference Nutrient Intake
SDINSDP	Sub-committee on Dietary Intake and Nutritional Supplements During Pregnancy
SNSWGDP	Sub-committee on Nutritional Status and Weight Gain During Pregnancy
SPSS	Statistical Package for the Social Sciences
UK	United Kingdom
UNICEF	United Nations' International Children's Emergency Fund
UNU	United Nations' University
USA	United States of America
WHO	World Health Organisation

Introduction

The United Kingdom (UK) ranks eighteenth in the world for early childhood mortality and is considered by the United Nations Development Programme to be one of the most unequal industrialised nations in the world, with regard to child health (UNICEF, 2002). Because of concerns over the inequalities in health, the British Government commissioned the Acheson Report on Inequalities in Health in the UK (Independent Inquiry into Inequalities in Health, 1998), to investigate the reasons for health inequalities in the UK and make recommendations for improvements in access to health. As a result of the Acheson Report policies were implemented to narrow the gap in inequalities in health in the UK resulting in the national strategy for England, *Saving lives: Our Healthier Nation* (DoH, 1999). *Inequalities in Health. From Vision to Reality* (DoH, 2001) has reported on the implementation of these policies such as Sure Start, which targets children in poverty from 0-4 years. There are currently no Sure Start programmes in Wiltshire and the National Evaluation of Sure Start makes no reference to nutrition during pregnancy and breastfeeding with regard to child development (NESS, 2003). The main targets of *Saving lives: Our Healthier Nation*, are to reduce the number of deaths caused by cancer, coronary heart disease (CHD), stroke and accidents by the year 2010. There is a growing body of valid and reliable evidence to suggest that the nutrition received in utero and early life can affect health in later years (Barker, 1998; Harding, 2001). Despite this evidence there do not appear to be any policies or recommendations that specifically address fetal and maternal nutrition. Some research indicates that the fetus is programmed, that is, any alteration in maternal nutrition during a critical period of fetal development, can change the physiology and metabolism of the body to such an extent that there may be lasting effects on the developing individual (Barker, 1994; Lucas, 1994; Langley-Evans & Jackson, 1994; Harding, 2001). Research has shown that these alterations to the fetal physiology and metabolism may be responsible for the onset of disease in later life (Barker, 1998; Godfrey & Barker, 2003). A critical or sensitive period is one where the development can only be carried out within a given time. If there is nutritional deprivation of any kind, then once the critical period has passed, there can be no catch-up period and the harm is permanent (McCance & Widdowson, 1974; Harding, 2001). Critical periods for the developing embryo/fetus occur early in the pregnancy. Barker's (1998) findings have suggested that people who had low birthweight (<2500g (King & Harrison, 2003)) are more at risk of developing disease in later life, for example, cardiovascular disease and related disorders such as hypertension. Moreover, low birthweight has been reliably associated with increased mortality and morbidity in the first year of life (Scottish Low Birthweight Study Group, 1992)

Research Problem

Maternal nutrition and the consequences of low birthweight are of particular interest in the UK for a number of reasons. Findings of the Acheson Report (1998) have shown that women in Britain are more likely than men to be deficient in nutrients such as iron, calcium, and folate, particularly amongst the lower socio-economic classes. These nutrients are important for healthy fetal development and subsequent lactation. Concern has been raised about the incidence of dieting (losing weight or maintaining low body weight) amongst British women, particularly as there is considerable evidence to suggest that a woman's physique, before and during pregnancy, can have long term effects on the health of the next generation (Godfrey, et al., 1994; Campbell, et al., 1996; Forsen, et al., 1997; Clark, et al., 1998; Ravelli, et al., 1998). Children of mothers with low body mass index <25 (weight/height^2, kg/m^2) are more likely to develop non-insulin dependent diabetes and raised blood pressure in later life (Campbell, et al, 1996; Ravelli, et al., 1998; Ong & Dunger, 2002).

Further findings of the Acheson Report suggested that infants born to women in the lower socio-economic classes are more likely to have lower birthweight than those in social classes I and II (Office for National Statistics, 1997). The Acheson Report (1998) recommended implementation of policies, which would increase availability and accessibility of foodstuffs to the lower social classes. This recommendation does not, however, take account of nutritional deficiencies as a consequence of dieting, and therefore may not be related to poor access to affordable food. Recommendations have also been made by the Acheson Report (1998) to improve nutritional education within schools by including food budgeting and food preparation in the curriculum. Nonetheless, these recommendations are not specific, and to date such nutritional education comes under the auspices of Food Technology or Child Development, which are General Certificate of Secondary Education (GCSE) options within Design and Technology, and not compulsory core subjects at Key Stage 4 (Qualifications and Curriculum Authority, 2003).

It is widely established that breastfeeding is beneficial for the mother and child (Heinig & Dewey, 1996; 1997; WHO/UNICEF, 1989; UNICEF UK Baby Friendly Initiative, 1994; Oddy, et al., 2003). Statistics show that the incidence of breastfeeding in Britain is lower than desired, despite the fact that breastfeeding is widely advocated (Fairbank, et al., 2000).

There is a view amongst evolutionary theorists that mothers have an instinctive urge to nurture and care for their young in order to facilitate genetic survival to the next generation (Dawkins, 1989; Horgan, 1995). This is a controversial area and psychological theories, such as Social Learning Theory, may provide a more acceptable explanation for the nurturing behaviour of a mother (Bandura, 1977). Social Learning Theory is based on the principle of vicarious reinforcement, that is, individuals are more likely to imitate behaviour they see being rewarded. However, behavioural theorists have established, that with the best of intentions there are many barriers to action (Ajzen, 1991). The Theory of Planned Behaviour, which developed from the Theory of Reasoned Action, assumes that factors, other than attitudes, determine individual behaviour (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Ajzen, 1985; Messer & Meldrum, 1995). Such a factor would be the subjective norm, which is the influence of significant others. A significant other is someone important to the individual, such as partner, family member and/or doctor or health professional. If the individual perceives the significant other as wanting them to engage/not engage in certain behaviour (known as the normative belief), then they will wish to engage/not engage in certain behaviour, in order to please the significant other (known as motivation to comply).

In the light of policies currently being implemented as a result of the Acheson Report (1998) such as Inequalities in Health. From Vision to Reality (Acheson & DoH, 2001) it is important that research is undertaken in order to establish what, if any, policies need to be implemented with regard to maternal and fetal nutrition.

Aim

The fundamental purpose of this research is to study the perceptions of diet and nutrition and the self-reported diets of primagravidae during pregnancy and post partum in order to establish the nutritional knowledge and self-reported nutrient intake of the women in the sample. This will be achieved by means of self-reported diet diaries. In addition, intended and self-reported nutritional intake behaviour with regard to nutrition and breastfeeding will be studied to investigate any possible barriers to action. On the basis of the conclusions of this study, recommendations will be made for improvements, if necessary, to government nutritional policies for women of child-bearing age in the UK.

Objectives

The objectives of this study are to:

1. Critically examine research findings, which demonstrate the importance of nutrition during pregnancy and determine what currently constitutes good nutrition pre-conceptually, during pregnancy and lactation. Identify areas of controversy within current fetal nutrition research;
2. Learn what the intentions of a sample of primagravidae are towards eating habits by using The Theory of Planned Behaviour and if those intentions change over time. Take account of the perceptions of good and bad nutrition during pregnancy and the actual nutritional knowledge of the participants on which these intentions are based;
3. Investigate possible obstacles to action and quantify what the participants report they are eating during their pregnancy and post

partum, via their diet diaries, in order to establish the nutritional status of the participants during the pregnancy and post partum based on these reports. Offer suggestions for bridging any gap between intention and action with regard to healthy eating during pregnancy and post partum;

4. Measure the level of nutritional knowledge of the participants, pertinent to pregnancy and post partum, in order to highlight possible gaps in health education related to fetal nutrition and breastfeeding;
5. Discover the source and quality of nutritional advice offered to the participants in the sample, during pregnancy and post partum, together with a measure of the participants' perceptions of such advice. Suggest proposals for improvements, if necessary, in the quality and timing of advice offered by health professionals, during pregnancy and post partum;
6. Ascertain intention and incidence of breastfeeding and determine reasons for:
   (a) not commencing to breastfeed, and;
   (b) failure to continue to breastfeed until the infant is six months old. Current recommendations are that infants should be exclusively breastfed for six months (UNICEF UK Baby Friendly Initiative, 1994; Oddy, et al., 2003). Make recommendations, if necessary, for improvements in the uptake and duration of breastfeeding. This study will measure the uptake and duration of breastfeeding within the sample, comparing intention with action and exploring possible barriers to action with regard to breastfeeding.

Method

The objectives were achieved by interviewing a number of primagravidae during the course of their pregnancy and six months post partum using Likert scale questionnaires, interviewer administered interviews and diet diaries. Multi-methods were employed, generating both quantitative and qualitative data and examining the two data sets.

Target population and details of sample

Primagravidae (women in their first pregnancy) have been chosen rather than multigravidae (women who have been pregnant one or more times previously) to participate in this study for two reasons:

a. A first pregnancy is a major event for the expectant mother, whether planned or unplanned. It is considered primagravidae may be more idealistic than multigravidae in their approach to the ensuing pregnancy because it is a new experience;
b. Assuming they are not caring for children of a partner who has children from a previous relationship, primagravidae will be unhampered by having to care for other offspring and will therefore be more able to participate in the study.

The diets of primagravidae from five general medical practices in North and West Wiltshire, South West England, were examined, in order to assess the quality of nutrition the mother and developing infant are receiving. The area in North Wiltshire is predominately working class, with pockets of deprivation, which are ranked among the twenty-five per cent most deprived in England (Hays, Collins & Landeryou, 2001). These areas were chosen for their geographical location because they were practical and convenient to the research for recruiting prospective participants.

This study is unique in that it has recruited participants directly from general practices during the first trimester. A comprehensive literature search has been unsuccessful in providing evidence of similar studies carried out in general practices or antenatal clinics. The majority of studies use participants at antenatal clinics where women do not usually present themselves until they have entered the second trimester. This has consequences for such studies, in that any data relating to the first trimester would be collected retrospectively and therefore may be inaccurate. The first trimester is a very important stage in the pregnancy as it is the time of critical development of the fetus (Little, 1990).

Methodology

Multi-methods were employed in this study to facilitate collection of quantitative and qualitative data. It is primarily an empirical study, which relies on quantitative data and statistical analyses to produce results that are objective and therefore more robust. Qualitative data was included thus offering the opportunity for richer, more in depth data. These qualitative data were mainly analyses of participants' perceptions of the quality of nutritional advice offered by primary care professionals. Participants were recruited from general practices during the first trimester of their pregnancy when they visited their general practitioner (GP) to arrange a booking-in appointment. A booking-in appointment is made at the hospital where the expectant mother is to be delivered of her child, when a medical checkup and discussions concerning delivery arrangements take place. A pilot study was initially carried out using six primagravidae to test the method of recruitment and the robustness of the research tools. For the main study, 39 participants were asked to keep a diet diary for one week, during the end of the first and third trimesters and at six months post partum. These diaries were used to assess the nutritional status of each participant over the three time periods. The participants were also interviewed at these junctures using interviewer administered questionnaires. These questionnaires were used to collect socio-economic data and measure the participants' level of nutritional knowledge and beliefs about the efficacy of certain foods. In addition, perceptions of nutritional advice were noted, together with perceptions of the participants' hospital stay regarding the birth of their infant and subsequent experience of breastfeeding. A Likert scale questionnaire was employed to facilitate interpretation of the participants' intentions, with regard to nutrition during pregnancy and post partum, for themselves and their child. This Likert scale questionnaire was based on the Theory of Planned Behaviour (Ajzen, 1985). It was conducted to ascertain if the participants' intentions, with regard to nutrition, changed over time and what factors, if any, influenced those intentions.

Outline of Dissertation

In order to determine what currently constitutes sound nutrition during pregnancy and breastfeeding, a range of research studies will be critiqued and synthesised. This will form Chapter One of the dissertation. This will be achieved by undertaking a literature review of the debates and issues surrounding fetal and maternal nutrition, interpreting and synthesising such research in order to identify gaps within the area of knowledge and, assuming there are gaps, provide justification for this study. This review will underpin the objectives of this research by providing the basis for analysis.

A literature review of the psychological theories surrounding intention and action, with particular reference to dietary behaviours will be undertaken in Chapter Two. Such theories are known as social cognition theories, which address both the psychological dynamics influencing health behaviour and the methods of promoting behaviour change. The chapter commences with various definitions of what constitutes health behaviour, followed by an evaluation of a number of models and theories. Such an evaluation provides justification for the theoretical model forming the foundation of this research, namely the Theory of Planned Behaviour.

A full description of the choice of method used in this research will be given in Chapter Three by addressing the methodological and ethical issues that affect the decisions taken. A detailed discussion of the theoretical and methodological issues that arise in patient-centred research will be included. Practical and ethical dilemmas will be outlined with careful consideration of the ethical guidelines set out by the Local Research Ethics Committee (LREC) (1995), from whom initial ethical consent to conduct the study was sought. In addition, the ethical guidelines of the British Psychological Society (1993), the Medical Research Council (2000) and the British Sociological Association (2002), are closely adhered to. There will be an overview of the research tools used, describing and justifying the techniques used or abandoned. The various methods of data collection will be considered, illustrating how the final research design decisions are arrived at. There will be clear justification for those decisions, considering in particular, validity, reliability and the benefits of a multi-method approach.

A full description and analyses of collated data from the sample, relating to pregnancy and diet, will be provided by using descriptive and inferential statistics to demonstrate the findings of those data. This will form the basis of Chapter Four. Such data analyses are of use in providing evidence of the socio-economic factors of participants and their infants, in order to highlight any class differences, which may be cause for concern to health professionals and policy makers. These results will serve to demonstrate potential gaps in health education related to fetal nutrition and breastfeeding. Evidence will be provided of levels of nutrition within the sample, in order to indicate possible areas of concern to health professionals and policy makers.

Such analyses provide a basis for interpretation and full discussion of the findings and their relevance to the research literature in Chapter Five. Limitations of the study will be addressed, making recommendations for improvements if the study was to be undertaken using a larger sample.

Conclusions will be drawn from the synthesis of the results and findings in terms of the aim and objectives of this study. Recommendations will be made on the basis of these conclusions. These recommendations will include a suggestion for a modified version of the Theory of Planned Behaviour for use in research on diet during pregnancy and post partum. This modified version will suggest the Theory of Planned Behaviour might be better utilised by addressing barriers to behaviour change in reverse of those suggested by the original model. Such conclusions and recommendations will form the basis of Chapter Six.

Chapter One

Literature review of research related to nutrition during pregnancy

Introduction

This chapter reviews the research surrounding the effects of nutrition on the mother and developing child, both prenatally and post partum. Part I deals with the debates encompassing prenatal nutrition. Research relating to the pre-conceptual health of the mother has been evaluated, followed by an examination of the debates surrounding the effects of nutrition on the pregnant woman and developing fetus. This evaluation includes research into the long-term effects on the individual, of nutrition in utero. A discussion of the beneficial and adverse effects of important nutrients is presented, highlighting medical conditions, which can occur during pregnancy. Such medical conditions may affect the health of the mother and/or child during gestation and have been identified as related to the intake of specific nutrients. An examination of current nutritional recommendations for pregnant women is included. Part I concludes with a synopsis of current recommendations regarding food consumption during pregnancy. Part II addresses issues related to breastfeeding. There is a critique of the debates surrounding the benefits and possible health costs to the mother and child. This critique is followed by a discussion of the development of the Baby Friendly Hospital Initiative in the UK (UNICEF (United Nations International Children's Emergency Fund now known as United Nations' Children's Fund) UK Baby Friendly Initiative, 2003). Part II concludes with the current recommendations for healthy nutrition of the infant up to six months of age. The chapter concludes with a summary of the salient findings relevant to Objective 1 of this study, which was to critically examine research findings relevant to good nutrition pre-conceptually, during pregnancy and lactation. There is also an update of the relevant literature relating to pre and post natal infant nutrition.

Part I Pre-natal nutrition

1.1 Pre-conceptual nutritional health

The Acheson Report (1998) recommended that improving the diet of women and girls would rapidly improve the health of the next generation. This recommendation was based on evidence to suggest that inequalities in nutrition can influence the health of women and children (Law, et al., 1993; Godfrey, et al., 1994; Campbell, et al., 1996; Forsen, et al., 1997; Clark, et al., 1998; Ravelli, et al., 1998). In order to bring about rapid benefits to mother and child, a logical starting point is to address the pre-conceptual health of females of child-bearing age. It has been suggested that nutritional advice, in relation to the pre-conceptual period, is usually only sought when there appear to be problems conceiving a child (Coad, 2003). Nevertheless, there is a considerable body of evidence to suggest that pre-conceptual nutrition has far reaching consequences for the healthy development of the individual throughout the life cycle. Much of the research relating to pre-conceptual nutrition has centred on:

1. Neural tube defects (NTDs);
2. The effects of over-consumption of Vitamin A;
3. Zinc
4. Alcohol.

Neural tube defects (NTDs)

NTDs are among the most prevalent congenital abnormalities, with an average incidence in the UK of 1:200 (Department of Health, (DOH) 2000). Were it not for antenatal screening and selective termination, the figure would be much higher in the UK, with an estimate of 600-1200 affected births (Coad, 2003). The neural tube is an open tissue tube that later develops to form the brain and spinal cord. After the brain and spinal cord have formed, between day 21 and day 27, post conception, the neural tube closes (Van Allen et al., 1993; Sizer & Whitney, 1997). On occasions, this tube does not close, and NTDs may result. Such defects are spina bifida, wherein the tube has not closed caudally, or anencephaly, where the tube has not sealed cranially (O'Rahilly & Muller, 1994; Coad, 2003). Current recommendations are that women intending to become pregnant should take Folic Acid supplements of 400mcg per day some weeks prior to becoming pregnant and for the first twelve weeks of the pregnancy (Department of Health, 2000). Thereafter, they should take at least 300mcg daily via their diet, eating folate rich foods such as Brussels sprouts, fortified breakfast cereals and bread (Czeizel and Dudas, 1992). The average folate intake per person in the UK is considered to be about 240μg per day (MAFF, 1999). This is thought to be due to increased consumption of fruit juice, fruit and fortified breakfast cereals (Coad, 2003). This may not be the case in the lower-socio-economic groups, where financial constraints may limit their availability. Moreover, women who consume a low calorie diet, may not have the estimated daily intake of folic acid. Such women who consume a nutritionally poor diet are considered to be at increased risk of a NTD affected pregnancy (Wald, 1994). Because not every pregnancy is planned, the UK government recommended that breakfast cereal and bread be fortified with folic acid (MRC Vitamin Study, 1991; DoH, 2000). Findings indicate that administering extra folic acid to women dramatically reduces the incidence of NTD. Folic acid interventions which were most successful, administered 400μg folic acid daily (Scott, Kirke, Molloy, et al., 1994). Furthermore, since the mandatory fortification of grain products with folic acid in the United States of America (USA), the occurrence of NTDs has declined by up to 20 per cent (Wise, 2001). These recommendations are based on extensive research into the causes of NTDs, which occur in the early stages of pregnancy (MRC Vitamin Study, 1991; Schorah and Smithells, 1991; DoH, 1993; Thomas, 1994; Barasi, 1997). It is suggested that folic acid may be correcting a folate deficiency or overcoming a folate metabolic block. Research carried out by Kirke et al (1993) examined both these aetiologies, comparing women who had borne a child(ren) with NTDs with those who had had a normal pregnancy. This was a comprehensive study looking at over 50,000 blood samples, collected over a four-year period. The findings suggest a metabolic block in folate metabolism, as those who had given birth to a NTD child had lower levels of cobalamin (Vitamin B_{12}) than controls. Thus, the low levels of cobalamin interfered with folate metabolism (Scott Kirke, et al, 1994).

The belief in a causal relationship between folate supplements, and the reduction in NTDs, is controversial. Panels from the SNSWGDP (Subcommittee on nutritional status and weight gain during pregnancy) and SDINSDP (Subcommittee on dietary intake and nutrient supplements during pregnancy) (1990) concluded that scientific evidence was not sufficient to make recommendations regarding the peri-conceptual use of vitamins and minerals in an attempt to prevent NTDs. Conversely, there is a body of scientific evidence in support of supplementation. Smithells, et al., (1981) and Laurence, et al., (1981) reported a reduction in NTDs when folate was given before and after conception to women, who had already given birth to a child with a NTD. The Medical Research Council (MRC) Vitamin Study Research Group (1991) found a 71 per cent reduction of NTDs in pregnancies where the mother had received 4 mg of folic acid pre-conceptually and through the first trimester of pregnancy. This evidence is substantiated by a statistically significant positive result of a large study of 1,817 women with a previous history of NTD infants. Of the women who received folate supplements, six gave birth to a child with a NTD, compared with 21 born to women who had not received folate supplements (MRC Vitamin Study Research Group, 1991). The British Isles Network of Congenital Anomaly Registers was set up in 1998, and figures show that no decline in the rate of NTDs was reported after publication of the results of the MRC Vitamin Study in 1991, or the launch of the Health Education Authority initiative in 1996 (Abramsky, et al., 1999). Various suggestions have been put forward for these findings, including that the diet of women had improved before the 1990s (Abramsky, et al, 1999). This contradicts the body of evidence to imply that many women have poor nutrition (Godfrey, et al., 1994; Pryer, et al., 1994; Clark, et al., 1998; The Acheson Report, 1998). Suggestions for the lack of continued improvement in the reduction of NTDs include:

(i) Women are not taking folic acid supplements; and,

(ii) Women are not aware of the benefits of taking folic acid supplements (Abramsky, et al., 1999).

These conflicting results may be indicative of the influence of environmental factors other than the need for folic acid, thus more research is required before such findings are conclusive.

Vitamin A

As the role of folic acid is controversial, there is a need for caution, as over-consumption of nutrients can be harmful, as in the case of Vitamin A. Determining safe amounts of Vitamin A consumption in pregnant women has also been the cause of recent concern. Animal research has suggested that ingestion of large amounts of Vitamin A by the mother can result in abnormalities of the brain, skeleton and eyes in the infant, but this may be species specific, and the relationship to human abnormalities is unclear (Conning, 1991). A Spanish study found an increase in birth defects amongst women who had taken Vitamin A supplements of between 6,000 and 167,000 μg daily during the first eight weeks of pregnancy (Martinez-Frais & Salvador, 1990). However, recent reviews of current animal research, using non-human primates, have suggested that a dose of 30,000 IU per day should not be considered teratogenic (a teratogen is anything that causes abnormality in the developing fetus) in man (Miller, et al., 1998; Wiegand, Hartmann & Hummler, 1998). A further review of the literature suggests that more research is necessary to more clearly define beneficial and risk levels of Vitamin A to the developing child (Dolk, et al., 1999). Furthermore, it is estimated that there have been <20 reported teratogenic cases, which can be related to Vitamin A consumption (Martinez-Frais & Salvador, 1990; Azais-Braesco & Pascal, 2000). Moreover, eradication of Vitamin A deficiency is now a major health goal of UNICEF and WHO (Sommer, 1998). Severe deficiency of Vitamin A is known to negatively affect the immune system and cause blindness (xerophthalmia). In areas where Vitamin A deficiency is prevalent, supplements are recommended for infants, children and pregnant women (Ross, 2002). Despite the lack of evidence, the DoH has been cautious, and recommends that women who are pregnant, or are considering becoming pregnant, should not take Vitamin A supplements (DoH, 1992). In addition, regardless of the fact that there is no research to suggest possible ill effects of liver consumption, the DoH (1992) advises that such women do not consume liver because of its high content of the retinol form of Vitamin A. Further recommendations are that levels in excess of 3300 μg per day are considered to be over-consumption. Fish liver oils such as cod and halibut should also be avoided because of their high amounts of the retinol form of Vitamin A (DoH, 1993). The evidence is problematic, in that there is no general agreement regarding safe amounts of Vitamin A. In view of the British Government's concern about the poor nutrition of some British women, and the uncertainty of the evidence surrounding safe amounts of Vitamin A, more research needs to be carried out in order to accommodate those who may be at risk of Vitamin A deficiency.

Zinc

Levels of zinc consumption are also considered important in the prevention of teratogenesis. Severe zinc deficiency in rats was found to have a teratogenic effect, but in humans the effect is unclear (Hurley & Mutch, 1973). There is limited evidence to show that severe maternal zinc deficiency may be associated with neural tube defects (NTDs) (Tamura & Goldenberg, 1996). Some studies have methodological problems such as a very small sample size (n=6) (Czeizel & Dudas, 1992). Moreover, other studies that found a positive effect of zinc supplementation on fetal growth were carried out on migrant groups of low socio-economic status (Castillo-Druan & Weisstaub, 2003). However, the findings suggest that early post-natal zinc supplementation may improve growth in low birthweight infants (Castillo-Druan & Weisstaub, 2003). It would seem that the degree of depletion is critical and only severe depletion results in teratogenesis (Malhotra, et al., 1990). A recent double blind study of zinc supplementation was carried out using 355 five-year-old children (Tamura, et al., 2003). The zinc supplementation had been administered prenatally during the second half of pregnancy. Results suggest no difference in the psychomotor development of the two groups of children. This evidence cannot be viewed as conclusive as it is a relatively small study which is not a national cross–section. Furthermore, there may have been an element of bias in that those who participated did not have zinc deficiency in the first place and some of those who declined to participate may have experienced zinc deficiency. In Britain, zinc deficiency would only be minimal as animal products are a significant source of dietary zinc and most Britons eat animal products. WHO (1996) states that high zinc availability can be found in diets which are low in cereal fibre and phytic acid, that is, a phytate/zinc ratio <5 and containing adequate animal or fish protein. This is very similar to the British diet, therefore it is unlikely that Britons will be deficient in zinc. There is an increase in the number of vegetarians who eat unprocessed foods and this could be a factor in zinc deficiency. WHO (1996) describes a diet consisting of unrefined cereals, high intake of soya products and high calcium intakes that are more likely to have low zinc availability. This is untypical of the British diet. Up-to-date research suggests that the role of zinc in prevention of NTDs remains unclear (Velie, et al., 1999). A review of current zinc deficiency research has suggested more research is needed to improve understanding of nutrient-nutrient interactions (Christian, 2003). Thus more research needs to be carried out into the effects of zinc deficiency.

Alcohol

In addition to nutrient levels, there is also concern about alcohol consumption preconceptually. Current recommendations are that women wishing to become pregnant, or who are pregnant, should limit their alcohol intake to 8 units per week, or no more than 2 units per day (University of Sheffield Centre for Pregnancy Nutrition, 2003). There is evidence to suggest that drinking more than five units per week adversely affects female fertility, although just how much more must be consumed in order to affect fertility is a matter of some debate. A large European study (n >4000 couples) showed indications that women with larger intakes of alcohol had more trouble conceiving (Olsen, et al., 1997). This study cannot be considered conclusive because, as the authors themselves point out, comparisons were made on varying levels of alcohol rather than comparing the couples with teetotal couples. A follow up study carried out in Denmark (n= 430 couples) found a reduction in female fecundity with a low alcohol intake (<5 drinks per week), although further research evidence is needed before these results can be conclusive (Jensen, Hjollund et al., 1998). Until there is more evidence of the effects of alcohol on fecundity, Hruska, et al., (2000) suggest that limiting or avoiding alcohol whilst trying to conceive should be encouraged.

1.2 Effects of consumption levels of specific nutrients during pregnancy

The effects of alcohol consumption during the course of the pregnancy are also cause for concern, as are the effects of consumption levels of various nutrients. The Acheson Report (1998) has indicated concern regarding the low intake of certain nutrients, identified as important to the healthy development of the fetus. There is debate surrounding the precise function of these and other nutrients in pregnancy. This section considers the current controversies surrounding alcohol consumption, iron, calcium, salt, vitamin D, vitamin K, lipids and fatty acids, glucose, and zinc with regard to fetal development and pregnancy.

1.3 Alcohol

Although alcohol is not technically considered to be a nutrient, apart from the Vitamin B contained in beer and stout, the effects of alcohol consumption before and during pregnancy can be far-reaching. Current recommendations are that a pregnant woman can have up to four units over a week (DoH, 1991; National Childbirth Trust, 1994). The DoH's nutritional recommendations for pregnant women have not changed since 1991 and this is the most up-to-date publication. A leaflet entitled Healthy Eating During Pregnancy produced by Swindon and Marlborough NHS Trust (undated) recommends that alcohol is avoided during pregnancy and no more than four units per week should be consumed. It does not explain how much a unit is. A further leaflet produced by The National Childbirth Trust (1994) states that excessive amounts of alcohol during pregnancy may harm the baby but that the "odd glass of wine or beer… is not known to cause any damage" (National Childbirth Trust (1994), Healthy Eating For Pregnancy, page 11). It does not state what constitutes 'the odd glass'. A booklet produced by Farley's states precisely what a unit consists of, that is, half a pint of beer or small glass of wine or single measure of spirits. (Farley's Your Healthy Pregnancy, 1995). Emma's Diary produced by the Royal College of General Practitioners states that it is advisable to have no more than one unit of alcohol per day, but does not state what constitutes a unit (Mackonochie, 1997). A possible consequence of too much alcohol consumption during pregnancy is Fetal Alcohol Syndrome which is currently considered to be a major cause of mental retardation in the Western world (Murphy-Brennan & Oei, 1999).

Fetal Alcohol Syndrome

Oxygen is vital to the development of the fetus, in particular the nervous system (Sizer & Whitney, 1997). Alcohol ingested into the bloodstream can interfere with the supply of oxygen to the fetus via the umbilical cord. In addition, alcohol can slow cell division, thereby reducing the number of cells produced, and causing abnormalities to that reduced number (Sizer & Whitney, 1997). This can have a profound effect on the developing embryo in the early stages, as 100,000 brain cells are growing per minute. Malnutrition can be caused by alcohol because it interferes with the transfer of nutrients from the placenta to the fetus in a number of ways. Alcohol disrupts glucose and oxygen supply to the fetus by interfering with the function of the placenta. In addition, the alcohol itself crosses the placenta directly to the fetus. Why alcohol can have a toxic effect on the fetus is not fully understood. What is known, is that ethanol (alcohol) passes freely across the placental barrier, which may directly affect fetal cell development. It may also be that acetaldehyde, which is the first metabolite of ethanol, is the main teratogen. Conversely, the alcohol may affect maternal metabolism, which could, in turn affect the mechanisms of nutritional intake, absorption and utilisation (Gray & Buttriss, 1994). Beattie (1992) suggests that the teratogenic effects of alcohol could actually be related to a zinc deficiency as discussed in section 1.2. There is substantial evidence to suggest that alcohol consumption can affect the development of the fetus to such a degree that Fetal Alcohol Syndrome (FAS) may develop (Wright, Toplis & Barrison, 1983; Beattie, 1992; Spohr, Willms & Steinhausen, 1993; Stromand & Hellstrom, 1996). FAS is a term devised by Jones & Smith (1973) to describe the neuro-developmental features seen in babies born to women with chronic alcoholism. Features of FAS include:

- pre-natal growth retardation
- post-natal growth retardation
- cranio-facial abnormalities characteristic of the condition, such as:
  small head with receding forehead; short, upturned nose with flat bridge; receding and underdeveloped jaw; downward slanting eyes with drooping eyelids; small in size and with extra skinfolds; may be short-sighted with an inability to focus; ears may be malformed and lips are thin and flat without a groove on the upper lip; low Apgar score (an Apgar score is a system of scoring an infant's physical condition right after birth. Heart rate respiration, muscle tone, response to stimuli and colour are ranked 0,1,2. A low score indicates that medical attention is required to facilitate survival)
- cardiac defects
- skeletal defects
- neurological abnormalities
- developmental abnormalities (Sizer & Whitney, 1997).

Spohr et al. (1993), in their ten-year study of children with FAS, found that although the characteristic facial malformations may diminish over time, the small stature persists. However, the most serious outcome of the condition is persistent mental retardation despite enrichment programmes. Spohr et al. (1993) estimate the incidence of FAS to be 1-2% per 1,000 live births dependent on the population being studied. The relationship between alcoholism and poverty, poor nutrition and other socio-economic factors should also be considered, as these will have a bearing on fetal development. It has been found that babies born to women who are socially disadvantaged, are more likely to have reduced growth in utero, and babies born into social classes IV and V, are on average, 130g lighter than babies born into social classes I and II (Office for National Statistics, 1997). Safe amounts of alcohol during pregnancy are the subject of much debate. Wright et al (1983) found little evidence of an association between pregnancy outcome and moderate alcohol intake (50-700g per week). However, they and Beattie (1992) concluded that as the effects of moderate alcohol consumption are still unclear, the wisest course of action is to advocate total abstinence during pregnancy. Spohr et al (1993) consider that an intake of more than 10 units (80g) per day may result in infants with FAS or partial FAS. Partial FAS is known as Fetal Alcohol Effect (FAE) and its occurrence is estimated at a rate of 3.5 per 1,000 live births. Current evidence suggests that daily consumption of at least two drinks or periodic binge drinking during the early stages of pregnancy may result in fetal abnormalities (Jacobson, Jacobson & Sokol, 1994). Canadian meta-analysis of worldwide research over the last 30 years looked at over 130,000 pregnancy outcomes (Polygenis, et al., 1998). Moderate drinking was defined as more than two drinks per week and up to and including two drinks per day. Of the original 24 studies selected, only seven were considered methodically sound enough for inclusion in the study. Findings suggest that there is no correlation between moderate drinking and teratogenic effects. However, what must be considered is if the individual studies gave a fair representation, generally, of pregnancy outcome. For example, there may be evidence of congenital defects amongst some communities. Also worth considering is the age of the studies and if there is a difference in the incidence of defects over time, which may indicate that alcohol is or is not a contributory factor. There is also the question of reliability in any self-reporting study. Currently the Royal College of Psychiatrists (2002), recommends no more than two drinks per week. On the other hand the Royal College of Obstetricians and Gynaecologists (2003), recommend no more than one standard drink per day.

1.4 Iron

Current research suggests that optimum amounts of alcohol remain the subject of debate as in the case of iron consumption during pregnancy. There is some debate regarding the total iron costs during pregnancy. There does not appear to be an accurate and agreed estimate of the iron costs of pregnancy currently available. The estimate is influenced by the inclusion, or exclusion, of the expansion of red cell mass, and also what iron reserves are present at the start of the pregnancy (Hytten, 1991; Thomas, 1994). Garza (1993) stated that the approximate iron needs during pregnancy are 800-900mg. Thomas (1994) had a lower iron costs estimate - Table 1.1.

Table 1.1 Iron costs during pregnancy according to Thomas, (1994).

	Amount of iron
Fetus	300 mg
Placenta and cord	50 mg
Post partum blood loss	200 mg
Total 'cost'	550 mg
Less amenorrhoea	200 mg
Net 'cost'	350 mg

Notwithstanding that Thomas, (1994) does not appear to allow for breastfeeding, there is still a considerable difference between the estimations of the net costs of iron in pregnancy. This is taking account of the fact that if one assumes the mother does not breastfeed for any considerable time, she will have started menstruating again. On the other hand, McGanity, Dawson and Fogelman (1994) had different estimates - Table 1.2.

Table 1.2 Iron costs during pregnancy according to McGanity et al., (1994).

	Amount of iron
Fetus	230-370mg
Placenta and cord	30-170mg
Post partum blood loss	90-300mg
Lactation	0-5mg per day

The total cost over the fifteen-month period of pregnancy and lactation is therefore estimated to be between 420-1030 mg, not taking account of the post partum blood loss, which is counteracted by amenorrhoea. Furthermore, no allowance has been made for the additional iron needed for expanded blood volume and increased uterus size (McGanity, Dawson & Fogelman, 1994). These estimates do not appear to take account of possible caesarean births, which will result in a post partum blood loss, double that of a normal delivery

(Whitney & Rolfes, 1997). However, Forsum (2003) estimates the cost to be about 1000 mg, taken up by the fetus, placenta, increased maternal red cell mass and maternal basal iron losses. A plentiful supply of iron is necessary, as an expansion of red cell mass by about 40-50 per cent occurs after 12 weeks, drawing this requirement from the iron reserves (Rodwell Williams, 1986; Thomas, 1994). An unrestricted iron store is also necessary to replenish that lost by delivery and the requirements of the fetus. The fetal liver requires an adequate enough store to last for six months after birth, as breast milk lacks iron (Rodwell Williams, 1986; Whitney & Rolfes, 1997). At term, the concentration of iron in the fetal blood is double that of the maternal blood (Stacey, 1991; Harris, 1992). The significance of this is a matter of some debate, as some schools of thought believe the reduction of iron in the maternal bloodstream is to do with the increase in blood volume. This increase in blood volume during the first trimester, enables the mother to transport oxygen to the placenta and fetus via the blood circulation. Thus the mother's iron is diluted (de Swiet, 1991; Letsky, 1991). It is considered by some that these are natural adaptations to pregnancy and are misinterpreted. Therefore, the efficacy of prescribing iron supplements in order to restore the blood to its pre-pregnant state is questionable (Enkin, Keirse & Chalmers, 1989; Letsky, 1991; Thomas, 2001). Piper (1996) believes the fetus to be a true parasite for iron at the expense of the mother, so certain physiological changes are made in order to adapt to these new requirements. It is recognised that humans have the capacity to adapt iron absorption according to physiological demands and dietary supplies, although the diet overall will determine the amount of iron available (Cook, 1990). Studies have shown that iron absorption does increase during pregnancy, but results differ according to the methodology used (Whittaker, 1991). To conserve iron stores, menstruation ceases for the duration of the pregnancy. Iron absorption is greatly increased due to a rise in blood transferrin, which is the body's iron and iron-carrying protein (Whitney & Rolfes, 1997). It is believed that iron requirements can be met by mobilising existing iron stores and by increased intestinal iron absorption. The current Daily Recommended Values (DRVs) (DoH, 1991) recommendation for iron in adult women is 14.8mg-1, with no increase during pregnancy. A recent study found that low iron stores were strongly associated with multiparity, low socio-economic status and low Body Mass Index (BMI) (Robinson, et al., 1998).

Anaemia

Moreover, a more recent German study found evidence to suggest that low educational levels and low maternal age were risk factors for iron deficiency and anaemia in pregnancy. Anaemia in pregnancy affects about twenty per cent of women in industrialised countries (Haram, Nilsen & Ulvik, 2001; Hercberg, Preziosi & Galan, 2001). It is associated with fetal morbidity and mortality (Breymann, 2001; Gambling, et al., 2002). Bergmann, et al. (2002) recommend that deficiencies should be treated with supplements. Iron supplements are offered routinely in the UK to pregnant women (Thomas, 2001). A review of research relating to iron supplementation during pregnancy concluded that the benefits of iron supplementation are unclear. Treatment and prevention strategies therefore require more rigorous evaluation (Sloan, Jordan & Winikoff, 2002). A Cochrane Review of the literature relating to iron deficiency anaemia in pregnancy found inconclusive evidence on the effects of treating iron deficiency anaemia, due to the shortage of good quality trials (Cuervo & Mahomed, 2003).

1.5 Calcium

A further important nutrient during pregnancy is calcium. Calcium is in great demand during pregnancy as it is a key element in building the skeleton. Calcium absorption increases during pregnancy in order to meet the needs of the fetus (Misra & Anderson, 1990). When the fetal bones begin to calcify in the last trimester, the mother's stores are drawn upon and there is a massive shift across the placenta. During the final weeks, over 300mg are transferred everyday to the fetus (Purdie, 1989; Committee on nutritional status during pregnancy and lactation, 1990; Whitney and Rolfes, 1997). Currently the DoH (1991) does not recommend that pregnant women need consume extra calcium, other than the 700mg-1 for women aged 19-50 years and 800mg-1 for women aged 15-18 years. There is little available evidence of the consequences of calcium toxicity, but a relatively recent study found no adverse effects in women who received 2000mg-1 calcium supplements (Levine, et al., 1997). One of the consequences of over-consumption of calcium is milk-alkali syndrome (MAS), the symptoms of which are hypercalcaemia, alkalosis and renal problems, but these tend to be in older people who have taken calcium containing medication for stomach problems (Food Standards Agency, 2003).

Adolescent mothers

However, teenage mothers have not achieved peak bone mass and will therefore have insufficient calcium for their own needs (Thomas, 2001). There is some variation in what constitutes adolescence. Adolescence is a period of growth transition from childhood to adulthood. In women it commences with the menarche (first menstrual cycle) and continues until growth is complete. Chang, et al., (2003) consider it to be <17 years old, whereas it is <18 years old according to Lawson (2003); Nogueira, Parente & Cozzolino, (2003), whilst Pobocik, et al (2003) consider it to be <20 years. This can be better explained by a study which used knee-height measurements collected retrospectively over a ten year period using growth charts, which suggest that about half of adolescent women are still growing six years after menarche (Lenders, McElrath & Scholl, 2000). Thus some women may still be growing at 20 years of age. A recent study looking at the gynaecological needs of female adolescents found there was uncertainty about the age range of adolescence. Some gynaecological units used the 12-16 years age range, whilst others considered 12-18 years to be an appropriate age range (Balen, Fleming & Robinson, 2002). They concluded there was no consensus on the age range of the adolescent population. This suggests that some of the research may be problematic because of the varying cut-off points. The *UNICEF Convention on the Rights of the Child* considers a child to be a person below 18 years old (UNICEF1997-2003). Thus, an adolescent mother would be one who is capable of reproduction and is below the age of 18 years of age. On the other hand, DRVs for pregnant women are based on women aged 19-50 years (DoH, 1991). Britain has the highest teenage conception rate in Western Europe and thirteen per cent of women aged 20 years have given birth to a child when in their teens (Social Exclusion Unit, 1999). The consequences of teenage pregnancy are associated with social exclusion and poor knowledge of contraception. Thus many teenage mothers often require support from a combination of social services (Wilts County Council, 2002). Adolescent mothers are most likely to be of low socio-economic status with inadequate nutrition (Coad, 2003). Such pregnancies are at greater risk of complication, such as neonatal mortality and low birthweight (Lenders, McElrath & Scholl, 2000). Whether this is because they are nutritionally compromised due to their own growth needs or because of a nutritionally poor diet, is unclear. Moreover, many young women in western society are likely to restrict their food intake because of body shape dissatisfaction (Orbach, 1978; Cooper, et al., 1987; Ogden, 1992). Adolescents are considered to be at risk of consuming diets high in fat and sugar but low in micronutrients. The extra demands of calcium can have negative effects on the mother, such as lordosis (curvature of the spine) or vertebral compression (Lawson, 2003). This is due to the skeletal demands of the fetus and skeletally immature mothers (Scholl & Hediger, 1993). Because of the high calcium demands of both the mother and fetus, the DoH (1991) recommends 800mg per day, but higher intakes may be necessary if the teenager is still growing rapidly or has previously had a nutritionally poor diet. This may be difficult to achieve, as a nutritionally poor diet is often consumed by adolescent women, particularly from the lower social classes (Lawson, 2003).

Pre-eclampsia

Calcium deficiency has been associated with pre-eclampsia. Pre-eclampsia occurs in some women, usually during first pregnancies after 20 weeks gestation and will normally disappear within two days of delivery (Whitney & Rolfes, 1997). The symptoms of pre-eclampsia are:

Oedema (fluid retention)

Hypertension

Protein present in the mother's urine.

Many women suffer from slight oedema during the latter stages of pregnancy, but in pre-eclampsia there is whole body oedema (Passmore & Eastwood, 1986; Sizer & Whitney, 1997; Whitney & Rolfes, 1997). Hypertension in pre-eclampsia is severe with a consistent blood pressure reading of 160/100 mm/Hg (Passmore & Eastwood, 1986). On the other hand, Whitney and Rolfes (1997), consider a blood pressure reading of 140/90mm to be high when the woman has not previously exhibited high blood pressure. Protein present in the urine (albuminuria) is also indicative of pre-eclampsia, with a level in excess of 250/mg per 24 hours (Passmore & Eastwood, 1986; Rodwell Williams, 1986). The consequences of pre-eclampsia are potentially serious, being a major cause of fetal and maternal morbidity and mortality (Gray & Buttriss, 1994; Whitney & Rolfes, 1997). Pre-eclampsia affects all of the mother's organs, including the circulatory system and the brain (Sizer & Whitney, 1997; Whitney & Rolfes, 1997). Bloodflow to the fetus is impeded and thus may affect fetal growth (Whitney & Rolfes, 1997). In extreme cases the placenta may separate from the uterus resulting in fetal death and stillbirth (Vigil-de Gracia et al 1996). Should eclampsia occur, then the mother might suffer convulsions and coma (Duley, Gulmezoglu & Henderson-Smart, 2000). There is much debate about the causes of pre-eclampsia and most hypotheses are diet-related. The effects of calcium levels on development of pre-eclampsia have been the focus of much research. A recent systematic review of calcium supplementation (Hofmeyr, et al., 2003) found evidence of benefits to women at high risk of hypertension and women in communities where calcium intake is low. However, this evidence was only found in small trials (n=<300) and the evidence is therefore inconclusive. An overview of the nutritional interventions during pregnancy recommends that calcium supplementation is effective in reducing hypertension and thus pre-eclampsia (Villar, et al., 2003). Calcium supplementation has been found effective in reducing bone resorption during pregnancy (Janakiraman, et al., 2003). This may be effective in preventing the development of osteoporosis in later life. Conversely, a recent twin study found no evidence to suggest long-term negative effects of pregnancy and lactation on bone mineral measures (Paton, et al., 2003).

1.6 Vitamin D

However, this study was carried out in Australia, which has high levels of sunshine throughout the year, which may indicate that the women had high levels of Vitamin D. This may have been the contributory factor in bone health in later life, rather than calcium levels. Vitamin D is necessary for the absorption of calcium (Thomas, 2001). Vitamin D is very low in human milk, so it is important that it is transferred across the placenta to the fetus to provide a store of the vitamin when it is born (Specker, Valanio & Hertzberg, 1985; Garza, 1993). Sunlight is a major source of vitamin D. Muslim women may need supplements as their skin is rarely exposed to sunlight, and there will be little skin synthesis of vitamin D (Brooke, et al., 1980). This study, carried out on 126 Asian women, found that those who received Vitamin D supplements of 1000 units per day from 28 weeks had comparable weight gains to a white control group, while those who did not receive supplements gained significantly less weight. Asian women tend to bear smaller babies than some other racial groups and there is evidence to suggest that poor nutrition may have a part to play in this (Bissenden, et al., 1981; Viegas, et al., 1982). Reasons for this less weight gain are unclear, but it is hypothesised by Brooke et al (1980) that the women may have reduced appetite due to the Vitamin D deficiency. A study in Scotland (Cockburn, et al., 1980) found that infants born to women with low amounts of Vitamin D had higher incidences of neonatal hypocalcaemia, secondary hyperparathyroidism and hypocalcaemia, which indicates that Vitamin D amounts were insufficient to assist absorption of the calcium requirement of the fetus (Forsum, 2003). A more recent study suggests that vitamin D deficiency during pregnancy can also lead to reduced birthweight (Salle, Delvin & Glorieus, 2002; Forsum, 2003). The DoH recommended that women in the UK who are pregnant should received supplementary vitamin D in order to maintain a daily intake of 10 μg per day (DoH, 1991). On the other hand, a recent South Wales study recommends screening for vitamin D deficiency for women in ethnic minorities (Datta, et al., 2002). It may be more appropriate to have general screening to assess vitamin D levels, of all pregnant women. By doing so, women who are at risk through poor diet or lifestyle will be included irrespective of their ethnic origin.

Until more studies have been carried out, Prentice (2003) recommends that supplementation of calcium and vitamin D should be given to high-risk individuals daily.

1.7 Sodium Chloride/Salt

High intake of sodium chloride (common salt) has also been associated with hypertension and pre-eclampsia. The increase in blood volume during pregnancy (section 1.3) often results in the kidneys retaining more sodium chloride and water (de Leeuw & Peeters, 1999). Women with hypertension and/or pre eclampsia during pregnancy have been found to have low body fluid volumes with high sodium chloride retention (de Leeuw & Peeters, 1999). Mattar and Sibai (1999) have concluded that diuretics and a low sodium chloride diet have been unsuccessful in preventing pre-eclampsia. In addition, maternal sodium chloride restriction can lead to hyponatremia (low sodium (Na) levels in the body) in the newborn, causing excessive sweating and vomiting (Unger, et al., 1998). However, this was a retrospective, relatively small study (n=160), and only three infants suffered from hyponatremia. Thus it is difficult to generalise from these results. A Cochrane Review of randomised control trials (Duley & Henderson-Smart, 2000) found no reliable evidence to suggest offering advice to pregnant women regarding levels of sodium chloride consumption. None of the trials included women with pre-eclampsia. Sodium chloride has also been associated with hypertension, and it has been found that blood pressure increases as social class decreases (Prescott-Clarke & Primatesta, 1995). Lower income groups consume more processed foods such as white bread, meat pies and processed vegetables, which contain added sodium chloride (Ministry of Agriculture, Fisheries & Food, 1980-1996). The lower socio-economic classes have higher rates of Coronary Heart Disease (CHD) (which can be exacerbated by hypertension) than the higher socio-economic classes (Drever & Bunting, 1997). It has been suggested that hypertension occurs when there is sodium (Na) sensitivity but it is difficult to identify such individuals (Suter, Sierro & Vetter, 2002). The INTERSALT project has investigated the association between sodium chloride consumption and hypertension, between and within populations, worldwide.

Two long-term follow-up studies of sodium chloride intake and CHD (Alderman et al., 1995; Alderman et al., 1998) suggest that low sodium chloride intake may be harmful, but three other such studies (Ikeda et al., 1986; He & Whelton, 1999; Tnomilehto et al., 2001) found a positive relationship between sodium chloride consumption and heart attack. At present the effects of reducing sodium chloride intake appear to be limited (Beevers, 2002). Nevertheless the Acheson Report (1998) has raised concerns about the excessive sodium chloride intake of British people and has recommended the introduction of policies which will reduce the sodium chloride content of processed foods without raising the cost to the consumer.

1.8 Lipids/fatty acids

In addition to sodium chloride, consumption of certain types of lipids and fatty acids have been associated with Coronary Heart Disease (CHD) (Anderson & Major, 2002; Byers, 2002; Lichtenstein, 2003). Lipids or fats are transferred from the maternal blood stream to the fetal blood stream as fatty acids, necessary for the development of the brain, nervous system and cell membranes (Olsen, Sorenson & Secher, 1992; Willatts, 2002). The brain is dependent on omega-3 and omega-6 fatty acids for its growth and development (Sizer & Whitney, 1997). According to Ibrahim and Forsyth (2003), the intakes of essential fatty acids (EFA) are related to socio-economic status with the lower groups consuming insufficient oily fish, which is a major source of omega-3 and omega-6 fatty acids. In addition, there is growing evidence to suggest that if there is a deficiency of long-chain polyunsaturated fatty acids (LCPUFAs), then the child may have impaired visual (Carlson, et al., 1996) and cognitive development (Agostini, et al., 1995; Willatts, et al., 1998). LCPUFAs are important components of cell membranes, particularly those in the brain and eyes (Crawford, 2000). N-3 fatty acids are needed for development of the fetal nervous system and are essential for normal neuro visual function (Olsen, et al., 1992; Innis & Elias, 2003). There has been recent renewed concern that trans fatty acids are injurious to health, and there is evidence to suggest that they may cross the placenta (Koletzko, 1991; Wahle & James 1993). Trans fatty acids are those such as hydrogenated vegetable oils, which are hardened commercially to increase their shelf life. Such fats are then similar to saturated fats, which can increase the build-up of plaque in the arteries (Stender & Dyerberg, 2001). Koletzko (1991) suggested that fatty acids might interfere with uterine growth, perhaps by impairing biosynthesis. Maternal fatty acid composition has been found to play a role in programming growth in offspring (Siemelink, et al., 2002). During the second stage of gestation the fetus is able to synthesise its own fat from glucose and so is no longer dependent on the placenta for this function (Van Aerde, Feldman & Clandinin, 1998). Breastmilk contains long-chain polyunsaturated fatty acids (LCPUFA)S, and research indicates that breastfed children had higher IQ scores than those who were fed on infant formula, which did not contain LCPUFAs (Willatts, 2002). Much of the evidence is inconclusive and more human research is needed to definitively establish the links between trans fatty acids during fetal development and later health (Larque, Zamora & Gil, 2001). In addition to lipids and fatty acids the human fetus needs glucose for growth (Gray & Buttriss, 1994).

1.9 Glucose

During pregnancy glucose is vitally important to the growing fetus and is its principle source of energy, thus there is an increasing transfer of maternal glucose to the fetus (Fowden, 1989; Rodwell Williams & Trahms, 1993; Gray & Buttriss, 1994). The placenta itself, because of the high metabolic activity required of it, has a great demand for glucose. The fetus' energy needs are greatest from about week 10, tapering off during the pregnancy's final weeks. The fetal uptake of glucose is approximately twice that of the mother and is approximately 30g of glucose daily (Rodwell Williams & Trahms, 1993). As glucose is the only energy source used significantly by the fetus, rapid absorption is guaranteed by carrier-mediated diffusion. Because of this requirement of the fetus, coupled with the nausea and vomiting of early pregnancy, there is usually a reduction in insulin needs and this is the result of less available circulating blood glucose (Rodwell Williams & Trahms, 1993). The purpose of insulin is to aid carbohydrate metabolism. Insulin resistance appears to develop in most women as the pregnancy progresses, but trans-placental transfer of glucose appears to be independent of insulin (Fraser, 1991). During the second half of pregnancy there is an increase in the diabetogenic effects of the placental hormones, which outweigh the continuous channelling of glucose to the fetus, and insulin requirements increase by 65 – 70 per cent (Rodwell Willliams & Trahms, 1993). Insulin from the mother does not cross the placenta and the fetus depends on its own supply of insulin (Rodwell Williams & Trahms, 1993). Fetal insulin is present at 12 weeks gestation and is stimulated by present amino acids and increased glucose from the mother. Amino acids are transferred across the placenta to meet fetal tissue synthesis requirements. Because placental hormones elevate blood insulin, and alter insulin resistance during pregnancy, the result can, in some cases, be gestational diabetes (Whitney & Rolfes, 1997). This means, oestrogen in particular, and to a lesser extent progesterone, act as insulin antagonists and so diminish the effectiveness of insulin. The insulin will be insufficient to cope with the raised glucose levels and gestational diabetes may develop if a woman ingests too much glucose. This diabetes usually occurs late in the pregnancy and returns to normal after the birth. The consequences of gestational diabetes can be serious, in some cases resulting in macrosomia (a large for gestational age fetus >4000g (Rhodes, Schoendorf & Parker, 2003)), prematurity or fetal or infant death (Beebe, 1987; Braveman, et al., 1988; Jovanovic-Peterson & Peterson, 1990; Kitzmiller, et al., 1991; Naylor, et al., 1996; Candy, Davies & Ross, 2001). Furthermore, research experiments with rats by van Assche and Aerts (1979) have shown indications of genetic transfer of diabetes over three generations. This suggests that prevention of diabetes in the first generation may affect the diabetic tendencies of future generations. It is possible that gestational diabetes may indicate a predisposition to Type 2 (non-insulin dependent) diabetes, rather than the pregnancy acting as a catalyst for Type 2 diabetes in later life, although this remains controversial (Kuhl, 1991).

1.10 Vitamin K

One nutrient that is unlikely to be over-consumed is Vitamin K. There is well-documented evidence regarding the importance of Vitamin K to the well-being of the neonate (O'Connor, 1983; Marwaha, 1984; Motohara, 1984; Kries, 1987; Pooni, et al., 2003). Thus the Committee on medical aspects of food policy (COMA) (1991) recommended that every child in the UK be injected at birth with Vitamin K. This is because Vitamin K is necessary for the clotting of blood but it is a difficult vitamin for the body to store, so most babies are born with a deficiency. Research has shown that a deficiency in the newborn could result in Haemorrhagic Disease of the Newborn (HDN) causing cutaneous, nasal or gastrointestinal haemorrhage. A recent Cochrane review of the randomised control trials found that one dose of Vitamin K reduced bleeding and improved coagulation (Puckett and Offringa, 2001). As newborn babies are routinely injected with Vitamin K there is no advantage in the mother taking Vitamin K supplements, and to do so may even prove injurious to the mother and child. In view of the varied micronutrients required for a healthy pregnancy, the DoH has compiled nutritional recommendations for daily consumption during pregnancy known as Dietary Reference Values (DoH, 1991). One nutrient which appears to have received little consideration in the UK, is iodine.

1.11 Iodine

Iodine is an important mineral and millions of people, worldwide are affected by Iodine Deficiency Disorder (IDD) (Maberly, 1994). The effects of iodine deficiency can be profound. If iodine deficiency is experienced in utero there is an increased risk of varying degrees of cretinism such as low IQ and or/deaf mutism and/or growth retardation. In addition, the child may show physical signs of hypothyroidism, such as dry skin, prominent tongue and coarse features (Poskitt, 2003). It is possible that the child may have low birthweight and the risk of perinatal mortality is increased. If the deficiency is experienced in infancy there is the risk of perinatal mortality and poor psychomotor development and low IQ. There are national programmes to iodise sodium chloride and the United Nations Children's Fund (UNICEF) (2001) believes this has protected over 90 million children from poor learning ability, which might be experienced if they had received insufficient iodine. A recent study found that 40 per cent of pregnant women in the United Kingdom consumed insufficient iodine (Ibrahim & Forsyth, 2003). In the UK it is not compulsory to add iodine to sodium chloride and this coupled with the low UK consumption of iodine rich fish means that deficiencies are not being addressed. The importance of iodine in the diet appears to have gone unrecognised in the UK and there does not appear to be any mention of iodine in diet in pregnancy advisory leaflets distributed to the women in this sample (National Childbirth Trust, 1994; Swindon and Marlborough NHS Trust, undated; Farley's Your Healthy Pregnancy, 1995; Mackonochie, 1997; Farley's Heinz, Guide to Weaning, 1998).

1.12 Nutritional recommendations during pregnancy

There is much debate about what constitutes the optimum diet for a pregnant woman. The second and third trimesters of pregnancy are periods of rapid growth, placing increased demands on the nutritional stores of the mother (Thomas, 1994). It is unclear, however, how much the mother needs to alter her nutritional intake to meet this need. Thomas (1994) argues that Dietary Reference Values (DRVs) cannot be applied indiscriminately to all pregnant women. Because of the disparity between dietary findings and calculated energy costs, the panel on DRVs was cautious and set the Estimated Average Requirement (EAR) at 200kcal extra per day in the third trimester only (DoH, 1991). Daily nutritional dietary reference values (DRVs) during pregnancy and for lactation are shown in Table 1.3:

Table 1.3 Dietary Reference Values (DRV) during pregnancy

Nutrient	Female (19-20 years)	Pregnancy	Lactation
Energy (EAR)[2]	1940 kcal, 8.10 MJ	+200 kcal, 0.80 MJ[1]	+450 kcal (1.9MJ) – 570 kcal (2.4 MJ)
Protein(RNI)[3]	45 g/day	+6 g/day	+11-8 g/day
Thiamin	0.8 mg/day	+0.1 mg/day[1]	+0.2 mg/day
Riboflavin	1.1 mg/day	+0,3 mg/day	+0.5 mg/day
Niacin	12 mg/day	No increment	+2 mg/day
Vitamin B6	1.2 mg/day	No increment	No increment
Vitamin B12	1.5 μg/day	No increment	+0.5 μg/day
Folate	200 μg/day	+100 μg/day	+60 μg/day
Vitamin C	40 mg/day	+10 mg/day	+30 mg/day
Vitamin D	0	10 μg/day	10μg/day
Calcium	700 mg/day	No increment	+550 mg/day
Magnesium	270 mg/day	No increment	+50 mg/day
Iron	14.8 mg/day	No increment unless iron stores are low	No increment
Zinc	7.0 mg/day	No increment	0-4 months, +6 mg/day; 4+ months
Copper	1.2 mg/day	No increment	+0.3 – 5 mg/day
Selenium	60 μg/day	No increment	+15 μg/day

(Source: COMA Report no. 41, DoH, (1991)

1 Last trimester only
2 Estimated average requirement
3 Reference nutrient intake
Note: Where a different range of values is given for lactation, this refers to the different stages of lactation. The EAR for a non pregnant woman aged between 15-18 years is 2110 Kcal per day, thus a pregnant women in this age group would require a total daily calorie intake of 2310 Kcal during the third trimester, and between 2560 Kcal and 2680 Kcal during lactation.

The physiology of pregnancy has adapted to facilitate increased absorption of vitamins. Metabolism is more efficient, and there is an increase in absorption and a decrease in excretion of vitamins. Johnstone (1983) stated that there was no good evidence for a pregnant woman to make major changes to her nutritional intake if she has maintained optimal body weight (BMI < 25) for some years prior to pregnancy, and has eaten a low fat, low sugar diet as recommended by the National Advisory Committee on Nutritional Education (NACNE) (1983). Lean and Anderson's (1990) Aberdeen study of pregnant women found evidence that women who received 35 per cent of their energy from fat had a good overall nutrient intake. This supports the adoption of a NACNE style diet (low in saturated fat, sodium chloride and sugar and high in fruit, vegetables, oily fish and carbohydrates) but does not take account of young women who may have followed these recommendations, but because their own body is still growing, may need extra nutrients. A joint Food Agriculture Organisation (FAO)/ World Health Organisation (WHO)/ United Nations University (UNU) Expert Consultation on Energy and Protein Requirements (FAO/WHO/UNU, 1985) recommended that the extra energy cost of pregnancy amounting to 285kcal should be met by increased food consumption, but if physical activity were reduced, 200kcal would be sufficient. Until 1991, the UK recommendation was an increase of 240kcal per day during the second and third trimesters only (Department of Health and Social Security (DHSS), 1979). Durnin (1991) carried out a multinational study across Scotland, Holland, The Gambia, Thailand and the Philippines. Results from the Scottish and Dutch studies indicated that in practice, only about 100kcal more per day were ingested during the second and third trimester, suggesting only a small addition to the pre-pregnancy calorie intake is necessary. This could be due to a reduction in physical activity as Durnin (1991) suggests, but this is not borne out by the results of the Gambian study (Lawrence, et al., 1984; Poppitt, et al., 1993). It is difficult to make comparisons however, as the Gambian population was in a state of marginal undernutrition and therefore had made metabolic adaptations. Prentice, et al., (1989) and Goldberg, et al., (1993) have also found evidence of metabolic adaptations, but due to the very small sample size (8 and 12 respectively), it is not wise to generalise from these results. During pregnancy it is common to see low serum values of nutrients and a greater excretion of nutrients via the kidneys (Gray & Buttriss, 1994). This suggested a dilution due to the increased blood volume during pregnancy, but other researchers believed it suggested nutrient deficiencies (Hytten and Chamberlain, 1980). The composition of the weight gain during pregnancy is different to that of the non pregnant weight gain, with 62 per cent being water. Thomas (1994) suggested 1 pint of milk per day will provide 600 mg of calcium, ensuring an adequate supply, but whether this should be full-fat or semi-skimmed milk is not stated.

Protein needs are usually met throughout pregnancy if energy supply is sufficient and it is unlikely that many women will need to increase their usual daily intake (Thomas, 2001). Research with pregnant rats indicates that protein is stored during the early stages of pregnancy and distributed to the fetus, as and when necessary but it is unclear if this is the same with humans (Naismith, 1977). As a result of Durnin, et al. (1985) and Durnin's (1987) studies in Scotland, the total energy cost of pregnancy is calculated at 70,000 kcal. Goldberg, et al., (1993) have shown that there are wide variations between individuals, with some women showing a reduction in Basal Metabolic Rate in the early stages, and others showing an increase from the beginning. From the conflicting evidence, perhaps the best advice for pregnant women is to eat as much as they need to satisfy their appetite, as suggested by Passmore and Eastwood (1986) and Thomas (1994). This does not take account of women whose diet, before and during pregnancy, may be compromised, such as smokers, ethnic minority groups, alcohol/drug users, those on a low income and adolescents (Lawson, 2003). Moreover, food consumption is grounded in culture (Iphofen, 2003). The food that is produced and available within a culture has a great influence on what individuals eat. Many cultural food choices are passed on intergenerationally. There are cultural constraints on what food is consumed, not least of which are economic factors (Iphofen, 2003). The quality and quantity of food consumption is determined by the funds available to purchase food. Moreover, consumption is influenced by cultural social practices such as family gatherings and culturally determined festive occasions (Iphofen, 2003). Advertising media promote foods that are often unhealthy (Sustain, 2001). Much of this advertising within the UK is of nutritionally poor foods that are frequently high in fats and sugars (Sustain, 2001). Such advertising employs psychological strategies to hold the viewer's attention and evoke an emotional response, thus resulting in the greater likelihood that the food is seen as desirable (Lewis & Hill, 1998). Recommendations are that women should eat four or more servings of carbohydrates; at least five servings of vegetables and fruit; three servings of calcium rich foods such as milk and milk products; two servings of protein such as lean meat, poultry, fish, eggs, beans and nuts; small amounts of fat and sugar (Gray & Buttriss, 1994; University of Sheffield Centre for Pregnancy Nutrition, 2003). The problem with such recommendations is the lack of definition of what constitutes a 'serving' or 'small' amount of fat. Moreover, people in the lower socio-economic groups tend to purchase energy dense foods, which are high in fat and sugar and lacking in other nutrients (Leather, 1996). Because of the risk of infection by Listeria and Salmonella, which could harm both the mother and developing fetus, it is recommended that pregnant women do not consume raw or lightly cooked eggs; shellfish or undercooked poultry; unpasteurized milk or mould-ripened or blue cheeses (DoH, 1996). In addition to avoiding certain foodstuffs there are recommendations regarding the optimum weight gain during pregnancy as shown in Table 1.4.

Table 1.4 Average composition of average weight gain during pregnancy. (Source: Barasi, 1997 page 201).

	Average weight
Fetus	3.5 kg
Increased maternal tissues such as blood volume, mammary glands and uterus	5.0 kg
Stored fat	4.0 kg

Barasi's (1997) estimate is based on UK studies carried out in the 1950s which set the physiological norm at 12.5kg. There is considerable debate about what constitutes optimum weight gain for a woman during pregnancy. According to Forsum (2003), this weight gain can vary between 6-14kg (Forsum, 2003). This is based on data from twelve studies from different parts of the world (Institute of Medicine, (IOM), 1990a). Feig and Naylor (1998) have suggested that such weight gain recommendations are too liberal in well-nourished Western societies. Moreover, Hytten (1991) indicates that there are many variations in the energy requirements of individual women. The difficulty with these studies on which the IOM's recommendations are based on is that they date from 1925-1986, thus there may have been variations in access to sufficient quantities of nutrients over the years. Evidence suggested that diets in the early part of the century would be lacking in red meat, fruit and vegetables and high in bread and fat (Ariouat & Barker, 1993). Thus weight gain may not be indicative of adequate nutrition. Weight gain in the second and third trimesters is an important determinant of fetal growth (IOM, 1990a; Susser, 1991). An American report reassessed the relationship between pregnancy weight and maternal and fetal outcomes (IOM, 1990b), and this confirmed a strong relationship between maternal weight gain and birthweight. From this evidence they provided target ranges for weight gain based on pre-pregnancy Body Mass Index (BMI). These ranges are known as the IOM's recommendations and have been assessed in a number of studies. Results indicate that women, whose weight falls outside the recommended ranges, tend to have poorer pregnancy outcomes for both the mother and infant (Abrams, Altman & Pickett, 2000). Low weight gain is associated with low infant birthweight, which can have detrimental consequences such as stunted growth, perinatal death (death in early infancy) and even neurobehavioural development (Gray & Buttriss, 1994). There is strong evidence to suggest that children born to women with a low BMI are more likely to develop non-insulin dependent diabetes and raised blood pressure in adult life and such women are more likely to be from disadvantaged social groups (Lobstein, 1991; Godfrey, et al. 1994; Office for National Statistics, (ONS) 1997; Clark, et al., 1998; Ravelli, et al., 1998). An American study, which examined the motor skills and intellectual ability of children of low income, obese African-American women, found no association with motor skills. There were, however, indications that obese mothers may have children with diminished intellectual ability. Obesity is defined as BMI >30 (DoH), 1994). There may, however, have been variables other than obesity, which may have confounded the results (Neggers, et al., 2003). On the other hand, a Croatian study found women who gained >12kg during pregnancy were more likely to have a higher incidence of caesarean delivery and/or perinatal mortality (Curzik, Topolovec & Sijanovic, 2002). Conversely, very high maternal weight gain can result in high infant birthweight, which can precipitate a forceps or even caesarean delivery, asphyxia and perinatal mortality (Gray & Buttriss, 1994). A recent study found no relationship between macrosomia (large for gestational age) and rate of caesarean deliveries (Rhodes, Schoendorf & Parker, 2003). A macrosomic infant is defined as having a birthweight >4000g (Zamorski & Biggs, 2001). Pre-gravid maternal BMI is a strong predictor of birthweight and obese mothers are eighteen times more likely to deliver macrosomic infants than normal or underweight mothers (Mancuso, D'Anna & Leonardi, 1991; Galtier-Dereure, Boegner & Bringer, 2000). Dietary restriction, in order to limit weight gain in obese women, is often practised in order to reduce the incidence of hypertension, gestational diabetes and/or pre-eclampsia. Campbell (1991) advocates dietary restriction only if there is evidence of impaired glucose intolerance, otherwise such restriction is of little value. Notwithstanding, this does not consider the detrimental health consequences of giving birth to a macrosomic infant. However, the consequences of low birthweight appear to be considerably more far reaching.

1.13 The long-term effects of low birthweight

The poor nutritional status of many women of childbearing age is of current concern in the UK. Not only is the health of the mother affected, but the long-term health of her offspring may be jeopardised. Approximately seven per cent of all births in the UK are low birthweight babies (Doyle, 2002). A low birthweight baby is considered to be <2500g while a very low birthweight infant is considered to be one born less than 1500g (King & Harrison, 2003). Such babies are more likely to be born to mothers who live in deprived areas, for example, Hackney, East London and/or from lower socio-economic groups (Office for National Statistics, 1997; Doyle, 2002). Infant mortality is higher in low birthweight babies than those with a birthweight >2500g (The Scottish Low Birthweight Study Group, 1992; Vik, et al. 1996). The UK has a high early childhood mortality rate in relation to other developed countries such as, Sweden, Germany, France, Singapore and developing countries such as Slovenia (Office for National Statistics, 1997). Maternal nutrition is considered to be a major factor influencing infant outcomes (Frankle & Owen, 1993). Genetics undoubtedly play a part in the growth and development of the fetus, however there is evidence suggesting that the standard of nutrients and oxygen the fetus receives, imposes limitations upon that development and growth (Haig & Graham, 1991; Barker, 1994). Birthweight is dependent on the height and weight of the mother, which in turn has been affected by her own growth during childhood. Many low birthweight babies are born to women in the lower socio-economic groups (Office for National Statistics, 1997). A large study (n=4555 women) in Chile found that underweight women were represented significantly more in those < 20 years of age. This study looked at underweight, normal weight, overweight and obese women, and found that the birthweights of the infants were proportional to the maternal weight (Robinovich, et al., 1995). This suggests that smaller babies are born to underweight mothers. Burnley, Lancashire, England was reported to have a high perinatal mortality rate (Law, et al., 1993). Babies born to women in Burnley, Lancashire were compared with babies born in Salisbury, Wiltshire. Findings indicate that more of the Burnley mothers were younger, shorter in height and of lower socio-economic status than the Salisbury mothers, which may account for the higher perinatal mortality rates. These results are inconclusive, but it could be argued that Burnley had a higher rate of teenage, unplanned pregnancies, and may account for the increased number of younger mothers. This would require further investigation to be conclusive. Seven years later these figures are different, in that Burnley had one death during the perinatal period (the period shortly before and after birth beginning with completion of the 20-28th week of gestation and ending 7-28 days after birth) (Medic 8, 2004) and Salisbury had no deaths during the perinatal period (Office for National Statistics, 2001). There are other areas with greater perinatal death rates, such as Manchester, with sixteen perinatal deaths during the year 2000 although it is acknowledged that Manchester is a larger area than Burnley (Office for National Statistics, 2001). Nonetheless these figures suggest a need for Law, et al. (1993) to review their findings using current data relating to perinatal mortality rates and the ages, heights and socio-economic status of the mothers in Burnley and Salisbury. A comprehensive Austrian study (n=10240) examined the impact of pre-pregnancy weight, and pregnancy weight gain, on infant birthweight (Kirchengast & Hartmann, 1998). The results suggest that poor maternal weight status is a risk factor for low birthweight babies. It is unclear how pre-pregnancy weight was ascertained accurately. If the mother's pre-pregnancy weight was self-reported, the results may have been subjective and inaccurate. A more recent study found that women with lower Body Mass Index (BMI) (<25) were more likely to produce smaller babies than women of higher BMI (>25). In addition, those mothers who gained more weight during pregnancy had heavier infants (Shapiro, Sutija & Bush, 2000). A longitudinal study (n=11833) carried out in the South West of England, found that poor quality diet was not an indicator of low birthweight (Rogers, et al., 1998). This would suggest that if the mother consumes adequate calories during her pregnancy, her baby would not be of small birthweight. A possible explanation for low birthweight babies is that those mothers with low preconceptual BMI (<25) do not eat sufficient calories prior to and throughout the course of the pregnancy, resulting in inadequate nutrient stores. If the mother has inadequate nutrient stores during critical periods of fetal development this can have far reaching consequences for the developing individual. Optimal nourishment of the mother is of paramount importance during the embryonic stages when the critical periods occur. The critical periods occur very early in gestation, most falling within the embryonic period. By eight weeks the fetus has developed a central nervous system, beating heart, digestive system and the beginnings of facial features (Little, 1990).

Critical Periods

The organs and tissues have critical periods of intense development (Godfrey & Barker, 2003). For example, the heart and brain are well developed at fourteen weeks, which is around the end of the first trimester. The central nervous system developmental critical period is the longest, starting at week three and ending at week 16. Other critical periods are shown in Table 1.5:

Table 1.5 Critical Periods in embryo/fetal development

Organ	Weeks of formation
Heart	3.50 – 6.50
Upper limbs	4.00 – 6.00
Lower limbs	4.25 – 7.25
Eyes	4.50 – 8.50
Teeth	6.75 – 8.00
Palate	6.75 – 9.25
External genitalia	7.50 – 10.00
Ears	4.25 – 9.50

Source: Little (1990)

If the fetus receives any insult (in this case, lack of nutrition) during a critical period, then the development may be interrupted and there can be no catch-up later (McCance, 1976). Current research suggests that the individual may become programmed and become prone to disease in later life. This has become known as The Barker Hypothesis.

The Barker Hypothesis

Barker (1999) hypothesised that if a developing individual has inadequate nutrition during a critical period in utero, the fetus responds by making permanent changes in its physiology and metabolism. It is these changes that predispose the individual to chronic disease in later life. Much of Barker's original work was based on the results of animal experiments and information provided by 'Margaret Burnside's Ledgers' (Barker, 1994).

Margaret Burnside's Ledgers.

Margaret Burnside's ledgers were detailed birth and growth records of individuals born in Hertfordshire from 1911 onwards. Margaret Burnside was the first Chief Health Visitor and Lady Inspector of Midwives for Hertfordshire (Barker, 1994). These detailed records allowed comparison of individuals' birthweight and early growth with later health and subsequent cause of death. The findings suggested a link between small birthweight and increasing rates of Coronary Heart Disease.

Coronary Heart Disease (CHD)

Those infants with low birthweights had increased death rates from CHD (Barker, 1998; Osmond, et al., 1993). A similar study, which looked at the birthweights of men born in Sheffield from 1907-1925, found that it was babies who were born small for dates, rather than preterm infants, who were more at risk of CHD (Barker, et al., 1993). A problem with retrospective studies is that there may be inaccuracies in records of birthweights or causes of death, which may confound the results. Many studies, using more recent data have comprehensively supported these findings, so that it is now widely accepted that small birthweight is a contributory factor in CHD (Frankel, et al., 1996; Rich-Edwards, et al., 1997 and Barker, et al., 2002). Current research suggests that it is not only the offspring who are at risk of CHD, but also the mother. One such study found a positive association between maternal adult leg length and birthweight of the offspring (Lawlor, Davey Smith & Ebrahim, 2003). Leg length can be used as an indicator of early environmental circumstances, particularly nutrition during infancy. Interpretation of these findings suggests the trans-generational association between birthweight and CHD is explained by maternal circumstances in early life. It could be argued, however, that the results are due to confounding variables, which may offer an alternative interpretation of the results. For example, such variables might be similar lifestyle and cultural factors continuing into the second generation, or indeed, genetic factors.

Hypertension

In addition to CHD, it has been suggested that a propensity for cardiovascular related conditions may also be a result of programming. One such condition is hypertension. The association between small birthweight and hypertension in later life has been widely documented (Voors, Webber & Frerichs, 1977; Simpson, Mortimer & Silva, 1981; Cater & Gill, 1984; Whincup, Cook & Shaper, 1989; Barker 1994). A systematic review of 80 studies across varying ages and different countries, has added support to the argument (Huxley, Shiell & Law, 2000). As with CHD, this is dependent on reduced fetal growth, rather than being born pre-term (Barker, 1998; Eriksson, et al., 2000). A large (n=10883) study in Jerusalem examined the birth records of 17-year-old men and women who had been drafted into the Israeli Army. These records were compared with blood pressure and BMI measures taken during Army medical checks. A positive correlation was indicated between blood pressure and BMI at aged 17, but none with birthweight or the mother's weight gain during pregnancy (Laor, et al., 1997). These findings do not indicate an association between low birthweight and high blood pressure in later life. One study which looked at the maternal diet of individuals born in Aberdeen between 1948 and 1954, found that those whose mothers had consumed a high carbohydrate and low protein diet, tended to have higher blood pressure than those whose mothers had eaten more protein and less carbohydrate (Campbell, et al., 1996). The conclusion was that the low protein diet had affected the size of the placenta, and thus the nourishment of the fetus was compromised. Experiments using animals have lent support to this hypothesis (Barker, et al, 1990; Law, et al., 1991).

Non-insulin diabetes and the Thrifty Phenotype Hypothesis

Conditions associated with hypertension include non-insulin diabetes. Non-insulin diabetes appears to increase the risk of heart disease (Hellerström, Swenne & Andersson, 1988; Bell, 2003). Insulin metabolises glucose which is necessary for energy and subsequent growth, thus having a vital role in fetal development. There appears to be a relationship between fetal growth and development of non-insulin diabetes in later life, and this has led to the Thrifty Phenotype Hypothesis. The Thrifty Phenotype Hypothesis suggests that non-insulin dependent diabetes occurs in individuals of low birthweight (Hales & Barker, 1992; 2001). In essence, the research suggests that poor nutrition in utero has led to under development and function of the β cells of the islets of Langerhans, resulting in insulin resistance. It is generally accepted that obesity and a sedentary lifestyle are contributory factors in development of non-insulin dependent diabetes, but it is suggested that this may only be in predisposed individuals (Barker, 1994). This predisposition may be the result of undernutrition in utero. Wells (2003) has challenged the Thrifty Phenotype Hypothesis, suggesting that the existing hypothesis fails to explain loss of plasticity (resilience or adaptability during critical periods) of development and that programming may be of more benefit maternally than to the offspring. Wells (2003) concludes that this approach indicates that public health improvement programmes should address maternal development rather than nutrition during pregnancy. However, this argument does not appear to be based on any empirical evidence. Conversely, the findings of the Aberdeen study of 168 men and women, born between 1948-1954, suggest that high intakes of protein and fat can lead to insulin deficiency through impaired fetal development. The offspring of thin mothers, on the other hand, appear to be insulin resistant (Shiell, et al., 2000). Ong and Dunger's (2002) review concludes that thrifty fetal genotypes may improve perinatal survival, but predispose to adulthood disease. Furthermore, Vuguin (2002) has carried out a systematic review of animal studies into the effects of intrauterine growth and growth restriction on subsequent glucose metabolism. The conclusions are that many of the results are dependent on the procedures employed, and therefore results can only be interpreted as preliminary. Although much of this research has centred on nutrition during critical periods, which occur during the first trimester, it fails to address the negative effects of nausea and vomiting in pregnancy (NVP).

Nausea and vomiting in pregnancy (NVP)

One explanation for nausea and vomiting in pregnancy is the genetic parent-offspring conflict argument (Trivers, 1974; Moore & Haig, 1991). This conflict commences immediately after meiosis (cell division during the reproductive/conceptual process) according to Trivers (1974). Although both mother and child are primarily concerned with the survival and well being of the fetus, the mother has also to serve her own best interests. This demands not only looking after her own state of health, but if the current fetus makes too many physiological demands upon her, it could jeopardise her future reproductive potential (Trevarthan, 1987). Flaxman and Sherman (2000) carried out a cross-sectional review of literature relating to NVP, and found evidence to suggest that societies who do not rely on animal protein as a dietary staple were less likely to experience NVP. Animal protein foods can contain toxins and micro-organisms if not totally fresh. The nausea could be interpreted as a protection mechanism within the body so that potentially poisonous foods are avoided. A more widely accepted view is that NVP is associated with increased hormone production. Once fertilisation has taken place, the embryo secretes human chorion gonadotropin (hCG) which allows oestrogen and progesterone secretion to continue by maintaining the corpus luteum (Forsum, 2003). These hormones play a significant part in the metabolic and physiological changes in the body of the pregnant woman. There is also an increase in the level of prolactin, which is important in preparing the mammary gland for lactation (Forsum, 2003). There is a body of evidence to suggest that this increase in hormone activity is largely responsible for the nausea experienced in the early stages of pregnancy (Sherman & Flaxman, 2002; Lagiou, et al., 2003). It is furthermore suggested that NVP can contribute to a positive outcome to the pregnancy, in that such pregnancies are less likely to result in miscarriage or preterm delivery (Furneaux, Langley-Evans & Langley- Evans, 2001). To date, this evidence is inconclusive and therefore these claims should be treated with caution. The nutritional status of the pregnant woman may be compromised if the NVP results in considerable loss of appetite and/or vomiting (Coad, Al-Rasasi & Morgan, 2002). There appears to be a scarcity of up-to-date research relating to the possible effects of NVP on nutrient stores, other than that relating to hyperemesis gravidarum. Hyperemesis gravidarum is persistent vomiting during pregnancy past the first trimester up to the 20^{th} week of gestation, when there is a major risk of malnutrition (Thomas, 2001). As the first trimester is a period of great nutritional activity, requiring nutrients not only for the development of the embryo but of the placenta, it is important that the mother consumes the appropriate nutrients. Moreover, what the pregnant woman eats is not only important for the healthy development of the fetus but also to prepare the maternal body for lactation and subsequent breastfeeding.

1.14 Current recommendations regarding food consumption during pregnancy

Current recommendations are that pregnant women should eat at least five portions of fruit and vegetables daily, including green vegetables for folic acid and iron (Food Standards Agency, 2004). They should also consume plenty of starchy foods, fibre, dairy foods for calcium and protein. To ensure adequate levels of iron some red meat should be consumed and/or fortified breakfast cereals. It is also recommended that all pregnant women should take 400mcg per day until the 12th week of pregnant to help prevent neural tube defects in the fetus. Moreover it is recommended that if the pregnancy is planned folic acid should be taken for some weeks prior to conception (DoH, 2000). Liver is to be avoided because of the high levels of Vitamin A which may be potentially teratogenic (DoH, 1992). Shark, swordfish and marlin should be avoided because of the high levels of mercury which may harm the development of the fetal nervous system (FSA, 2004). Tuna should be rationed to no more than four medium sized cans per week for the same reason. Soft, mould-ripened cheeses, pâté and raw eggs should be avoided because of the dangers of contracting Listeriosis. Finally, alcohol should be limited to one or two units, once or twice a week (FSA, 2004).

Part II Breastfeeding

1.15 Issues surrounding breastfeeding

The Acheson Report (1998) presents evidence that babies in the UK, whose fathers are in social class I, are more likely to be breastfed than those whose fathers are in social class V. Moreover, it is less likely that mothers from the lower social classes will continue to breastfeed until the child is weaned (Foster, Lader & Cheesbrough, 1997). Uptake of breastfeeding in the UK is among the lowest in the developed world (Earle, 2002). Findings suggest that decisions to breastfeed are made without reference to the advice of health care professionals, and these decisions do not change over the course of the pregnancy and post partum (Earle, 2002). This was a qualitative study using only 19 participants, thus it would be difficult to generalise from such results. There is considerable research to indicate that breastfeeding from birth to six months has long-term benefits for both the mother and the child (American Academy of Pediatrics, 1997). For example, breastfeeding appears to give the mother protection against ovarian and/or breast cancers (Layde, et al., 1989; Rosenblatt & Thomas, 1993; UK Study group 1993; Newcomb, et al., 1994). Cumming & Klineberg (1993) suggest that if women have breastfed they are more likely to develop hip fractures in later life but this was subsequently criticised by the DoH (1998), which states that there is no evidence that lactation has any effect on bone health. Generally the mother loses weight and body fat during lactation (Dewey, Heinig & Nommsen, 1993; Heinig & Dewey, 1997; Winkvist, & Rasmussen, 1999). This would be considered beneficial in Western Society. It is argued by some, that such weight loss is minimal (Winkvist & Rasmussen, 1999; Sichieri et al., 2003). There are also the additional benefits of not having to prepare feeds, and a financial saving, as artificial milk powder would be unnecessary (MIDIRS, 1997). However, it is possible that any financial saving may be cancelled out if the breastfeeding mother spends more on nutritional food in order to improve the quality of her milk. In any event, such a financial outlay would be justified by the nutritional benefits to both the mother and child. A longitudinal study of 216 pre-term children found that those who consumed donated breastmilk had lower blood pressure readings than those fed with pre-term or standard milk formula (Singhal, Cole, & Lucas, 2001). In addition, there is evidence to suggest that those who are bottle fed, rather than breastfed, are more at risk of developing insulin dependent diabetes (Ellis & Atkinson, 1996; Atkinson & Ellis, 1997). However, the authors themselves point out that there is insufficient evidence to be conclusive. A meta-analysis of such studies identified a weak but significant association between bottle-feeding and the risk of insulin-dependent diabetes (Gerstein, 1994). Nevertheless, other studies have not supported this belief (Bodington, McNally & Burden, 1994; Patterson, et al., 1994). A large study (n=2602) in Western Australia found that predominant breastfeeding for at least six months, reduced the risk of respiratory infection (Oddy, et al., 2003). Results of a study of premature infants, who were randomly assigned to an enriched milk formula, or a standard milk formula used with babies who had been brought to term, have indicated that there appears to be programming.

Although the standard milk formula was only used for a few weeks, findings show that those fed the preterm formula from birth had better motor development at eighteen months. These results suggest that the early weeks are critical to development and early dietary manipulation might be beneficial for the infant's future development (Lucas, Morley, Cole et al., 1990). This was a fair-sized study (n=377) and it might have been useful to vary the length of the four week trial within the sample. A further study found that preterm babies fed breastmilk had better cognitive development than those fed preterm formula milk (Lucas, Morley, Cole et al., 1994). It is possible there may have been confounding variables such as the intelligence and socio-economic status of the parents and which may account for the results. For example, some mothers may be better nourished and thus have better quality breastmilk and/or some babies may have inherited intellectual abilities which account for their better cognitive development. It would be useful to follow up the further development of the children in the study to see if those on the standard formula, caught up in their development compared with those who were breastfed. It has been suggested that breastmilk promotes cognitive development and offers protection against allergies (Kramer & Moroz, 1981; Miskelly, et al., 1988; Chandra, 1991; Lucas, 1993). There is well-documented evidence from research in the United States, Canada and Europe to suggest that breastfeeding decreases the incidence of diarrhoea in the infant (Kovar, et al., 1984; Howie, et al., 1990; Heinig, et al., 1994; Beaudry, Dufour & Marcoux, 1995; American Academy of Pediatrics, 1997). A major criticism of this evidence is that it was obtained from predominantly middle class participants, and there may be other socio-economic factors to explain lack of infection, other than breastfeeding. Middle class people are more likely to have access to better housing and hygiene conditions. Moreover, as more middle class mothers than lower class mothers breastfeed, this could explain why there appears to be a relationship between breastfeeding and protection against diarrhoea. A recent study in Malaysia found that low birthweight infants who were fed expressed breastmilk gained less weight overall than those fed on preterm formula. These findings somewhat support the previous studies' findings of a relationship between enriched milk formula and improved development (Lim, Cheah, & Soosai, 2001). There is a considerable body of evidence to suggest that breastfeeding can have a detrimental effect on the infant in the long term. It has been thought that the high cholesterol content and saturated fat may programme lipid metabolism throughout life and increase the risk of cardiovascular disease, but there is insufficient evidence to support this hypothesis (Kris-Etherton, et al., 1979; Green, Dohner & Green, 1981). Experiments carried out on baboons, who were either breastfed or bottle fed, indicate that those who were breastfed had a higher low density lipoprotein cholesterol to high density lipoprotein cholesterol ratio, suggesting that breastfeeding may have a negative effect on cholesterol metabolism in later life, which might lead to cardiovascular disease in some cases. Evidence suggests that babies exclusively breastfed after the age of six months, often fail to develop adequate iron stores (Saarinen, 1978). In addition, there may be vitamin deficiencies, particularly vitamin D, if the mother is poorly nourished (Belton & Rickets, 1986). The Hertfordshire study of health visitor records from 1911 – 1945 found that those babies who had been breastfed beyond one year had fewer teeth, and weighed less than those who had been weaned (Barker, 1994). This would suggest that those who had been weaned had a diet higher in calories and which facilitated teething. It is difficult to be conclusive however, because of the great variation there would have been in diets according to class and income. There is evidence that those who had been breastfed beyond a year had higher birthweights, but by age one year their weight was lower than children who were no longer being breastfed. Moreover, these infants had the highest death rates from coronary heart disease in later life (Fall, et al., 1992). Studies investigating the impact of infant feeding on chronic illness are confounded by their retrospective design (Weaver & Prentice, 2003). What should be borne in mind is the quality of food available at the turn of the 20th century. Mothers' diets would not have been as nutritionally sound as today and non breastfed babies would have been fed milk from a variety of sources such as cows' milk, perhaps un-pasteurised, tinned, sweetened, condensed or evaporated milk as well as proprietary infant milk powder. There would also be the added problem of poor hygiene. Breastfeeding for the first six months is more beneficial where there is a heightened risk of infection through poor hygiene and sanitation (Elsom & Weaver, 1999). Feeding bottles may not be adequately sterilised and drinking water may not be boiled leaving the way open to infections, which could have a detrimental effect later in life. Despite the contradictory evidence regarding the benefits of breastfeeding to the mother and the child, the Acheson Report recommends "...policies which will increase the prevalence of breastfeeding" (The Acheson Report, 1998 page 3, recommendation 22). UNICEF and WHO recommend exclusive breastfeeding for the first six months of life based on evidence that such infants who have this type of feeding rarely fail to thrive (Weaver & Prentice, 2003). On the basis of these recommendations the UK DoH has advocated exclusive breastfeeding for six months.

1.16 Baby Friendly Hospital Initiative

Breastfeeding has been considered so important for the health of the child, that the Baby Friendly Hospital Initiative was developed (WHO/UNICEF, 1989). In 1991 UNICEF and the World Health Organisation launched the Baby Friendly Hospital Initiative to reverse the negative effects on breastfeeding, of the practices of many maternity units worldwide (WHO, 1989; Lancet, 1994). This initiative encourages maternity units and hospitals to adopt ten steps to successful breastfeeding. In essence these are:

(i) A written breastfeeding policy that all health care staff are automatically made aware of;

(ii) Adequate skills training to all staff involved in implementation of policy;

(iii) Verbal and written communication to all women of benefits and accomplishment of breastfeeding;

(iv) Assistance with commencement of breastfeeding within half an hour of delivery;

(v) Explain breastfeeding procedures to mothers including maintenance of lactation by expression of milk even if separated from child;

(vi) Newborns should not be given any food or drink unless for medical reasons and formula food should not be promoted;

(vii) Mothers should have the infant's cot beside them 24 hours a day;

(viii) Breastfeeding on demand is to be encouraged;

(ix) Pacifiers and 'dummies' are not to be given to infants;

(x) Establish breastfeeding support groups to which mothers should be referred (adapted from Malik & Cutting, 1998).

In Britain there remains a strong culture for bottle-feeding, despite the widely publicised benefits of nourishment, improved bonding and protection from infection, and breastfeeding rates are lower than other countries (Fairbank, et al., 2000). Currently there are 53 fully accredited Baby Friendly healthcare facilities and 69 maternity units or community services with a certificate of commitment (UNICEF UK Baby Friendly Initiative, 2004). These figures suggest that the majority of units and hospitals have not adopted all of the policies. Beeken & Waterston (1992) suggest that closer monitoring of training and hospital practices is necessary. On the other hand, there is evidence to suggest that the mother's perception of the father's attitude towards breastfeeding and the mother's milk supply will affect the mother's decision regarding feeding (Arora, et al., 2000). Results of this study indicated that the initiation rate was 44.3 per cent with 13 per cent still breastfeeding at six months post partum. This study states that decisions regarding feeding were made before the pregnancy or during the first trimester. This appears to preclude unplanned pregnancies and it is not made clear how many women adhered to their original decision. Hospital based breastfeeding interventions can have a beneficial effect on lactation success, particularly among primiparous (having given birth for the first time) women (Perez-Escamilla, et al., 1994). In contrast however, primiparity, long labour and stress can adversely affect lactogenesis (Chen, et al., 1998). There has been an increase in breastfeeding rates but not significantly so. The highest rates of breastfeeding at all maternal ages in the UK are in Scotland (DoH, 2002). Class differences are more marked in Scotland than in the rest of the UK, with fewer Scottish mothers in the lower classes initiating breastfeeding (DoH, 2002). Scotland has a national target set in 1994, which states that more than

50 per cent of mothers should still be breastfeeding their infants at six weeks old. Currently 37 per cent of such mothers whose babies were born in 2002 were still breastfeeding at six – eight weeks (ISD, 2003).

1.17 Nutritional needs of infant 0-6 months

There is conflicting advice on when to introduce weaning the infant onto solid foods (Weaver & Prentice, 2003). Human milk contains all the nutrient and energy requirements for healthy infants until they reach about six months old (Weaver & Prentice, 2003). There are worldwide differences in the timing of introduction of weaning foods (Michaelsen, et al., 2000). The DoH, (2002) recommends that weaning foods should not be introduced until after the age of four months for both breastfed and formula fed infants. The introduction of cow's milk before the age of one year may result in iron deficiency (Mira, et al., 1996). This is unlikely to occur in the breastfed infant if a solid food containing iron is introduced at 4-6 months (Williams, 1991). A systematic review of 300 breastfeeding studies found many methodological flaws and only thirteen papers met the criteria (Lanigan, et al., 2001). There was no evidence to suggest modification of UK guidelines for weaning practices. The WHO carried out its own review of the literature and as a result recommended exclusive breastfeeding for six months, with the subsequent introduction of weaning foods and continued breastfeeding (WHO, 2001). From the available evidence, current recommendations are that in the best interests of the infant, there should be exclusive breastfeeding for six months. There is therefore a need to address the issues of low rates of uptake of breastfeeding and continuance of breastfeeding in the UK.

1.18 Conclusion

This chapter has reviewed the literature on nutrition during pregnancy and breastfeeding for the healthy development of the infant. It has brought to the fore areas of controversy within the research. In so doing, it has highlighted methodological flaws within some research designs. Gaps within the area of knowledge have been identified and suggestions have been made for future nutritional research which will increase the body of knowledge. In particular there is limited knowledge regarding the effects on a pregnancy of nutrient intake preconceptually and debate about consumption of alcohol prior to and during pregnancy. There appears to be a lack of consensus regarding optimum weight gain during pregnancy and sparse literature relating to the effects of over-consumption of nutrients in pregnancy other than fats and glucose. This may be a reflection of a lack of satisfactory methods to obtain accurate nutritional data. An examination of current literature suggests that exclusive breastfeeding for the first six months of life as recommended by the British government may not be in the best interests of every infant. More research is needed to be conclusive. To date just 53 hospitals/units in the UK have full Baby Friendly accreditation (as at 23 April, 2004), which may account in part for the poor breastfeeding rates in the UK (UNICEF UK Baby Friendly Initiative, 2004). Six of the 53 are community services making 47 that are maternity units. Of the babies born in the UK 15.6 per cent are born in a Baby Friendly Hospital (Radford, 2004).

1.19 Literature Update

A recent search to update the literature on nutrition in pregnancy has brought to the fore a number of relevant studies, although there is still a paucity of relevant UK research. Nonetheless, the results of some of these studies can be applied to the UK.

Neural Tube Defects

A French study was carried out using three case studies (two Algerian and one French) of women who had conceived a NTD fetus (Candito, Hourcher, Boisson et al., 2004). Blood samples were taken from the two Algerian women two days after termination of the pregnancy and one month after the French woman's termination. In all three cases the women had below normal or at the lowest level of normal rates of vitamin B12. Vitamin B12 deficiency is indicated in intracellular folate cycle failure. The authors concluded that it would be advisable to fortify grains with both folic acid and vitamin B12. It may be unwise to base these conclusions on such weak evidence and further investigations are required. A recent report on the incidence of NTDs in the

USA prior to and since the USA folic acid mandate has found that cases of anencephaly have reduced by 16 per cent and spina bifida by 31 per cent. This has been interpreted as highlighting the success of the USA folic acid fortification programme. The report recommends that all women capable of becoming pregnant should consume 400μg of folic acid per day. This may however mean that some women will ingest too much folic acid if they take folic acid supplements in addition to folic acid fortified grains and food naturally rich in folic acid (Centers for disease control and prevention (CDC), 2004). A New Zealand study has recently examined the benefits of a once-a-week folic acid supplement compared with a daily dose of folic acid (Norsworthy, Skeaff, Adank et al., 2004). The participants were 114 volunteer non-pregnant women and were randomly assigned to either a daily dose of 400μg or a once-a-week dose of 2800μg of folic acid for a 12-week period. Results showed that pariticpants who received the once-a-week dose had slightly less red blood cell folate concentrations than those who had taken a daily dose. Thus it was concluded that the weekly dose was less effective but taken before pregnancy may prevent neural tube defects. However, the consequences of taking such a high dose of folic acid at any one time should be investigated before these conclusions become recommendations.

Alcohol

A recent Canadian study carried out on rats found that prenatal ethanol exposure decreased fetal growth and delayed the development of the skeleton pre-natally (Keiver and Weinberg, 2004). The problem with this study is that it is difficult to apply the findings to humans because of the unknown amounts of ethanol that might be required to produce the same effects in humans. A large, human study (4705 cases and 4329 controls) classified infants who had been exposed to alcohol prenatally, whatever the amount and those who had not been exposed to alcohol prenatally (Martinez-Frias, Bermejo, Rogriguez-Pinilla et al., 2004). Those who had been exposed to alcohol prenatally were further subdivided into five groups according to their levels of alcohol consumption. Two groups had increasing sporadic alcohol consumption while the other three consumed increasing daily amounts of alcohol. Results showed that even low sporadic doses may increase congenital anomalies which are at risk of increasing in line with the amount of alcohol exposure. As the consumption of alcohol among the women may be more than was actually self-reported the recommendations of the authors for complete abstinence during pregnancy should be advocated.

Fetal Alcohol Syndrome

A recent study carried out with American Plains Indian women and South African women found that the level of risk of producing a child with Fetal Alcohol Syndrome is affected by environmental and behavioural conditions variant between and within populations (May, Gossazge, White-Country et al., 2004). A further suggestion was that genetic factors should also be considered. Another American study suggests that one in eight women report drinking alcohol with approximately 80,000 reporting binge drinking (Floyd & Sidhu, 2004). These figures suggest that there has been no significant change in the figures over the past ten-year period. As these figures may be inaccurate due to non-reporting, the authors are wise to recommend development of programmes to prevent Fetal Alcohol Syndrome.

Iron Supplements

Research is still ongoing into the debate regarding dietary iron supplementation during pregnancy. A recent Mexican study (n=453) tested the efficacy of iron only supplements versus multiple micronutrient supplements (Ramakrishnan, Neufel, Gonzalez-Cossio et al., 2004). Findings suggest that multiple micronutrient supplements actually reduced haemoglobin concentrations although only slightly. The conclusion was that neither iron only or multiple micronutrient supplements met iron needs during pregnancy. It is possible that because the women were being given supplements they felt it unnecessary to eat iron rich foods and this could account for the results. A further study in Cleveland, Ohio, used 513 low-income pregnant women who were assigned to either placebos or iron supplements (Cogswell, Parvant, Ickes et al., 2003). Results found that there was no significant reduction in anaemia. There was however, a significantly lower incidence of lower birthweight in infants whose mothers received iron supplements. This study concluded that the benefits of iron supplementation as a measure to reduce low birthweight should be further examined.

Calcium

A recent case study of a 36 year old woman who developed hypercalcemia after commencing breastfeeding of her second child found she was supplementing an already high calcium diet to avoid an osteoporotic fracture which occurred while breastfeeding her first child (Caplan, Miller, Silva, 2004). The authors concluded that daily recommended allowances for calcium should not be exceeded during breastfeeding. As this conclusion was based on just one case study it is not possible to generalise from these results. Thus empirical research needs to be conducted before this result can be conclusive.

Vitamin D

Lack of vitamin D is causing concern in the United States particularly amongst individuals with dark skin (Hollis & Wagner, 2004). At present the optimum daily dose during pregnancy and lactation is unknown. Hollis and Wagner's review suggests more studies are needed to determine optimal vitamin D daily intakes for pregnant and lactation women depending on skin colour/race.

Iodine

A recent study found that iodine deficiency is problematic in Australia (Hamrosi, Wallace and Rileym, 2003). This study examined a multiethnic population in Australia and concluded the woman were mildly to moderately iodine deficient and these findings may have implications for fetal development as well as public health advice. It would be worth conducting a similar study in the UK for the same reasons. It is important for the UK to note the importance of iodine during pregnancy in view of the fact that some women may be iodine deficient due to lack of consumption of iodine rich foods such as fish.

Female Diets

A recent, large (n=6125) UK study examined the diets of pregnant women aged between 20-34 years (Robinson, Crozier, Borland et al., 2004). Food intake was measured using an interviewer administered food frequency questionnaire. Low diet scores were indicative of low intakes of recommended foods such as fruit, vegetables, pasta and wholemeal foods and high intakes of foods such as chips, roast potatoes, full fat dairy products, red meat, sugar and white bread. There was a relationship between low scores and low educational attainment. Conclusions were that these findings are not just due to deprivation or poverty but there are other barriers to improving quality of diet that may need further investigation.

Longterm Effects of Low Birthweight

An Indian study assessed the cognitive development of a cohort of children aged 12 years who had a birthweight of <2000g and been discharged from a Neonatal Special Care Baby Unit (Chaudhari, Otive, Chitale, et al., 2004). The authors concluded from the findings that those with a birthweight of <2000g performed less well on cognitive tests than those controls with birthweights within the normal range.

Gestational Diabetes Mellitus

A Danish follow-up study of two cohorts, ten years apart, of women with gestational diabetes (n=241 and >500 respectively) found that over the ten year period the incidence of diabetes had almost doubled (Lauenborg, Hansen, Jenson et al., 2004). The authors concluded there was a relationship between large BMI and development of diabetes in women who had previously had gestational diabetes mellitus. However, this study may be biased as the second cohort was more than double in size and this may account for the greater incidence of diabetes.

Exclusive Breastfeeding

A Brazilian longitudinal study of 102 full term, exclusively breastfed infants with a birthweight not less than 2500g were followed until the age of six months Marques, Lopez & Braga, 2004). Average weight at six months was above the 50th percentile of the NCHS (National Center for Health Statistics). The authors concluded that these results confirm the benefits of exclusive breastfeeding until six months. However, more studies are needed as suggested by MacDonald (2003) who considered the benefits of exclusive breastfeeding. MacDonald concluded that there is insufficient evidence regarding exclusive breastfeeding or early weaning. However, as the prevalence of breastfeeding in the UK is low and the introduction of solid food early is high, mothers should be encouraged to continue to breastfeed for longer periods than currently practised.

Conclusion

Although there is ongoing research into nutrition in pregnancy, much of which is valid and reliable, more is still needed in order to settle debates within the area and reach conclusions.

Chapter Two

Literature review of psychological theories of health-related behaviours.

Introduction

The impact of the mother's diet on the developing fetus has been well researched (Martinez-Frias & Salvador, 1990; Ben-Shlomo & Davey-Smith, 1991; Schorah & Smithells, 1991; Barker, 1992; Fall, et al., 1992; Barker, et al., 1993a; Barker, et al., 1993b; Barker, et al., 1993c; Osmond, et al., 1993; Gray & Buttriss, 1994; The Maternity Alliance, 1995; Dent, 1995; Godfrey, et al., 1996; Stein, et al., 1996). Over recent years there have been many health campaigns to increase public awareness of the differences between healthy and unhealthy foods. Despite this wealth of information, many individuals show a disregard for these warnings, as in the case of confectionery consumption and the risk of dental caries (Conner & Norman, 2001). Consequently, the reasons for such health damaging behaviour, and modification of this behaviour, have become a major interest for health psychologists in recent years. This has culminated in a wide body of research, and social cognitive models have been developed in an attempt to explain why individuals engage in health damaging behaviour (Stroebe & Stroebe, 1995). Therefore, in order to understand and appreciate the processes and factors that determine an individual's health-related behaviour, this chapter presents an in-depth examination of a number of social cognitive models of such behaviour. The first part of the chapter explores the concept of health and health behaviours and why they are important to this research. The chapter goes on to define and examine the social cognitive models pertinent to health-related behaviour. A critique of each model will be provided, in order to justify and defend the cognitive model chosen for this research.

2.1 Health as a concept

Definitions of health

Health is a subjective concept, therefore it is important to identify and establish concepts relating to perceptions of health. The WHO (1948) defined health as 'a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity'. Ewles and Simnett (1985), who adopt a holistic approach to health believed that a definition of health should encompass elements such as emotional, spiritiual and societal. Later, Ewles and Simnett (1992) criticised the WHO (1948) definition for being unrealistic and idealistic, and implying that health is static. They took their criticisms further, questioning the right of any organisation or individual to define a state of health when it is a subjective concept. Because of the vagueness of the WHO definition the Alameda County Study (1965-1974) developed a health measure based on a spectrum ranging from death, disability and illness to positive well-being (Berkman & Breslow, 1983). The current health policy adopted by WHO is, *Health-for-All in the Twenty-First Century* and adopts a whole approach to health (WHO, 1998). Its main aims are to improve the quality of life and increase life expectancy and are based on five general principles:

(i) Equity = everyone should have similar chances for good health.

(ii) Empowerment = everyone should have control over their own health.

(iii) Participation = people should be involved in the planning and running of the services they use.

(iv) Primary care = everyone should have services close to them.

(v) Multidisciplinary inter-agency working = everyone should work together for the good of the community.

These aims are problematic as not everyone can access participation in these principles for reasons of intelligence, education and socio-economic background. In addition, it still leaves the question of how to define an individual's absence of disease, absence of ill health and presence of positive health. Seedhouse (1986) favoured the suggestion that health is made up of a number of factors that help people to maximise their personal potential. Aggleton (1990) criticised this definition as it is not possible to accurately measure personal potential, and like the original WHO definition, it is slightly mystical. Health has been defined as being the presence of positive well-being and not merely the absence of disease (Stone, 1979; Seeman, 1989). Kemm and Close (1995) defined physical well-being as the absence of all physical disease; mental well-being as an individual's mental and physical functions in harmony and social well-being as how well the individual would function in society. As in the original WHO definition, the Kemm and Close definition has the problem of measuring well-being. Seedhouse (1986) drew attention to the assumption within the WHO original definition, that no one can be healthy if they have any physical, mental or social problem. Indeed using the WHO definition it would be very difficult to find individuals without any physical, mental or social problem, however small, thus few, if any people would be considered healthy. Of note, Rokeach (1973) found in his study of values that all participants ranked health first. This might indicate that all individuals would be motivated to seek health care and advice.

Perceptions of health

At one end of the health spectrum we have perfect health moving along a continuum to death at the other end (Dorn, 1955). From the individual's standpoint, the measurement or perception of health is subjective. This is problematic, as what is ill to one person may only be considered as mild discomfort to another, which raises the issue as to where positive health ends and ill-health begins. Merrell and Reed (1949) proposed a graded scale from positive to negative health based on the individual's feelings of well-being. They avoided the use of the term ill and focused on descriptive measures such as, very well, well, fairly well, through to those who feel poorly and then definitely ill. Blaxter (1990) examined lay perceptions of health based on a survey of 9,000 lay people carried out by the University of Cambridge Clinical School. Fifteen per cent of the participants of the ten per cent random sample analysed by Blaxter perceived themselves as being unhealthy. Others saw health as not being ill, while some respondents viewed health as the absence of disease or symptoms. Some considered health to be quick recovery from illness or infirmity, whilst others saw healthy behaviour, such as not smoking or drinking and taking exercise, as an indication of health. To some individuals, physical fitness represented good health, whereas to others, energy, or vitality was important. Because of the variety in health and lay perceptions of health there are marked differences in individual health behaviour. According to Taylor (1995), a large part of Psychology's involvement in health is a commitment to keeping people healthy, rather than waiting to treat them after they become ill. Moreover, patient care today focuses on preventive medicine, which to a large extent relies on individual health behaviours.

Measurement of health

From the point of view of clinicians and health promotion professionals, health is measured against such indices as mortality rates and other statistics such as those used by the health-service (Bowling, 1991). Medical professionals can often base an individual's state of health only on self-reporting. The consideration, above, of the definitions of health has ascertained that any standard measure of 'health' is problematic.

2.2 Definition of Health Behaviours

Health behaviours are those indulged in by people who wish to maintain or improve their health (Kasl & Cobb, 1966; Stone, 1979). Many individuals demonstrate unrealistic optimism about their resilience to diseases, and this may prevent them from attending, for example, periodic blood pressure checks (Weinstein, 1982, 1983, 1987). This may lead to many conditions going unnoticed until they have developed into full-scale illnesses. Indeed, it has been suggested by some, that unrealistic optimism may prevent individuals from choosing good health behaviours (Weinstein, 1982, 1987; Lee, 1989; Croyle, Sun & Louie, 1993). However, individuals may be motivated to seek preventive care, but this may have an adverse effect. The stress generated from attendance at surgeries and clinics may cause a rise in blood pressure, known as white coat hypertension (Dubbert, 1995), which may lead to unnecessary medication and worry for the patient. Moreover, the attitudes of doctors and other health professionals may cause stress, which in many cases, particularly women, may lead to over-eating and thus obesity or malnourishment. It is generally accepted that women are more likely than men to make use of health services, discounting pregnancy and childbirth (Nathanson, 1975, 1977;

Mechanic, 1976; Rosenstock & Kirscht, 1979; Verbrugge, 1979,1980; Cleary, Mechanic & Greenley, 1982; Pennebaker, 1982; Waldron, 1988; Fuller, et al., 1993). There are also the problems of socio-economic factors, which appear to affect health care usage. Pennebaker (1982) found that people in the higher social groups experienced fewer symptoms, but when they did, they would seek health care faster than those in the lower socio-economic groups. However, those in the lower socio-economic groups, tended to be more frequent users of hospitals (Brannon & Feist, 1992). Health behaviour is sometimes affected by cultural differences in what represents ill health, and if and when an individual should seek medical help (Ruiz & Ruiz, 1983; DiNicola & DiMatteo, 1984;). Moreover, Illich (1975) criticised modern medicine for becoming iatrogenic, that is, illness caused by medicine itself. Indeed he takes iatrogenics further and breaks it down into components. Social iatrogenesis is the psychological injury caused by the impersonal and business-like way medicine is now conducted. Cultural iatrogenesis refers to the concept of managed health, where the individual no longer has responsibility for their health. Illich (1975) used the term medicalisation of life, meaning minor complaints and depressed moods, which could have been solved alone or through social networks, have now been granted illness status. However, with the development of health psychology Illich's views may not be so relevant today. People wishing to improve or maintain their state of health usually enter into health behaviours (Kasl & Cobb, 1966; Stone, 1979; Mattarazzo, 1984). However, some health behaviours will have been socialised, for example smoking, or are the result of legislation such as the wearing of crash helmets when motor-cycling in the United Kingdom. A health habit, either good or bad, is a firmly established and often automatic behaviour pattern, which is performed without awareness. Health habits differ from cognitions and perceptions because they are entrenched and automatic. Cognitions in relation to health behaviours are variables such as attitudes, perceptions and knowledge regarding the efficacy or risk factors of various health related behaviours (Conner and Norman, 1995). These cognitive variables are often formed in childhood due to the influence of parental models (Conner and Norman, 1995). For example, parental attitude towards toothbrushing would be reflected in the child's behaviour towards toothbrushing. If the parents believe toothbrushing to be unnecessary for prevention of tooth decay then it is unlikely they will persuade their child to clean its teeth. Thus the perception that toothbrushing is unnecessary will have been passed on to the child. During schooling or via the media the child may learn that toothbrushing can prevent tooth decay. However, despite this knowledge the individual will be unlikely to change their health behaviour because the original behaviour has become entrenched and thus a habit. A search of the relevant literature has not found a study similar to the aforementioned example. Health habits formed in childhood have been shown to stabilise at about age 11 or 12 (Cohen, Brownell & Felix, 1990; Taylor 1995). Although such behaviour may have developed from parental reinforcement, eventually it becomes independent and is maintained by customary environmental factors (Taylor, 1995). The renowned Alameda County, California, study conducted by Belloc and Breslow (1972) found that of the approximately 7,000 residents who took part, those who maintained better health habits had fewer illnesses. A follow-up nine and a half years later found that those who practiced the seven health habits defined as important by Belloc and Breslow (1972) had dramatically lower mortality rates (Berkman & Breslow, 1983). The good health habits of the Alameda County, California, study were defined as:

(i) Sleeping seven to eight hours a night;
(ii) Not smoking;
(iii) Eating breakfast every day;
(iv) Having no more than one or two alcoholic drinks per day;
(v) Getting regular exercise;
(vi) Not eating between meals; and
(vii) Not being more than ten per cent overweight (Belloc & Breslow 1972; Breslow & Enstrom 1980; Kaplan 1985; Kaplan, et al., 1991; Wingard, Berkman & Brand, 1982).

This research takes a bio-psychosocial approach, recognising that health is determined by many different influences (Kaplan, Sallis & Patterson, 1993).

In this instance the influence of interest is diet. The term bio-psychosocial recognises the influence of biological, psychological and social factors (Engel, 1977; Schwartz, 1982). As the name implies, the fundamental assumption is that any health or illness outcome is a consequence of the interplay of biological, psychological and social factors. Good health behaviour at the individual level involves developing habits early in life and carrying them through adulthood and old age. Health habits are strongly affected by early socialisation, especially the influence of parents as social models (Lau, Quadrel & Hartman, 1990). McKinlay, McKinlay & Beaglehole (1989) believe that health is affected more by personal behaviour than medical intervention. From the evidence, therefore, it would seem prudent to establish good health habits with expectant mothers from early in pregnancy, so that there is a greater chance of passing on these behaviours to the child and so establishing them for the next generation.

2.3 Definition of a Social Cognitive Model

It is generally considered that the leading causes of death, such as heart disease and cancer, can be attributable in many cases to individual behaviour patterns (Stroebe & Stroebe, 1995). Diseases, such as Coronary Heart Disease and cancer, have a causal link to dietary intake, and the Health of the Nation (1992), lists among its objectives improvement in: nutrition; food and drug safety; maternal and infant health; reduction of heart disease, stroke and cancer. The Center for Diseases Control (1980) estimated that 50 percent of deaths from the ten leading causes in the USA were due to lifestyles that could have been modified (Taylor, 1995). These figures are comparable with the United Kingdom (Ogden, 1996). This has led to much research in an attempt to identify the underlying factors determining health behaviours (Winett, 1985; Rodin & Salovey, 1989; Glanz, Lewis & Rimmer, 1990; McQueen, 1991; Hochbaum & Lorig, 1992; McLeroy, et al., 1993; Adler & Matthews, 1994). The motivation behind such research is to understand why individuals perform various behaviours and to intervene in health compromising behaviours (Conner & Norman, 1996). Kaplan, Sallis and Patterson (1993) claimed that our ability to comprehend, predict and control human behaviour is limited.

Research indicates that there are many intrinsic and extrinsic factors influencing the behaviour of the individual. Extrinsic factors range from legal restrictions, such as wearing seatbelts, to financial restrictions such as taxes on alcohol and tobacco (Conner & Norman, 1996). Intrinsic factors would be cognitions, socio-demographic factors, social and family support, and personality (Kaplan, et al., 1993; Conner & Norman, 1996). Psychologists are more interested in intrinsic factors, with cognitive factors receiving most attention (Conner & Norman, 1996). Some research has identified how cognitive factors produce social behaviours, and findings have been developed into Social Cognitive Models (Conner & Norman, 1996).

There are many factors to consider relating to human behaviour, such as state of health, education and socio-economic background (Kaplan, et al., 1993; Conner & Norman, 1996). Some behaviours occur directly under medical supervision, whilst others are performed without supervision (Kaplan, et al., 1993). Successful modification of health behaviour may have several beneficial effects, such as reducing the number of deaths related to a particular lifestyle. It may also increase longevity and life expectancy. Due to the diversity of health behaviours, no one theory has been shown to address all variables. Most cognitive social theories have their origins in the fundamentals of social learning theory and many contain elements of self-efficacy and/or locus of control. An overview of these concepts is therefore necessary in order to understand the various theories under discussion here.

2.4 Social Learning Theory

Social Learning Theory developed in the 1940s and 1950s in the USA as a reinterpretation of Freud's psychoanalytical theory. This became known as Orthodox Learning Theory (Dollard & Miller, 1950) and was thereafter developed in the 1960s and 1970s by Bandura and became known as Social Learning Theory. Essentially it is a theory based on imitation or modelling of the individual on a particular person, such as a parent or teacher. It does not involve conditioning, reinforcement or punishment, and the learning takes place purely through observation of role models. There are several important points to note about the concept of observational learning. The person whose behaviour is being observed is called the model, thus modelling is normally used synonymously with observational learning. Social Learning theorists believe that all behaviour is learned through the same mechanisms, according to the same principles of learning. Social Learning Theory is a comprehensive theory, which is based on the interrelationships of the cognitive, behavioural and emotional processing of the individual and the physical and social environments. It is well established that behaviour is determined by the environmental stimuli that precede and follow it (Skinner, 1953; Bandura, 1969). The learning takes place with no deliberate effort on the learner's part or any intention to teach on the model's part. Therefore, observational learning, as such, takes place without any reinforcement (Bandura, 1965), and exposure to the model is sufficient for learning to take place. However, whether the learning actually reveals itself in the imitated behaviour depends, inter alia, on the consequences of the behaviour, both for the model and the learner (Bandura & MacDonald, 1963). Bandura (1965) argued that the consequence exerts its influence forwards, into the future; by giving the learner information about what effects can be expected if their behaviour is repeated in similar circumstances. For these reasons we can learn from observing others (as well as from our own behaviour), as this can provide the information as to what kind of behaviour leads to which consequence. Thus, whereas for Skinner the role of reinforcement is central to the learning process itself, for the Social Learning theorists it is important only in so far as it determines the likelihood of learned responses actually being demonstrated. It has been suggested that this theory amongst others has been very effective in facilitating understanding of a wide range of human behaviours (Bellack, Hersen & Kazdin, 1982). Emotional fears such as visiting the doctor or hospital, and more specific behaviours such as smoking, can be modelled. Emotional fears would be modelled through body posture, facial expressions and demeanour. Thus, they are essentially learned by imitation, as in the case of more specific behaviours. Much of the Social Learning theorists' research has centred on the characteristics of models that make them more or less likely to be imitated, and the conditions under which the learning will be performed. Bandura believed that there are five major functions involved in observational learning:

(i) The learner must pay attention.

(ii) Reading a visual image or semantic code for the modelled behaviour in memory.

(iii) Without an adequate coding system the learner fails to store what has been seen or heard.

(iv) Memory permanence. This refers to devices such as rehearsal and use of multiple codes to help retain the stored information over long periods.

(v) Reproducing the observed motor activities accurately.

(vi) Motivation. Behaviourists have traditionally equated this with the role of the consequences of behaviour.

By motivational, Bandura (1974) meant that we are more likely to try to learn the modelled behaviour if we value the consequences related to that behaviour. But, as Bandura also made the distinction between learning and performance, the motivational effect of reinforcement may be greater in relation to demonstration of learning, rather than the learning itself. Bandura (1974) believed that behaviour is changed in humans through the influence of thought. The main tenet of Social Learning Theory is that the likelihood of a behaviour occurring in a given situation is a joint function of the individual's expectancy that the behaviour will lead to a particular reinforcement and the extent to which the reinforcement is valued (Conner & Norman, 1996). Rotter (1954) proposed that the theory could operate on a general, as well as a specific level. So, in addition to having expectancy beliefs for particular situations, individuals are also believed to have generalized expectancies that cut across situations. According to Social Learning Theory, behaviour is a function of expectancy beliefs and the value attached to certain outcomes. It was from this perspective that the notion of Locus of Control was introduced as a generalized expectancy relating to the perceived relations between one's actions and experienced outcomes (Norman & Bennett, 1996).

2.5 Locus of Control/Health Locus of Control

Locus of Control is a concept developed by Rotter (1966), which can be traced back to his 1954 Social Learning Theory. He developed a scale for measuring people's perceptions of whether events in their lives were controlled by internal or external events. Thus a person could be placed on a continuum depending on how much control they believed they had over their lives. Those who perceived themselves to have control over their lives were deemed to have an internal Locus of Control, while those who perceived themselves to be in the hands of fate, chance or other individuals, had an external Locus of Control (Rotter, 1966; Lau, 1988). It has been suggested that those with an internal Locus of Control might be more likely to seek more health information than those with an external Locus of Control (Strickland, 1978). However, there have been problems of measurement and no significant correlation has been found (Taylor, 1995). Nevertheless, Strickland (1978) generated some evidence to suggest that those with an internal Locus of Control, who value their health, would be more likely to seek health information than those with an internal locus of control who do not value their health. These findings have led others to more closely examine Locus of Control within the context of health (Wallston, Wallston & DeVellis, 1978; Lau & Ware, 1981). Wallston et al. (1978) developed the Health Locus of Control Scale with three measuring subscales for measuring perception of control over an individual's health status. The first subscale uses terminology such as "I am in control of my health" and "The main thing that affects my health is what I myself do." The second subscale measures the effect of powerful others, such as "Whenever I don't feel well, I should consult a medically trained professional" and "Whenever I recover from illness, it's usually because other people have been taking good care of me." Other people might range from doctors and nurses to family and friends. The last subscale measures the perception of chance affecting health. Items such as "Luck plays a big part in determining how I will recover from an illness", or, "If I'm going to get sick, I will get sick."

Research has shown that individuals in manual occupations, women, those with limited formal education and older people, tended to have higher scores on chance and powerful others categories (Calnan, 1988). However, research carried out by Pill and Stott (1985) indicated that working class women have strong beliefs about personal responsibility for health and illness, in addition to external causes such as hereditary, environmental factors and germs. This research also indicates such women are more likely to place importance on eating properly and not smoking. There are many factors affecting Locus of Control such as occupation, education, gender, age and socio-economic status (Kemm & Close, 1995). Those of low socio-economic status tend to fulfil the criteria for external Locus of Control (Hussey & Gilliland, 1989). Although studies indicate that an internal Locus of Control leads to improvements in the health outcomes of individuals, it has been suggested that a multidimensional construct is preferable to the simple internal - external dimension, which is uni-dimensional, according to a number of researchers (Gurin, et al., 1969; Mirels, 1970; Collins, 1974; Levenson, 1974). Levenson, in particular, argued that internal Locus of Control beliefs are orthogonal to external Locus of Control beliefs and we can differentiate between the influence of powerful others and chance or fate. Wallston, Wallston and DeVellis (1978) developed a multidimensional health Locus of Control scale, predicting that those who scored internally would be more likely to engage in health promoting activities. Their theory has become the most popular measure used in research on health behaviour. Results of various studies are less conclusive, for example some studies have found a positive relationship with internal Locus of Control and health behaviour (Mechanic & Cleary, 1980; Seeman & Seeman, 1983; Rauckhorst, 1987; Duffy, 1988; Weiss & Larson, 1990; Waller & Bates, 1992). However, other studies have not found such a relationship (Winefield, 1982; Brown, Muhlenkamp, Fox & Osborn, 1983; Muhlenkamp, Brown & Sands, 1985; Wurtele, Britcher & Saslawskyl, 1985; Steptoe, et al., 1994; Norman, 1985). Yet further studies have resulted in a negative relationship (Brown, et al., 1983; Muhlenkamp, Brown & Sands, 1985; Steptoe, et al., 1994). Overall the evidence has culminated in a weak link with internal health Locus of Control and preventive health behaviour. One important criticism made by researchers is that many tests of health Locus of Control have not paid attention to the value people place on their health, and thus it has proved inadequate (Lau, Hartman & Ware, 1986; Weiss & Larson, 1990 and Wallston, 1991). Norman and Bennett (1996) pointed out that behaviour is a function of expectancy beliefs, and the value attached to certain outcomes. Therefore, we must consider the influence of health Locus of Control beliefs in tandem with the individual's value of their own health. Wallston (1991) says that even if health value is considered, it should be done in a multiplicative way rather than the usual additive fashion. Some studies looking specifically for a correlation between health Locus of Control and health value have produced positive results (Weiss & Larson, 1990). However, other studies have not found such a correlation (Wurtele, Britcher & Saslawsky, 1985). Interestingly, an interaction has been found between health value and Locus of Control for dietary behaviour (Hayes & Ross, 1987). In addition, a fetal health Locus of Control has been developed specifically to look at the health-related behaviour of pregnant women (Labs & Wurtele, 1986). This measures the degree of control women believe they have over the health of their unborn child, and how much it is under the control of others or chance. Results indicated that it was possible to predict that those with internal Locus of Control were more likely to engage in health enhancing behaviours such as not smoking, limiting caffeine intake and attending antenatal classes. However, using the multidimensional health Locus of Control, it was not possible to predict the health enchancing behaviour of the women. Further research by Tinsley & Holtgrave (1989) similarly found a link between neonatal locus of control and the use of preventive health services. Thus, from the evidence, it should be expected that individuals with a high internal Locus of Control will score highly on a health Locus of Control scale if they value their health highly. However, the overall evidence suggests that the health Locus of Control is only predictive if it is behaviour specific rather than multidimensional.

2.6 Self-efficacy

The concept of Self-efficacy theory was defined by Bandura (1977) as the expectancy of an individual to carry out a desired behaviour. Choice of activities, and the amount of effort put into problems and setbacks is governed by self-efficacy (Bandura, 1982). Thus, individuals with a strong sense of self-efficacy would be more likely to stick to health regimes than those with a weak sense of self-efficacy. For example, applying self-efficacy to weight reduction through diet would show four fundamental elements:

(i) Past successes and failures.

(ii) Observations and perceptions of the performance of others.

(iii) Positive or negative feedback from others.

(iv) The physiological state of the individual (Sheridan & Radmacher, 1992).

Accordingly, we would expect our degree of self-efficacy to be dependent, to a large degree, on the behaviour of other people. For example, if we are exposed to people who have achieved success, and receive positive encouragement from significant others, we are more likely to stay on course with the diet. However, if we only see people who have tried and failed, and we ourselves have failed in the past, and we receive no encouragement from significant others, we are more likely to have a low degree of self-efficacy and failure is highly probable. Moreover, it is very important not to overlook the physiological state of the individual, as negative or positive emotional feelings will affect the rate of success. For example, past failures and successes can have a physiological effect on the individual by causing stress that can in turn affect future success rates. Bandura (1977) believed that self-efficacy is an important determinant in the successful practice of health behaviours, and much research has indicated this to be the case in a variety of health behaviours (Prochaska & DiClemente, 1984; Strecher, et al., 1986; Coates, Morin & McKusick, 1987; Weinstein, Sandman & Roberts, 1991; McAuley & Courney, 1992; Grembowski, et al., 1993). Moreover, research has found a strong relationship between self-efficacy and existing health behaviours, as well as those that have involved change (Taylor, 1995). Furthermore, experiments carried out to increase self-efficacy have met with some success, which appears to be related to health behaviour changes (Stretcher, et al.1986). Indeed, Schwarzer (1992) found that self-efficacy was the best predictor of both behavioural change and behavioural intentions, and this concept is central to his own model, the Health Action Approach. Implicit in the concept of self-efficacy is the amount of control that individuals believe they have over their behaviour (Ogden, 1996). Fundamentally, there are three types of expectancies, which the individual has:

(i) Outcome of the individual's situation.

(ii) Outcome of the individual's action.

(iii) Perception of self-efficacy.

Thus, in the situation outcome, an individual may see their weight as a health threat. Their expectancy of the action outcome might be that they will lose weight or they will not lose weight. Finally, the perception of self-efficacy is how much control individuals believe they have over losing weight (Bandura, 1977). Thus the higher an individual's expectancies, the more optimistic they will be about the outcome. The more optimistic their perceptions, the more likely it is to predict a positive outcome (Bandura, 1992; Schwarzer, 1992). Self-efficacy has played a major role in different theories of health behaviour, one of which is the Health Belief Model.

2.7 Health Belief Model

The Health Belief Model originated in the United States of America in the 1950s, when researchers in the public health service were trying to explain why certain individuals failed to take up health screening tests. Those most influential in the early stages of the development of the model were Hochbaum, 1958; Rosenstock, 1966; Becker, 1974; Brannon & Feist, 1992; Harris & Middleton, 1995 Kemm & Close, 1995; Stroebe & Stroebe, 1995; Sheeran & Abraham, 1996; Ogden, 1996. Evidence suggested that gender, ethnicity, age and socio-economic status are influential in people's adoption of preventive health behaviours (Rosenstock, 1974). Health education and publicly funded services did not alleviate the effects of socio-economic factors (Sheeran & Abraham, 1996). Later the model was expanded to include responses to symptoms and adherence and compliance with medical regimens (Rosenstock, 1974; Becker & Maiman, 1975; Wallston & Wallston, 1981; Janz & Becker, 1984; Adler, Kegeles & Genevro, 1992; Schwarzer, 1992). It has since become one of the most highly influential and widely used theories of individual health behaviours (Taylor, 1995). It has been used to predict a vast variety of health-related behaviours such as dental behaviours (Kegeles, 1963;

Chen & Tatsuoka, 1984), alcohol behaviours (Portnoy, 1980; Beck, 1981; Gottlieb & Baker, 1986; Rees, 1986 & Werch, 1990), smoking behaviours (Penderson, Wanklin & Baskerville, 1982; Gianetti, Reynolds & Rihen, 1985; Gottlieb & Baker, 1986; Stacy & Lloyd, 1990), through to screening and clinic use (Charney, Bynum & Eldridge, 1967; Becker, et al., 1975; Kirsht & Rosenstock, 1977; Becker, Radius & Rosenstock, 1978; Hartman & Becker, 1978; Nelson, Stason & Neutra, 1978; Aho, 1979; Cummings, Jette & Brock, 1979; Leavitt, 1979; Hershey, et al., 1980; Cummings, Becker & Kirscht, 1982; Larson, Bergman & Heidrich, 1982; Connelly, 1984; Calnan, 1985; Harris & Lynn, 1985; Hester & Macrina, 1985; Bradley, Gamsu & Moses, 1987; Brownlee-Duffeck, Peterson & Simonds, 1987; Lowe & Radius, 1987; Owens, et al., 1987; Pan & Tantam, 1989; Ronis & Harel, 1989; Norman & Conner, 1993). There are four fundamental components to the Health Belief Model as follows:

(i) Perceived severity;

(ii) Perceived susceptibility;

(iii) Perceived benefits;

(iv) Perceived barriers (Rosenstock, 1966; Rosenstock & Kirscht, 1979; Brannon & Feist, 1992; Sheridan & Radmacher, 1992; Kemm & Close, 1995).

Thus, an individual might be motivated to lower cholesterol in their diet, depending on how serious they considered heart disease to be. They would also consider how susceptible they believed themselves to be to the likelihood of a heart attack. For example, if the individual had a parent or sibling who had died from heart failure, they may believe themselves to be at greater risk. If the individual believed that reducing cholesterol would prolong their life they might be motivated to change their diet. Perceived barriers, which might prevent them from altering their diet, might be the increased cost of food, not wanting to give up certain foods or difficulty and inconvenience in preparation. Thus people make decisions (often unconsciously) about their behaviour, and Damrosch (1991) described this as a cost-benefit analysis whereby the individual weighs up the pros and cons of entering into a certain behaviour (Rosenstock, 1974; Becker & Rosenstock, 1984; Kemm & Close, 1995).

Implicit in the model are cues to action, which can be external or internal (Harris & Middleton, 1995; Kemm & Close, 1995). External cues might be advertising campaigns or an appointment card for a health screening. Internal cues could be symptoms experienced by the individual such as pain or breathlessness (Harris & Middleton, 1995; Kemm & Close, 1995; Ogden, 1996). One problem with cues to action is that they are not sufficient on their own for individuals to act. They need to be prompted by the threat of the disease or problem. Thus the person must perceive susceptibility and seriousness of the disease or problem to feel threatened (Harris & Middleton, 1995). Rosenstock (1974) further developed the Health Belief Model, incorporating into it socio-cognitive theory and self-efficacy, based on the individual's subjective feelings of susceptibility and possible benefits of preventive behaviour. It has been suggested that individuals are unrealistically optimistic about their susceptibility and vulnerability, and thus they underestimate their chances of becoming ill (Weinstein 1980, 1984; Brannon & Feist, 1992). The Health Belief Model is thought by some to give an adequate explanation of the health habits people engage in (Kirscht, 1983; Janz & Becker, 1984). Results have shown that health beliefs do affect people's intentions with regard to health practices. Moreover, in-depth examinations of the specific components of the Health Belief Model would appear to indicate that perceived barriers to the practice of the particular health behaviour are the strongest factors, which influence whether individuals do engage in health behaviours. In studies that examined breast self-examination behaviour, findings suggested that barriers and perceived susceptibility appeared to be the best indicators of beneficial health behaviour (Lashley, 1987; Wyper, 1990). Perceived barriers were found to be the best predictors of attendance at health screening clinics (Norman & Fitter, 1989). There does not appear to be a standard measure of barriers or susceptibility (Janz & Becker, 1984). Nonetheless, several studies support the original model of Health Belief. A variety of behaviours are related to susceptibility to disease or health problems such as dental checkups, keeping up-to-date with vaccinations, complying with dietary advice and practising safe sex. Research has also provided support for the role of cues- to-action in predicting health behaviours, in particular, external cues such as informational input. Therefore, according to the Health Belief Model, an individual would only engage in those behaviours if they believed they were susceptible to the health endangering condition, and that the benefits of so doing would outweigh the costs (Becker, 1974; Becker Haefner & Maiman, 1977; Becker & Rosenstock, 1984). In this way individuals may change their attitudes, and consequently their behaviour, if they are given the right fear-arousing messages directed towards behaviours such as safe driving, smoking and dental health (Sutton, 1982; Flay, 1985; Sutton & Hallett, 1989). Some research has shown a significant relationship between health information and preventive health behaviour (Ogden, 1996). Knowledge about breast cancer is related to having regular mammograms (Rimer, et al., 1991). Other studies related to breast cancer have shown a positive correlation between knowledge and breast self-examination (Alagna & Reddy, 1984; Lashley, 1987; Champion, 1990). Another study has shown that knowledge is related to screening for cervical cancer (O'Brien & Lee, 1990). Ogden (1996) has carried out a review of the literature relating to health behaviours, and it is of interest to note that those that have received most attention, are behaviours relating to prevention of breast and cervical cancer. This may be an indication that women are more knowledgeable about health matters, or it may be that most studies have been carried out with women as the participants, as females in Western societies tend to be greater health service users than men (Kohn & White, 1976; Verbrugge, 1982; Dean, Holst & Wagner, 1983; Waldron, 1983). Indeed, there is some evidence to suggest that where a child is involved, compliance is related to the health beliefs of the parents, the mother in particular. In addition, habits such as diet are affected by parental influence (Becker, et al., 1977a).

In a review of 46 studies of the Health Belief Model, Janz and Becker (1984) developed a significance ratio for each element, by dividing the statistically significant results in favour of the element, by the total reported significance levels for that element. Stroebe and Stroebe (1995) considered this to be an indication of strong support for the Health Belief Model. However, they pointed out that such information is not very informative, and in order to obtain a true picture of the results affect, sample sizes would be helpful. Moreover, a sample consisting of 46 studies is not a particularly large one from which to generalise. In addition, some studies have indicated conflicting findings. Janz and Becker (1984) reported that behavioural intentions were not related to high perceptions of seriousness, but to low perceptions of seriousness. Their study found that perceived barriers and perceived susceptibility were the best prognosticators of health behaviours. On the other hand, Becker and Rosenstock (1984) found costs and benefits and perceived seriousness to be the best predictors of behaviour. Furthermore, Hill, Gardner and Rassaby (1985) found that in the case of cervical cancer, perceived susceptibility and barriers to action were the best predictors of behaviour. The variation between the studies does appear to cause problems, and Adler, Kegeles and Genevro (1992) argued that this might be related to the lack of a standard measure for the variables within the model. The Health Belief Model has been used in a variety of formats (Brannon & Feist, 1992), although no one standard has been laid down as to how it should be utilised and how the components might be measured (Harris & Middleton, 1995).

These conflicting results indicate that different criteria for using the Health Belief Model are needed for different behaviours. Ogden (1996) made further criticisms of the Health Belief Model, stating that the Health Belief Model makes no allowance for emotional factors within the individual. Fear and denial are factors in health behaviour, which do not appear to have been identified (Ogden, 1996; Beck & Frankel, 1981; Kirscht, 1988). These are two of the most subjective factors to be considered in any theory of health behaviour. Individuals will often ignore symptoms and warning signs, or will not take part in screening programmes, for fear of the outcome. Many individuals practise the ethos of 'letting sleeping dogs lie' where their health is concerned. Ogden (1996) also posits the question of individuals actually weighing up the costs and benefits of tooth brushing. However, with tooth brushing, the individual may not have made a rational decision but in this particular case the behaviour may have emanated from parental influence.

The parent will have made a rational decision to prevent their child from developing tooth decay by instilling oral hygiene habits during childhood (Becker, et al., 1977a). Kirscht (1988) implied that there is no evidence that the Health Belief Model is of any use with children, but this opinion appears to be based on only two studies (Weisenberg, Kegeles & Lund, 1980; Kegeles & Lund, 1982). A retrospective study mentioned by Dielman, et al., (1982) and Kirscht, (1988) found no relationship between health behaviours and the factors of the Health Belief Model. On this basis, Kirscht (1988) gave no support to the Health Belief Model and the behaviour of children. Perhaps Kirscht (1988), failed to consider that the behaviours are already there, developed through parental, teacher and other social influences. Because the behaviours are habits, and so considered to be the norm by the children, factors such as barriers, susceptibility, efficacy or severity, are not considered by the children. Kirscht (1983) made the point that the Health Belief Model does not take account of cultural factors and socio-economic status. There are those who take this point further, and claim that the Health Belief Model best explains the health behaviour of people of high socio-economic status who comprehend the reasons behind health behaviour (Gochman, 1972; Anderson & Bartkus, 1973; Wolinsky, 1978). The problem with this thesis is firstly, the research is dated, and secondly, most people have equal opportunity to health education via schools and the mass media, and this may be an indication that behaviours depend more on culture and individual intelligence rather than socio-economic status. Furthermore, it has been suggested that health behaviours are not due to components of the Health Belief Model, but to the perception of symptoms (Leventhal, Prochaska & Hirschman, 1985). However, this argument does not appear to allow for preventive health behaviours where no symptoms may be experienced. Many, if not most, health behaviours are preventive, i.e. checkups, screening, personal and food hygiene, healthy diet to name but a few. On the subject of habits, perhaps one of the great difficulties with the Health Belief Model is the undoing of old habits as in the case of chronic conditions (Kirscht, 1988). Thus there needs to be a factor built into the Health Belief Model to consider the problems associated with the breaking of old habits and development of new habits. The Health Belief

Model does communicate something of the reasons for health behaviour, but it does not communicate the psychology behind the variables in the model and how they relate to the behaviour. It has been suggested that the Health Belief Model is static and has not made allowances for the processes and development of behaviour change (Schwarzer, 1992). Thus, to include self-efficacy in the Health Belief Model may improve predications of health behaviour (Seydal, Taal & Wiegman, 1990; Schwarzer, 1992). Ogden (1996) further criticized the Health Belief Model for the importance it gives to the individual at the cost of social and environmental factors. Here perhaps, Ogden has misinterpreted the perceived barriers and motivation to adopt health behaviours and in fact there may be an inverse relationship. For example, an individual may perceive social and environmental factors (e.g. peer pressure and smoking) as a barrier and will be motivated not to adopt certain behaviour such as giving up smoking or avoiding friends who do. This reinforces the concept of cost benefit analysis (Dielman et al.1982). There is research that does not support the Health Belief Model (Haefner et al.1967; Weisenberg, Kegeles & Lund, 1980). The findings suggested that the Health Belief Model is used in a variety of ways to test for the variables of the model. Thus, individual researchers have devised their own questions, as there is no standardised version, and this makes it difficult to compare studies (Taylor, 1995). As a result of the various criticisms of the Health Belief Model, Becker and Rosenstock (1987) made refinements to the Health Belief Model, which include the explicit concept of self-efficacy. However, they argued that self-efficacy was implicit in the original model (Ogden, 1996).

2.8 Protection Motivation Theory

Because of the controversy and problems with the Health Belief Model, researchers have used the Health Belief Model to develop other more appropriate theories. One such theory is the Protection Motivation Theory. The Protection Motivation Theory was developed from the Health Belief Model (Becker, 1974) by Rogers, 1975, 1983, 1985 (Ogden, 1996). In effect it is an expansion of the Health Belief Model (Becker, 1974) with the addition of Bandura's (1974) Self-efficacy (Prentice-Dunn & Rogers, 1986). The Protection Motivation Theory originally had three variables:

(i) Perceived severity of a noxious event;

(ii) Perceived susceptibility;

(iii) Perceived efficacy of the recommended response (Stroebe & Stroebe, 1995).

In the main, the Protection Motivation Theory is based on expectancy values as in the case of the Health Belief Model, (Becker, 1974) but it differs in the concept of protection motivation. Thus individuals are motivated to protect themselves from danger (Messer & Meldrum, 1995). The motivation to protect oneself from danger is fear, and Rogers (1975, 1983 and 1985) devised the Protection Motivation Theory to explain the importance of fear as a motivation to individual behaviours. Early research (Hovland, Janis & Kelley, 1953) based on the Fear-drive Model indicated that messages received by individuals would motivate them to act on a trial and error basis. Thus a fear-invoking message would motivate the individual to act to reduce the fear. If the action did not reduce the fear the individual would enter denial and maladaptive coping responses. Messages, which distributed reassuring advice, would also invoke action to follow the advice based on fear of the consequences of non-compliance. However, as with the fear-invoking message, if the fear were not reduced, the individual would enter the denial and maladaption phase (Boer & Seydel, 1996). To obtain the maximum adoption of the advocated behaviour, there needs to be a balance between the messages and the responses, and so a medium level of fear is advocated (Leventhal, 1970; Boer & Seydel, 1996). Rogers and Mewborn (1976) tested the Protection Motivation Theory in relation to preventive behaviours for venereal diseases, smoking and traffic safety. These experiments, which involved manipulation of the variables within the Protection Motivation Theory, did not provide empirical support for the model (Stroebe & Stroebe, 1995). It has been pointed out by Sutton (1982) that failure may have been due to the model's supposition that perceived efficacy and perceived susceptibility are independent of each other. Sutton (1982) believed they are not. This is an arbitrary point, as individuals may perceive themselves as highly susceptible to heart disease, but for reasons of socio-economic and cultural factors, may not have a high self-efficacy and internal locus of control towards suitable behaviour. However, in a revision of the Protection Motivation Theory, Rogers (1983) and Rippetoe and Rogers (1987) discarded the hypothesis that the factors worked in tandem, and included the concept of self-efficacy (Stroebe & Stroebe, 1995). The revised model also borrowed the perceived barrier variable from the Health Belief Model (Becker, 1974). Thus the revised model now had four variables. Therefore, if someone received a message that exercise would help prevent heart disease, they would be motivated to take up exercise depending on their perception of the various factors of the Protection Motivation Theory. Thus motivation would depend on:

(i) How severe a condition they considered heart disease to be;

(ii) How vulnerable or susceptible they considered themselves to be to heart disease;

(iii) How effective they believed exercise to be in reducing the threat of heart disease;

(iv) The individual's self-efficacy towards exercise (Messer & Meldrum, 1995).

The Protection Motivation Theory has been used in a variety of health-related behaviours such as breast self-examination (Rippetoe & Rogers, 1987), drinking in teenagers (Stainback & Rogers, 1983), exercise (Wurtele & Maddux, 1987), exercise and threat of heart disease in teenagers (Fruin, Pratt & Owen, 1991), osteoporosis (Wurtele, 1988), sexual behaviour (van der Velde & van der Pligt, 1991), sexually transmitted disease (Tanner, Hunt & Eppright, 1991), health compliance (Brouwers & Sorrentino, 1993) oral hygiene (Beck & Lund, 1981) and alcohol use (Runge, Prentice-Dunn & Scogin, 1993).

The Protection Motivation Theory has not been criticised as widely as other models, such as the Health Belief Model (Becker, 1974). There are however, certain points, which should receive consideration. Research carried out by Wurtele & Maddux, (1987); Wurtele, (1988); and Brouwers & Sorrentino, (1993) found that fear was a motivating factor if the health threat was new and previously unknown to the individual. However, where response efficacy is concerned, research has indicated a positive effect (van der Velde & van der Pligt, 1991; Stanley & Maddux 1986; Rippetoe & Rogers, 1987; Wurtele, 1988). Some of these and other studies report that self-efficacy also provides an important role in health behaviour (Beck & Lund, 1981; Stanley & Maddux, 1986; Rippetoe & Rogers, 1987; Fruin, Pratt & Owen, 1991; van der Velde & van der Pligt, 1991). Because of these ambiguities within the model, it is difficult to advocate its use in this research. There is little evidence to suggest its usefulness in dietary adherence, which is important to this research. Indeed, the model has been criticised for not examining the process involved in the changing of behaviour (Schwarzer, 1992). This must be a prime consideration in any behavioural change programme. In keeping with the Health Belief Model from which it borrows heavily, the Protection Motivation Theory does not allow for existing habits, the effects of socio-economic and cultural factors, and it assumes that the individual is a rational thinker (Ogden, 1996).

In conclusion, the Protection Motivation Theory is a mongrel theory based on the Health Belief Model (Becker, 1974) and self-efficacy (Bandura, 1977), both valuable components in their own right. The evidence, nonetheless, is insufficient to either reject or advocate the use of the Protection Motivation Theory. Another model, which incorporates components of the Protection Motivation Theory, and has been widely used, is the Theory of Planned Behaviour.

2.9 Theory of Planned Behaviour

The Theory of Planned Behaviour (Fishbein & Ajzen, 1975; Ajzen, 1985) was developed from the Theory of Reasoned Action (Ajzen & Fishbein, 1980). The fundamental assumption in this theory is that attitudes are not the only determinants of individual behaviour, but are just one influence (Messer & Meldrum, 1995). Underlying this assumption is that intention to behaviour is more predictive of behaviour than attitude. The Theory of Planned Behaviour has been used to examine a wide variety of behaviours (Ajzen, 1988, 1991; Sheppard, Hartwick & Warshaw, 1988; Tesser & Shaffer, 1990; Eagly & Chaiken, 1993; Olson & Zanna, 1993; Conner & Sparks, 1996). The original

Theory of Reasoned Action consisted of two variables: i) the individual's attitude towards the behaviour and ii) the subjective norm. Attitudes have both a positive or negative effect on evaluation of a certain behaviour (Ogden, 1996). Thus, in the case of the smoker, the individual decides whether giving up is beneficial to him /her. For example, even though the smoker accepts that smoking is on the whole, unhealthy, he or she is unlikely to give up if he or she believes it will not do actual harm, because of general fitness and hardiness throughout the family (Stroebe & Stroebe, 1995). Implicit in the attitude variable is a cost-benefit analysis where the individual evaluates the consequences of an action. For example, using a seven-point Likert scale, an individual might be asked to assess the benefits of eating fruit as good, bad, harmful, beneficial, pleasant, unpleasant (Osgood, Suci & Tannenbaum, 1957; Conner & Sparks, 1996). One problem to be considered is that of cognitive dissonance, which is a conflict between attitudes and behaviour. (Festinger, 1957; Fazio & Cooper, 1983). Johnston (1995) used the example of consumption of a high fat diet. A person who eats a high fat diet may feel uncomfortable because of conflicting messages from significant others and media campaigns. The individual will try to alleviate this dissonance and the easiest way to do so is through attitude change. As behaviour is often resistant to change, the easiest route would be to rationalise existing behaviour (Fiske & Taylor, 1983; Johnston, 1995). Moreover, as discussed in 2.2 health-related behaviours may have become entrenched in childhood as habits. There are problems associated with undoing of old habits (Kirscht, 1988). For example, according to Janz and Becker (1984:44) some behaviours such as toothbrushing or cigarette smoking 'have a substantial habitual component obviating any ongoing psychosocial decision-making process'. Sutton (1994) makes a distinction between habits and routines. A habit does not require conscious thought whereas a routine requires self reminders and thus conscious thought (Sutton, 1994). Thus behaviours of a habitual nature may be more difficult to undo.

The second variable, the subjective norm, is the influence of significant others on the behaviour. Thus, if an individual believes that important people such as partner, family friends, general practitioner, for example, would approve or disapprove of a particular behaviour, such approval or disapproval would affect the behaviour of the individual. Therefore, in the case of attempting to stop smoking, if individuals believe that to continue to smoke is harming their health they are unlikely to stop if their partners disapprove of their stopping. The subjective norm is a result of the normative belief coupled with motivation to comply (Stroebe & Stroebe, 1995). Accordingly, if an individual perceives that their partner wants them to stop smoking (normative belief) and they want to do as their partner wishes (motivation to comply), this results in the subjective norm (Stroebe & Stroebe, 1995). According to Eagly & Chaiken, (1993) it is useful to distinguish between characteristics of the individual and the social environment, although Miniard and Cohen (1981) believe such a distinction to be arbitrary. Moreover, O'Keefe (1990) found a correlation between attitude and subjective norm, and commonsense dictates that their social environment would affect an individual's behavioural beliefs.

As a result of various criticisms that the Theory of Reasoned Action did not take account of barriers to volitional control such as past behaviour, co-operation of others, opportunities, accomplishments and talents, Ajzen (1985) modified the theory to become the Theory of Planned Behaviour (Bentler & Speckart, 1979; 1981; Liska, 1984; Sutton & Hallett, 1989; de Wit, et al., 1990; Van den Putte, 1991; Eagly & Chaiken, 1993; Schaalma, Kok & Peters, 1993). It must be considered that implicit among such variables is the individual's cognitive skills. In other words, does the individual have the reasoning power or intelligence to weigh up the pros and cons of altering certain behaviours, albeit unconsciously?

The Theory of Planned Behaviour differs from the Theory of Reasoned Action by the addition of another variable, namely, perception of control (Conner & Norman, 1996). Thus, a person would only engage in a particular behaviour if they believed that they could control that behaviour. Stroebe and Stroebe (1995) and Johnston (1995) use the example of attempting to give up smoking. An individual would only give up smoking if they perceived themselves able to do so, even though they agreed it was bad for their health and their significant others wanted them to give up. The concept of perceived control is similar to the Self-efficacy model (Bandura, 1986). The ethos behind this variable is that if people are unable, for whatever reason, to achieve a goal they will modify their intentions accordingly. Stroebe and Stroebe (1995) used the example of examination grades. If a student does not achieve the grades they had originally hoped for, they will modify their perceived control, in other words their behaviour is dependent on expectancy-value motivation based on past behaviour. The similarity of perceived control and self-efficacy is obvious when considering the various factors that affect individual behaviour. Internal factors might range from information, skills or cognitive abilities while external factors might be financial, opportunistic or personal commitments (Ogden, 1996).

As with any theory, the Theory of Planned Behaviour is not without its critics. Schwarzer (1992) drew attention to the lack of a temporal element within the model, and believes this should be included. Indeed Schwarzer (1992) has developed his own model, the Health Action Process Approach, the hypothesis behind this approach is that individuals decide to act or not during the motivation stage. The problem with this is the assumption that individuals are rational thinkers and are constantly making conscious decisions regarding behaviour. Adopting the behaviourist approach, all behaviour is a response to stimuli and reinforced by the environment (Gross, 1996). Thus behaviour is, in the main, normative and performed unconsciously. The Theory of Planned Behaviour has also been criticised by Fischhoff, Goitein and Shapira (1982) and Fazio (1986) for being too complex, but it has been used extensively with a variety of behaviours, and in particular has been applied to health-related behaviours (Conner & Sparks, 1996). Among those health-related behaviour applications which have shown encouraging results, are weight loss (Schifter & Ajzen, 1985; de Wit, et al., 1990), AIDS (Richard & van der Pligt, 1991; Abraham, et al., 1992), testicular self examination (Brubacker & Wickersham, 1990), smoking (Sherman, et al., 1982; Marin, et al., 1990), family planning (Ajzen & Fishbein, 1980; Smetana & Adler, 1980), limiting infants' sugar intake (Beale & Manstead, 1991), taking exercise after giving birth (Godin, Vezina & Lambert, 1989) and food choices (Sparks & Shepherd, 1992; Sparks, Hedderley & Shepherd, 1992; Towler & Shepherd, 1992). The Theory of Planned Behaviour has been chosen for this piece of research because of this success in the application to health-related behaviours. Moreover, it is a comprehensive theory whose elements can be traced back to Social Learning Theory, Locus of Control, Self-efficacy, Health Belief Model and Protection Motivation Theory. Examining each element in turn it is possible to see where these theories and models fit in. Using a schema approach it is possible to see where elements of the other theories and models have shown their influence Table 2.1:

Table 2.1 Influence of previous health behaviour theories on the Theory of Planned Behaviour.

Influential factors on determinants of behaviour	Determinants of behaviour	Influence of other theories
Beliefs	Attitude	PMT i.e. Behavioural intention
Evaluations	Attitude	HBM i.e. Susceptibility and severity
Normative beliefs	Subjective norm	HBM i.e. Benefits and barriers
Motivation	Subjective norm	HBM i.e. Benefits and barriers
Control beliefs	Perceived behavioural control	Health locus of control

PMT = Protection Motivation Theory
HBM = Health Belief Model
Adapted from Ogden (1996) page 29.

Thus it can be seen that the Theory of Planned Behaviour encompasses the important theories and models relevant to an understanding of health behaviour. In addition, it gives attention to normative beliefs and motivation which comprise the subjective norm, and although this is an important consideration in any human behaviour, it has not been covered in depth in the other theories and models reviewed here. For these reasons, the Theory of

Planned Behaviour is considered to be the most suitable for this piece of research.

2.10 Literature Update

A literature search of papers cited in the Proceedings of the British Psychological Society (2004) has indicated that the Theory of Planned Behaviour continues to be used in an increasing variety of health behaviours such as physical exercise amongst the mentally ill (Campbell, MacAuley & Leslie, 2004), exercise in Chinese adolescents (Callaghan & Norman, 2004); implementation intentions in promoting exercise participation (Griffin, Eves & Cheng, 2004); exercise initiation and maintenance (Jones, Conner, Harris and Armitage, 2004); influences of perceived autonomy support on physical activity (Chatzisarantis, Hagger & Biddle, 2004); intervention to improve attendance rates for cervical screening (Walsh, 2004); basic psychological needs and perceived locus of causality (Harris & Hagger, 2004); prosthetic use in amputees (Callaghan, Condie & Johnston, 2004); handwashing practices in catering establishments (Clayton, Griffith & Price, 2004); adolescent smoking initiations (Conner, Sandberg, Higgins & McMillan, 2004); treatment for dizziness in primary care (Donovan-Hall & Yardley, 2004); condom use in South Africa (Giles, Liddell & Bydawell, 2004) and staff adherence to a mental health guideline (Hanbury, Wallace, Cushway & Clark, 2004). There appears to be no relevant research relating to food consumption intentions during pregnancy. There are however, a number of studies related to infant feeding using the concept of self-efficacy, Theory of Reasoned Action and the Theory of Planned Behaviour and these are outlined below.

Self-efficacy

Self-efficacy is a strong predictor of health behaviour and may play an important role in facilitating breastfeeding in infants born preterm (Barnes & Adamson-Macedo, 2004). This study used two groups (n=25 each group) of breastfeeding and nonbreastfeeding mothers of preterm infants. Findings show that self-efficacy was lower in mothers who were breastfeeding compared with those who were bottlefeeding. Breastfeeding a preterm infant appears to act as a mediator on how mothers perceive their parenting self-efficacy whilst in hospital.

Theory of Reasoned Action

A longitudinal study examined social cognitive processes of 85 first time mothers involved in informing intention to breastfeed or bottlefeed and actual infant feeding behaviour (Callaghan & Lea, 2004). A scale specifically designed for the study was used. Differential attitude and differential subjective norm was highly predictive of the differential intention, which was predictive of choice intention. Choice intention was highly predictive of infant feeding behaviour following delivery.

Theory of Planned Behaviour

This study used an extended version of the Theory of Planned Behaviour to examine factors that influence infant feeding choice of primiparous women (McMillan, Dyson, Conner, et al., 2004). Additions to the model were descriptive norms, moral norms and self-identity. Information was provided by 232 mothers on infant feeding practices at discharge, two weeks and six weeks. Moral norms but not descriptive norms explained additional variance in intentions. Moreover, self-identity explained aspects of the variance in intentions over and above the Theory of Planned Behaviour variables. Perceived Behavioural Control significantly predicted behaviour at discharge and two weeks but intention was not significant. At six weeks intention and Perceived Behavioural Control were both predictive of infant feeding behaviour. The authors conclude there is a need for a broader conception of normative influences on intentions and support the inclusion of self-identity in the Theory of Planned Behaviour.

Conclusion

There is a large body of research addressing health behaviours but to date there appears to be little that is relevant to the intentions and behaviours of pregnant women in relation to food consumption.

Chapter 3
Methodology

Introduction

This chapter gives a detailed overview of the methods chosen for this research and provides a full justification for the methodological decisions taken. The chapter is structured in the order that the research was undertaken, commencing with an overview of the methods used to conduct the literature search and analysis, as this process took place prior to finalising the study design. Issues regarding the research design are then debated, illustrating how the decisions were arrived at. This is followed by a detailed critical description of the construction of the research tools, including the rationale for rejecting a number of attitude measurement scales. Sampling techniques are examined and a full justification is offered of the final sampling method chosen. Ethical issues are debated fully and take full account of the ethical requirements of medical and social science research. A detailed analysis is presented of the pilot study that was conducted prior to recruitment for the main study. Finally, there is a full description of the procedure of the main study and a summary of the approaches used in data analyses. The limitations of the study permeate each section of the methodology chapter.

3.1 Literature Analysis

A literature analysis of theories of health behaviours and research into nutrition during pregnancy and post partum was carried out using library search techniques between 1996 and 1998. Libraries used were University of Bath, University of West of England Nurse Education Library at Princess Margaret's Hospital, Bath Spa University College, Royal United Hospital Postgraduate Library, Research and Development Support Unit Library, The Wolfson Centre, Royal United Hospital, and internet sources. References were updated at regular intervals. In designing research tools and methodology the above libraries were utilised in addition to the research and development department of a North Wiltshire medical practice. Initial advice was sought from the Research and Development Support Unit at the School of Postgraduate Medicine at University of Bath regarding research design. During 1998, at the end of the pilot study, research method literature was again searched when making amendments to the methodology. Prior to the commencement of the project, training and experience had been obtained in interview techniques. Thus it was not felt necessary to explore the literature on interviewing in any depth. It was important to exclude as many non-human animal studies as possible so that most of the studies and subsequent references related to human studies. Much medical research including nutritional research makes recommendations based on the results of procedures carried out on rats (Brown et al, 1990; Snoeck et al., 1990; Langley-Evans & Jackson, 1994). Such studies were considered inappropriate for this research as the results of animal studies cannot be conclusively applied to humans. To this end, all of the above libraries were searched in addition to considerable Internet searches. Internet searches were made using an Athens account that accesses the Ovid Biomedical Collection. This included ASSIA for Health (Applied Social Sciences Index and Abstracts); CINAHL, which is a database equivalent to the Cumulative Index to Nursing and Allied Health Literature print index; Medline, which includes a variety of medical journals and the Cochrane Database of Systematic Reviews. In addition, the electronic version of the National Library of Medicine (PubMed) was used to access up-to-date nutritional research via Medline. The post-graduate library at Princess Margaret Hospital, Swindon was searched for textbooks on fetal nutrition. The University of West of England Nursing Education library was also searched at Princess Margaret Hospital for books on nutrition. The research and development department of a North Wiltshire medical practice library was used on a regular basis to read copies of The British Medical Journal and Lancet in depth. The most helpful libraries have been the University of West of England Nurses Education Library at Swindon, the library at the research and development department of a North Wiltshire medical practice, Royal United Hospital Postgraduate Library and the Research and Development Support Unit, School of Postgraduate Medicine, University of Bath, not only for their content, but for the personal service provided, enabling more thorough searches to take place. In addition to current nutritional research it was necessary to acquire details of the nutritional processes taking place during pregnancy. This was achieved by accessing a number of nutritional textbooks. When analysing literature relating to psychological theories of health behaviours, as many as possible relating to eating habits were considered, while those relating to other health behaviours, for example, smoking, were discounted. All studies were written in English and in the main carried out in England and America. Nutrition research was confined, as far as possible, to human studies and written in English. Non-western studies were not considered relevant due to the differences in the nutritional requirements and cultural eating behaviours of third world communities. Research tools and methodology literature related to social sciences, in particular methods for health-care workers. All literature was as up-to-date as possible, although a small number of old studies were included as they are considered to be classics, such as the Dutch Hunger Winter (Stein et al., 1975).

3.2 Research design

Before any design decisions can be made it is important to contemplate the type of data needed to answer the research question, how it is to be collected and how best to achieve validity and reliability.

Validity

Validity refers to the extent to which research tools measure what they purport to measure (Bailey, 1997). Evidence of validity is dependent on whether research is qualitative or quantitative. Qualitative methods include interviewing and content analysis, which to be rigorous require the researcher to be disciplined, trained and knowledgeable (Patton, 1990). Quantitative methods require care in construction of the research tool(s), which are in effect the measuring instruments (Patton, 1990). Whichever type of research is undertaken there are a number of research effects that can affect validity. There is the Hawthorne Effect (Mayo, 1933) or the Halo Effect (Asch, 1946) where the presence or interest of another person positively affects the participant's performance. By participating in this current research the primagravidae may have been influenced to eat a perceived 'better' diet or they may lie when answering questions in order to please and give themselves a more positive image. This is known as subject expectation when the participants behave as they believe is expected of them. In addition, the person carrying out the research may become personally involved with the participants and so lose his/her sensitivity (Bailey, 1997). To prevent this happening, relationships with the participants in this study were maintained at a professional level at all times. There can be the further problem of bias on the part of the researcher when interpreting data. To obviate this potential problem, quantitative data analysis was used whenever feasible. With quantitative methods there are different types of validity – internal and external. Internal validity refers to factors within the study, which will cause the overall result to be incorrectly interpreted, such as order effects or biased allocation to groups. Order effects did not occur in this study as there was no direct manipulation of an independent variable, thus there was just one group of participants. Order effects are when the participants become practiced at a task and so boredom or fatigue may affect their performance. The only occasion when an order effect may have occurred in this research was when assessing change over time with regard to attitudes of the sample by means of a questionnaire. The same questionnaire was used at three time points. However, there was a time gap of about six months between completing one questionnaire and the next, therefore enough time would have elapsed to prevent any serious order effect occurring. Biased allocation to groups did not occur, but there may have been biased selection on the part of the general practitioners who carried out the initial recruitment, during the first consultation with the patient. It is possible they did not recruit women for reasons of value judgements. For example, they may have considered a participant was too old, too young, unintelligent, or had a number of health problems and they did not therefore include them in the recruitment process.

Reliability

According to Bailey (1997) study reliability is more difficult to achieve than validity. Reliability refers to rigour. If the study has been carried out rigorously, similar results should be obtained if the study is repeated (Bailey, 1997). As with validity, there is external and internal reliability. External reliability can be affected by the social context in which data are gathered. Informants may not feel free to reveal certain information in formal settings that they may do in informal settings. During the pilot study for this research women were approached at the surgery, but it was felt that the more informal setting of the patient's own home would lead to greater external reliability. Internal reliability is achieved through inter-rater or inter-observer reliability. This is mainly concerned with qualitative research, but as this study had only one researcher and limited qualitative data, it was not possible to use this measure of reliability. On the other hand, quantitative methods use standardised measures, with predetermined response categories in order to produce quantifiable data (Patton, 1990). Using the wrong statistical test and getting apparently significant differences would seriously jeopardise the internal validity of a study. In this instance there was scientific rigour, as the sample (n=37) was large enough to allow for meaningful data analyses. Data were treated as nominal or ordinal, as it is unlikely the sample was from a normally distributed population. Had the sample been considerably larger it would have been possible to test for the likelihood of it being from a normally distributed population by carrying out a chi-square 'goodness of fit' test. A $p \leq 0.05$ level of significance was used as this gives a 95 per cent (or greater) certainty that the results are due to the independent variable and not some chance factor. In this case this was used to analyse changes in women's perceptions and beliefs over time (first trimester, third trimester and six months post partum) – Table 4.10. This level of significance strikes a balance between making a type one and type two error. A type one error is accepting the alternative hypothesis, when in fact the results are due to chance. Using too lenient a significance level, for example $p \leq 0.1$, can cause this. On the other hand, using too stringent a significance level, for example, $p \leq 0.01$, may result in the alternative hypothesis being rejected when in fact the effect being tested for exists. This is known as a type 2 error (Coolican, 1995). In some instances the results were tested for significance at $p \leq 0.01$ if significant at $p \leq 0.05$. Other factors that may affect internal reliability are history – such as illness, losing interest in the study and not making an effort to complete the diary. To control for this as far as possible, participants were not required to weigh food, they were telephoned one week before the diary was required and reminded to fill it in on a daily basis. In some instances diary sheets had been mislaid by the participants, so they were assured that this was not a problem and to write what they ate daily on any available paper. Practice effects are where the participant becomes accomplished at a task and thus poses a threat to reliability. It was possible this may have occurred with the Likert scale questionnaires used at the first trimester, third trimester and six months post partum. It was considered this was not a real threat as four to six months had elapsed between completion of each questionnaire. It was also considered that the women would be too busy and preoccupied with their pregnancy and subsequent childcare to remember each questionnaire in detail. In any study there is always the problem of attrition when participants are lost through geographic moves or mortality. Thus the sample needs to be large enough to allow for attrition, otherwise the number of participants who remain in the study to completion may be too small to provide reliable results. In this case, 49 participants were initially recruited and 37 remained in the study to its conclusion. This number was considered sufficient for reliability.

Methods

Multiple methods was considered the best approach to collecting data as it employs a number of methods of data collection, resulting in increased validity and reliability. Using multiple methods is a reliable way to lend rigour to a study design. This means using several methods of data collection, including both quantitative and qualitative. Interviews providing qualitative data are often considered to be of limited reliability because of the subjective nature of responses (Denzin, 1978). Respondents' replies may be distorted through emotion, politics, personal beliefs and so on. There is the additional problem of retrospective accounts being misleading as memory recall is often inaccurate. By using a number of methods of data collection, in this instance, interviewer administered questionnaires containing closed and open questions, Likert scale questionnaires, analyses of participants' comments, and diet diaries, the validity and reliability of the study is increased. The interviewer administered questionnaires enabled collection of socio-economic data relating to the participants, measurement of nutritional knowledge and individual perceptions of nutritional advice offered during the pregnancy process for future content analysis. The Likert scale questionnaires were used to collect measurable data pertaining to intentions towards food consumption during pregnancy and breastfeeding and which relate to the Theory of Planned Behaviour (Ajzen, 1991). Information from the diet diaries provided evidence of what the women were actually eating and could be compared with nutritional knowledge. Employing multiple methods meant it would be possible to produce qualitative and quantitative data. This would enhance the possibility of convergent validity, meaning that different measures all converge to support one another (Mathers & Huang, 1998).

3.3 Questionnaire Design

An interviewer administered questionnaire, carried out on a one-to-one basis, was considered the most appropriate as this would yield a higher response and retention rate than postal questionnaires. Bowling (2002) makes a valid suggestion when recommending that non-essential questions be excluded. Accordingly, questions were collated into an interviewer administered questionnaire and some were deleted as being not directly relevant to the current topic under investigation. Some questions considered irrelevant included:

What kind of margarine do you use? – this was unnecessary as it would be apparent from the diet diary and subsequent discussion what type of margarine was used.

What brands do you use in relation to specific foods? (as they occurred in the conversation) – this would have provided too much data that would have been extremely difficult to analyse as it would have been necessary to investigate the nutrient content of specific and perhaps numerous brands of foods.

Do you eat beef? – again it would be obvious from the diet diary if they ate beef or not.

How old is your partner? – this was thought to be irrelevant apart from providing socio-economic data.

How long have you been together? – this was abandoned as it was considered to be intrusive and irrelevant. Questions 9-31 inclusive were also abandoned because they were not felt to be directly relevant to the aims of the project (appendix I). These questions were about shopping and menu planning and valuable sociological data might have been drawn from the answers. It was felt, however, such data would have been more useful in a directly sociological context. In order to keep the focus on the research aim these questions were abandoned in favour of questions more directly related to perceptions of healthy diet and actual nutritional knowledge. Questions 41-43, which related to information about food advertising, packaging and beef products were also abandoned as they were considered to be outside the auspices of this study. Patton (2002) recommended that six types of questions can be asked in an interview:

(i) Questions about knowledge;
(ii) Experience;
(iii) Socio-economic details;
(iv) Those based on behaviour or experience;
(v) Personal opinions;
(vi) Feelings.

Patton (2002) further recommends that questions should be neutral, sensitive, clear to the interviewee and open-ended. It was thus decided to cut the number of questions down to more specific topics, covering socio-economic details, nutritional knowledge, nutritional opinions and intentions. It was also important that the interviewer administered questionnaire should be semi-structured as it formed the basis of the interview. By having specific questions, collection of the required data was assured and the focus of the interview was not lost. It was considered that a more structured interviewer administered questionnaire, with a mix of specific and open-ended questions would improve the interview technique. There are advantages and disadvantages with both closed and open-ended questions. Closed questions requiring yes/no/maybe answers are simple and quick to analyse and are best used for topics about which much is known. There is the disadvantage that participants are forced to categorise their reply, which restricts possible answers. It is important that the direction of questions should be changed to avoid response acquiescence set. This means that people often agree rather than disagree with statements. Cohen, Forbes & Garraway, (1996) disagreed with this, arguing that negative descriptions can often produce a greater level of reported dissatisfaction than giving them a positive description. On the other hand, open questions are necessary when the replies are unknown, such as perceptions of a healthy diet, which in itself is subjective. The down side of such questions is that they require the participant to consider their replies in some depth and this can be tiring. This was one reason why postal questionnaires were discounted from the outset. Participants may not have written full replies to the open-ended questions and this may have added to a possible poor response rate. There is the added disadvantage of coding qualitative data, which lends itself to subjective interpretation and thus bias. In view of these polemics it was decided to strike a balance between open and closed questions. In designing the questions and interview technique, Whyte's (1982) directiveness scale for analysing interview technique was considered as follows:

1. Make encouraging noises when interviewee is speaking;
2. Reflect on the remarks made by interviewee;
3. Probe on the last remark by the informant if appropriate;
4. Probe an idea preceding the last remark by the informant;
5. Probe an idea expressed earlier in the interview (this was not considered appropriate and ideas were probed as and when they occurred during the interview process);
6. Introduce a new topic (this was not considered necessary as questions were designed to logically lead on to the next one and the interview developed from a questionnaire to an unstructured interview as it progressed).

1 = least directive

6= most directive.

What should be added to the above is to allow the participant the opportunity to finish speaking before moving on to the next question. Often valuable data is lost through anxiety on the part of the interviewer to conclude the interview.

Three separate interviewer administered questionnaires were used at each time point, during the first trimester; third trimester, and six months post partum (appendices II, III and IV respectively). It was necessary to make amendments to the interviewer administered questionnaire to take account of the relevant stage of pregnancy or feeding practices. For example, during the first trimester it was important to obtain socio-economic data and to include questions relating to nausea. The first section of the interviewer administered questionnaire related to personal details, following on with details of the pregnancy and intention to breastfeed and intentions regarding paid employment. Perceptions of a healthy diet were followed by a question relating to physical problems, which may have affected food consumption. There followed a set of questions relating to nutritional knowledge. The interviewer administered questionnaire continued with further personal details such as consumption of food supplements and/or medication; level of satisfaction with nutritional advice received; questions regarding income and food expenditure; smoking and drinking (appendix II). The second interviewer administered questionnaire was completed towards the end of the third trimester at about 36 weeks. The timing of this second interview was to ensure the interviewer administered questionnaires were completed before possible early deliveries. During the initial pilot study one woman delivered three weeks before term and thus it was not possible to carry out the second interviewer administered questionnaire before the baby was born. Questions in this interviewer administered questionnaire related to possible change in eating habits and possible reasons for such change; where the baby was to be delivered; perceptions of received nutritional advice; intention to breastfeed and intention regarding paid employment. The questions regarding breastfeeding and employment were asked in the first and second interviewer administered questionnaires to measure change in attitude (if any, and to analyse possible reasons for such change) (appendices II and III). During the third trimester it was important to know if there had been any change in personal circumstances and if there were any physical or domestic problems affecting food intake. The third and final interviewer administered questionnaire was completed at six months post partum. This was to take account of feeding practices such as cessation of breastfeeding and commencement of weaning (appendix IV).

Attitude Measurement Questionnaire

Attitude measurement scales evaluate an attitude in a positive or negative way. Using attitude measurement scales produces quantitative data in the form of a numerical score of a person's attitude. The attitude object (that which is evaluated) may be a tangible thing such as a house, or people such as partners, or behaviour, or, as in this case, eating behaviour. They also encompass abstract ideas such as health status (Stroebe & Stroebe, 1995). A Likert Scale was considered the most appropriate attitude measurement scale for this research.

Likert Scale

The Likert scale is the most commonly used scaling method by sociologists and psychologists because it is relatively quick to develop (Gross, 2001). It is similar to the Thurstone method of scaling, but avoids using judges to order the statements. A Likert scale is constructed by producing an equal number of negative and positive statements about an attitude object. Next, respondents are asked to indicate their agreement/disagreement on a scale as follows:

5	4	3	2	1
Strongly agree	Agree	Undecided	Disagree	Strongly disagree

Using the values on the scale results in a score for each item. Thus, if a respondent were to strongly agree on five items they would have a score of 25, whereas if they strongly disagreed on five items, they would have a score of 5. Therefore, the higher the score, the more positive the attitude to an object. The scores are then added to calculate an overall score for each respondent. An item analysis test is then carried out to find the most determining items. Because the Likert scale carries out an analysis test it is superior to the other attitude scales. It does not need to relate obviously to the attitude object or issue, but can be counted as diagnostic if responses correlate well with overall responses. For these reasons it is considered the most appropriate for this research, despite certain weaknesses. One such weakness is that when totalled, there may be a set of responses which total the same score but may be made up of many different components, thus there is a certain loss of information of those components (Edelmann, 1996). For each respondent, scores only have meaning relative to the scores in the distribution obtained from other respondents. Data produced is therefore best treated as ordinal. Ordinal data tells us the position of an item in a group. Thurstone (1928) on the other hand, considered intervals on his scale to be truly equal. The middle score – number 3, 'undecided' is ambiguous and may imply no opinion or an on-the-fence position where the respondent is undecided. Therefore, overall scores that are centrally distributed are ambiguous. It may be that middle scores are undecided, or have no opinion and thus the scale may be measuring two attitudes.

A Likert scale questionnaire was constructed for use during the first trimester, third trimester and six months post partum. During the pilot study, when research tools were tested, participants 4, 5 and 6 were asked to evaluate the Likert scale questionnaire. An example of the Likert scale questionnaire can be seen in appendix V and this was not amended for use during the first and third trimesters of the main study. Slight amendments were made for the interview at six months post partum to take account of breastfeeding and weaning, and included an additional question to look at media influences (appendix VI). The Likert scale questionnaire was used to assess intentions towards changing eating habits. This questionnaire was adapted from an example by Connor and Sparks (1996) which applies the Theory of Planned Behaviour to healthy food choice and dietary change. Each section of the questionnaire deals with aspects of the Theory of Planned Behaviour as follows:

1. Intentions towards eating habits, which measures desire and self-prediction of the behaviour towards eating habits during pregnancy (Sheppard, Hartwick, & Warshaw (1988); Fishbein & Stasson, 1990; Norman & Smith, 1995).

2. Attitudes to eating habits require participants to evaluate the described behaviour.
3. Measures behavioural beliefs about changing eating habits.
4. Measures outcome evaluations of eating a healthier diet.
5. Significant others measures subjective norms, i.e. whether or not significant others would wish the individual to carry out the behaviour.
6. Beliefs about significant others measures normative beliefs, which are individual perceptions of how the significant other would wish them to behave.
7. Influences of others on eating habits, measures the individual's willingness to comply with the wishes of those significant others.
8. Personal control measures the individual's perceived control, taking account of factors that the individual may feel will prevent them from carrying out the desired behaviour.
9. Influential factors measures control beliefs/power that assess the existence or non-existence of factors, which may further or hinder the desired behaviours.

The Likert scale questionnaire used in this research differed from Connor and Sparks (1996) in that it looked at attitudes and intentions towards change in diet because of pregnancy. The measuring components used were as above but all questions were original. Amendments were made to the Likert scale questionnaire for use at six months' post partum to take account of feeding practices in the following way:

Breastfeeding, bottle-feeding and weaning were substituted for pregnancy/pregnant. In section 5 (significant others) an extra question was added to take account of media influences as follows:

Media (magazines, newspapers, television) information has an important influence on my eating habits now that I am breast/bottle-feeding/weaning

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

This question was analysed separately from the other questions. During the course of the pilot interviews it was noted that some participants had not received nutritional advice from a specific person or source. General comments had been made that nutritional advice had been obtained through reading magazines and books. The Likert scale questionnaire was looking for a difference in intentions towards eating habits over three time periods, during the first trimester; towards the end of the third trimester; and six months post-partum.

Research Materials

(i) Draft questionnaire – Pilot study (appendix I);

(ii) Questionnaire – First trimester (appendix II);

(iii) Questionnaire – Third trimester (appendix III);

(iv) Questionnaire – Six months post partum (appendix IV);

(v) Likert scale questionnaire for use during first and third trimester (appendix V);

(vi) Likert scale questionnaire for use at six months post partum (appendix VI);

(vii) Pink referral form (appendix VII). Bright pink paper was used as it would be readily noticeable by the general practitioner and serve as a reminder to inform the patient of the research during the initial consultation. Details required were the patient's name, address, telephone number, date of birth, expected date of confinement and name of general practitioner;

(viii) Patient information sheet (appendix VIII);

(ix) Letter of acknowledgement (appendix IX);

(x) Consent form (appendix X), also an ethical requirement, the consent form confirmed that the participant had been given sufficient information, understood their right to withdraw and agreed to take part in the research;

(xi) Diet diary (appendix XI);

(xii) Sample of diet diary analyses (appendix XIV);

(xiii) Sample of a completed diet diary (appendix XV);

(xiv) Sample of food consumption data collation, prior to computer nutrient analyses, for one participant during the third trimester (appendix XVI).

3.4 Sampling

Sampling is a very important aspect of research design as using an inappropriate sampling technique can result in bias (Bowling, 2002). Bias will be present in any sampling technique, but when the sample is drawn correctly this can be greatly reduced. The risk of bias will be higher in small samples and reduced in large samples (Howie, 1979). In addition, the small samples are likely to be less representative of the population than a large sample (Bowling, 2002). However, if a sample were enlarged using the same sampling technique, then the bias would still be in the sample. According to Patton (1990), sample size depends on what information is being sought. In qualitative research there are no fixed rules and there is a trade-off between breadth and depth. Thus, in a small sample, phenomena can be studied in considerable depth, whereas a large sample will give greater insight to diversity or variation within the chosen population. Quantitative data on the other hand, has to be considered in the context of probability and, as stated previously, numbers need to be sufficient to carry out reliable statistical analysis. Whilst sample size is often determined by scientific principles, there are practical considerations such as the length of time available in which to carry out the study and the time taken to recruit the participants (Ingleton, 1998). When deciding on sample size, there are a number of considerations such as:

Homogeneity of variance;

Orientation of the study;

Type of analysis.

Homogeneity of variance

Homogeneity of variance refers to how homogeneous or similar the members of the population are. If there is high homogeneity then only a small sample need be recruited. The more variability, the higher the sample should be. The participants came from five different surgeries with marked class differences. Some surgeries were predominantly working class and some were predominantly middle class. Other socio-economic factors that might have been considered were marital status, income and age. Thus, a sample large enough to take account of these variations was necessary.

Orientation of the study

Orientation of the study has implications for the size of the sample and as multi-methods were, it was necessary to have a large enough sample to allow for analysis of both qualitative and quantitative data. Initially, it was hoped to recruit 50 active participants who remained in the study to six months post partum. A sample size of 50 was considered sufficient to enable statistical analysis and a workable number within the constraints of time and finance. The recruitment process was slow due to the natural process of pregnancy and the paucity of prospective participants. Thus it was decided to stop when 49 participants had been recruited. Twelve were lost through attrition and other reasons, which are detailed in Chapter 4. Therefore, the final number of active participants, that is, those who remained throughout the study until six months post partum was 37. Time was an important factor, as each participant required a time span of 13-15 months to allow for the pregnancy and six months post partum. Thus the early participants' children and the data would be older than the later participants. The results may have been confounded by changes in nutritional information and advice offered to the participants. Thirty-seven participants was a sufficient number to allow for statistical analysis and production of qualitative and quantitative data. Coolican (2002) suggests that 25 to 30 participants is sufficient to test an independent variable for significance and if using this number does not produce a significant result, then the variables and design of the study need further consideration and modification. With such a low number of participants (n=37) however, it would not be possible to generalise these results to the wider population thus the study must be considered in the context of a pilot study for a subsequent much larger study. Some data was analysed quantitatively and some qualitatively.

Sampling frame

Before the sampling method was decided upon, the sampling frame had to be considered (Bowling, 2002). This was important because of the many ethical issues involved in recruiting participants to take part in any study. There were the added logistical problems of distance, time and availability of participants to consider. The sampling frame in this case was a list of patients who met the required criteria of being in the early stages of their first pregnancy. Women who had previously been pregnant and had a termination or miscarriage were not excluded from the study. The only proviso was that this pregnancy would be the first carried to term. In effect, there were a number of sampling frames as the patient list at each participating surgery represented a sampling frame. For reasons of confidentiality it is not possible to make patient lists available, although there is an analysis of the number of women recruited from each participating surgery - Table 4.42. How best to recruit the sample from those frames had to be considered.

Stratified Random Sample

Stratified random sampling is considered to be the ideal sampling technique within the social sciences as every member of the population has an equal chance of being selected, thus making it possible to generalise from the results. In this instance, the population would be all primagravidae at each participating surgery. Stratified random sampling guards against being unrepresentative or biased by dividing the population into strata and randomly selecting from each strata. In this case, the strata would be each surgery and a proportionally representative sample would have been randomly selected from each strata. Such a method is more precise than other methods but, for many reasons, it is difficult to achieve (Bowling, 2002). In practice it was not feasible, because ethically it would not have been possible to have a list of all primagravids from each surgery. Moreover, such lists may not be complete or accurate, as doctors might not be yet aware that some women were pregnant. Others may have left the area but their details were still on the surgery patient list. Because of patient confidentiality doctors would not have been able to release the names of all prospective participants without obtaining consent from each patient. This would have caused too much delay, as pregnancy is a dynamic process and by the time the sampling process was complete many patients would have delivered their baby. In addition, there was no way of knowing who might become pregnant or when. The only other way to obtain such a sample would have been to carry the study out at an antenatal clinic in a hospital. This would not have served the purposes of the study, as it was important to recruit women during the first trimester and the majority of women do not present at antenatal clinics until the pregnancy is well advanced. Therefore, the time constraints and logistics of stratified random sampling meant it was unviable as a method in this case.

Disproportionate Random Sample

A disproportionate random sample was disregarded for the reasons given above. This type of sampling would be used if some of the strata in the population were more heterogeneous than others, for example, some of the strata may have had a higher percentage of teenage mothers or women of a particular social class.

Quota Sampling

Quota sampling was considered because it allows for stratification, but this was impractical for a number of reasons. In the first place, because of ethical constraints, no lists of patients were available. Quota sampling works on the principle of taking the first available of each subsection until the quota is obtained. Thus, it is not random and there may be a high degree of bias (Crookes & Davies, 1998). Furthermore, patient lists may be biased, in that they are organised alphabetically and/or by doctor. Thus the quota may contain a cluster of participants of one ethnic origin who share the same surname, for example Singh. This may make the sample distorted and not truly representative. Such cluster effects are known as ecological fallacy because it is not possible to generalise from the results (Cornfield, 1978). To make inferences about the group from such individuals is known as individualistic or reductionist fallacy (Bowling, 2002).

Opportunity or Convenience Sampling

Opportunity or convenience sampling is taking whoever is available providing they meet the criteria. In this case they needed to be in the first trimester of their first pregnancy and a registered patient at one of the participating surgeries. Because of the difficulties outlined above, of accessing patient lists and randomising, opportunity sampling was considered the most valid and reliable method in the circumstances. The downside of such a method of sampling is that there is little external validity (Coolican, 2002; Bowling, 2002). It is impossible to generalise, as there may be hidden bias present (Bowling, 2002). In this case general practitioners referred the first available, consenting, prospective participants to take part in the research. It is possible that there was an element of choice of who was asked and referred, such as choosing middle class and/or educated women to take part, while discounting the unmarried, teenage and/or lower social class primagravidae. Thus caution must be observed when drawing conclusions from the results of such a study (Snowden & Kane, 1995). Notwithstanding, this method was considered the most appropriate and 55 women were recruited opportunely. Six of these women were the pilots and a further 12 were lost through attrition, making a total of 37 active participants. A breakdown of these figures can be seen in the results chapter.

Recruitment

In August 1995 the lead practitioner of a North Wiltshire General Practice, was approached by letter with a view to using the research and development facilities at the surgery. Consent was received from the partners at the practice in October 1995. Medical ethical approval was obtained from the Bath Local Research Medical Ethics Committee (LREC) before participants could be approached. This entailed making an application to the LREC to carry out the research and approval was given at an ethics committee meeting on 31st May 1996. Copies of ethical approval are in appendices XII and XIII. The Patient Information Sheet had to be amended before approval was granted as there was a superfluous comma that may have altered the meaning of the wording. Initial recruitment was slow, so in order to obtain enough participants, two further medical practices in a nearby town were approached via a letter of introduction from the senior partner at the first practice. All surgeries agreed to provide participants but the additional ones were unable to provide access to patients via the surgery for logistical reasons, and one of these surgeries agreed to patients being contacted via the antenatal clinic at the local Maternity Hospital and the other surgery agreed to invite patients to take part at the time of the initial consultation. As these two additional practices were unable to provide enough participants and recruitment was generally slow, two further practices were approached in the town of the initial recruitment and agreed to take part in the project. All partners at the participating medical practices agreed to the practices being identified but as some of the comments made by the participants were negative it was decided not to name the surgeries for ethical reasons. Infants in the sample were delivered at one of five hospitals. Three of the hospitals are maternity hospitals, have full accreditation as Baby Friendly Hospitals and belong to the same Primary Care Trust. The remaining hospitals are large general hospitals and do not have Baby Friendly Awards. However, one hospital did not agree to being identified, and as some of the comments made by the participants regarding the hospitals were negative it was considered inappropriate to name any of the hospitals.

Sample profile

Women in the first trimester of their first pregnancy were approached on an individual basis, having first been invited by their physician to take part in the project. For ethical reasons (that is, patient confidentiality) it was not possible to approach prospective participants directly and they had to be referred via the general practitioner concerned. The initial North Wiltshire Surgery provided 31 women, including six women who were selected by opportunity sampling to take part in a pilot study. Five of the remaining 24 prospective participants declined to continue with the study (see Figure 4.1 for recruitment and attrition details). The data from the pilot study are not included in the final results. One West Wiltshire Surgery supplied ten participants, another West Wiltshire Surgery provided one participant, one North Wiltshire Surgery provided nine participants and another North Wiltshire Surgery supplied four participants, making a total of 55 participants. The women were all English speaking and aged between 16-35 years. They came from a variety of social backgrounds and were all potential primagravidae. One participant had previously had a termination at age 16 years and two other participants had had miscarriages within the previous twelve months.

3.5 Ethical Considerations

Most professional bodies, such as those representing the different branches of medicine and the social scientists, have developed a code of ethics for carrying out research. The Medical Research Council (MRC) (2000) has published a series of booklets on ethical guidelines for good research practice, in particular Good Research Practice (MRC, 2000) and Personal Information in Medical Research (MRC, 2000). Reynolds (1979) has compiled a detailed code of ethics for the social scientist, containing over 70 ethical principles. In the social sciences, ethical codes tend to be guidelines rather than rules. The British Sociological Association's (2002) Statement of Ethical Practice emphasises that it informs ethical judgements rather than imposing external standards. It recommends that 'as far as possible sociological research should be based on the freely given informed consent of those studied' (Page 3:16). This contrasts strongly with the requirements of medical local health district ethical committees and reflects the different nature of the research methodologies. Punch (1986) argued that it would be absurd to obtain ethical consent from everyone being observed in an observational study of crowd behaviour. In support, Humphreys' (1970) maxim is that the main commitment of the social scientist is the enhancement of knowledge. Humphreys' statement may have been made to justify, what was in effect, a very unethical study. He was studying the pick-up behaviour of homosexuals whilst posing as a lookout outside a public lavatory. It was a covert, participant observation, in that the participants did not know they were being observed and thought that he was one of them. Before any research is undertaken, a moral judgement has to be made. Is any potential harm both to participants and the professional body(ies) justified by the enhancement of knowledge and is this knowledge for the greater good? The researcher must consider the aims of the research and the costs and benefits to both the research and the participant. Dillman (1978) considers research from an exchange perspective, wherein the researcher may be in an ethical dilemma if the respondent is short-changed in the exchange relationship.

What must be considered in this case are the negative/positive benefits for the research participant and researcher. For the research participant a negative benefit may be an invasion of privacy, as visits were made at the participant's home. This could be outweighed by the benefit of convenience, as the researcher saw each participant at a time and place that was convenient to the participant. Taking part in the research per se could be seen as a negative benefit, as there was an investment of time on the part of the participant in keeping food diaries. On the other hand this could be viewed as a potential benefit, as taking part in the research may have caused the participant to consider more carefully what foods she was consuming and thus improve the overall nutrition of the participant and the infant.

Whichever professional body governs individual research, the rules or principles must be upheld whatever an individual's personal philosophy or religion. Beauchamp & Childress (1989) and Gillon (1994) believe that whatever his/her personal beliefs, the researcher will have no difficulty in committing to four prima facie (absolute) moral principles, which are:

- Respect for autonomy (respecting people's right to make their own decisions);
- Beneficence (to give people benefits and balance those benefits against risks);
- Non-maleficence (to avoid causing harm whether physical or mental);
- Justice (to be fair).

Seedhouse (1998) takes this a step further, believing that health workers should have a competence in ethical thinking. To fully develop this thinking it is necessary to understand the theories of moral philosophy. It is not sufficient to be moral, or want to behave correctly, but to develop moral reasoning. Although Emmet's (1979) work is over 20 years old, it provides an excellent analogy of moral reasoning as a prism, which shines different lights onto issues. Thus, the greater the theoretical understanding of moral reasoning one has, the greater the options about which light to shine on moral dilemmas. One theory is not adequate for the many problems or dilemmas, which may arise. The main distinction in moral philosophy is between deontology and consequentialism.

Deontology

Deontology means 'the study of duty' (Seedhouse, 1998), which in essence is the premise that a person should perform duties without exception whatever the consequences. For example, a researcher may feel it his/her duty to tell the truth at all times. In addition, researchers should feel it important not to cause distress to their participants. A participant may ask how their infant's birth-weight and six month post partum weight compared with those of other infants in the study. It may be that the participant's infant is considerably under-weight and she may be distressed to know this. Does the researcher tell the truth and cause distress? The deontologist has to employ moral reasoning in order to resolve the dilemma. There is a further issue of confidentiality to the other participants. Taking the deontologist approach results in a moral dilemma that is difficult to resolve while upholding the individual's moral beliefs. Thus the deontologist approach was considered inappropriate and consequentialism was therefore considered next.

Consequentialism

To take a consequentialist view is to weigh up the advantages and disadvantages of the consequences of actions. In the above scenario, a consequentialist would consider the effect of lying to the patient or telling the truth. Telling the truth may distress the participant. On the other hand, not telling the truth amounts to deception, which is against most codes of ethics. The simplest solution is to respect the confidentiality of the other participants and direct the participant to her general practitioner for advice. It was stated in the patient information sheet that as the researcher was not a medical practitioner she was not competent to give medical or nutritional advice. Moreover, it was stated that personal details and information would remain confidential. As many of the participants may have known each other, due to geographical proximity, it was of the utmost importance that no participant details of any kind were discussed with other participants.

The British Psychological Society (BPS) has agreed guidelines on the ethical issues involved in psychological research. There is a code of conduct for members (1985) and a book of statements (1993) (BPS). A subdivision of the BPS is the Division of Teachers and Researchers in Psychology. Such members are eligible for chartered status and thus must uphold certain professional standards. It is designed to protect both researchers and participants and complaints are brought before the ethics committee who then adjudicate. Depending on the outcome of such adjudication, the psychologist may be reprimanded and required to alter behaviour or dismissed from the Society. The 1993 BPS ethical principles cover: consent; deception; debriefing; withdrawal; confidentiality; protection of participants; giving advice to participants; competence. Ethical permission had to be obtained from the LREC (Local Research Ethics Committee) before the study could proceed. All patient documentation, together with a copy of the research proposal, had to be approved by the committee. The study complied with all ethical guidelines of the LREC, those of The British Psychological Society and The Association of Teachers of Psychology. The function of the LREC is to 'independently examine all proposals for research which is to be carried out within the geographical boundaries of the Authority, within the NHS and which involves human subjects. All research projects should be submitted even if thought to be of a trivial nature' (South and West Local Research Ethics Committees, 1995 – page 1). The *Code of Conduct for Psychologists* (BPS, 1985) sets outs guidelines for both research and practice. Emanating from this Code of Conduct are the *Ethical Principles for Conducting Research with Human Participants* (BPS, 1990,1993). Such guidelines need to be revised periodically to take account of changing social and political climates (Gale, Code of Conduct are the *Ethical Principles for Conducting Research with Human Participants* (BPS, 1990,1993). Such guidelines need to be revised periodically to take account of changing social and political climates (Gale, 1995). In order to comply with those guidelines the study was designed with the following considerations:

Informed consent

The ethical principle governing all research is that respondents should not be harmed as a result of participating in the research and they should give their informed consent to participate (Bowling, 2002). All prospective participants were provided with a comprehensive information sheet - appendix VIII. It should be noted that where there are very clear direct dangers to human life, the investigator might contravene the confidentiality rule (Coolican, 1995). At no time during this research was there any danger to the participants either directly or indirectly and thus no rules of confidentiality were broken. The British Psychological Society and the LREC require that all participants fully understand what is being asked of them. To that end an information sheet must be provided for the prospective participant that fully sets out details of the proposed study in plain language. It is important not to use medical or psychological jargon that the prospective participant may not understand. They may not wish to admit to not understanding the jargon and may therefore agree to take part in something of which they are not fully informed and which they may later regret. In addition, some participants may have problems of dyslexia or literacy, so the Information Sheet was read aloud to each participant and they were then allowed to study it at their own pace. As this study involved NHS patients the LREC format for a Patient Information Sheet was followed. This was adapted from a Report of the Royal College of Physicians stating that, although it should be written in plain English, it should not overlook or oversimplify possible inconvenience or discomfort. Thus a Patient Information Sheet was prepared which addressed the following points:

(i) It stated the purpose of the investigation, nature of procedures, risks (including psychological distress) and the possible benefit to the individual or to society;

that refusal to participate would not affect the individual's relationship with their general practitioner. It was important that individuals were aware participation was not mandatory and that their general practitioner would not mind either way. Some individuals see their general practitioners as figures of authority and may feel they should do as they are asked, otherwise their doctor may not wish to give them medical treatment in the future;

(iii) Right to withdraw – potential participants had to be made aware of their right to withdraw at any time and without giving a reason, therefore a letter of consent was prepared which pointed out the right to withdraw. In addition, it was a requirement of the LREC that the right to withdraw should be stated in the Consent Form (Appendix X).

(iv) Participants were not deceived in anyway as to the purpose of the study. It is a requirement of both the LREC and British Psychological Society that participants were told the true reasons for the study. In this case the Patient Information Sheet clearly set out the true purpose of the study. A classic study of deception is that of Milgram and the Obedience to Authority experiment (Milgram, 1963). Participants were led to believe that they were taking part in a study of learning and were told they were administering electric shocks to learners who had responded with an incorrect answer. In reality, the learners were stooges and no electric shocks were administered. However, participants were not given the right to withdraw and many became very stressed at being forced to administer the supposed electric shocks. The study was actually testing under what circumstances people will obey authority figures. Society learned much about obedience to authority from this study, but there is considerable debate as to whether this justifies the stress experienced by the participants. Beauchamp & Childress (1989,1994) consider that deception may be acceptable if it is essential to obtain important information and there is no risk to the participant. Furthermore, participants should be informed that deception is part of the study before they consent to participate. This is a contradiction in terms, because if the participant knows that there is deception, there is the risk they may become apprehensive and experience stress and distress. If there is a chance, however small, that a participant may be at risk of any discomfort, whether physical or mental, then deception cannot be justified. In the broad body of social science research there is very little, if any, which can justify deception;

(v) Other information required was contact details should the participant have any interim questions.

Consent should be in writing and only given after the aims and procedures, including risks and discomforts, have been made clear to the prospective participant. It must also be made clear in that consent form that the participant understands that she is free to withdraw at any time without jeopardising her future healthcare or relationship with her general practitioner. This consent is two-fold in that it protects the freedom of the participant and reduces the legal liability of the researcher (Bowling, 2002).

Complete confidentiality

It was critical for the research that no participant was identified in any way. During the course of research participants might reveal information of a very personal nature that they would not wish to be divulged to third parties. Gale (1995) cited the ethical dilemma of AIDS research and whether a researcher should inform the sexual partner of an HIV-infected partner. Gale (1995) justified confidentiality, pointing out that a consequence of breaches of confidentiality could result in the withdrawal of consent by certain groups and so undermine any future research. If a participant has been assured of complete confidentiality then that is what they should have. In this case participants supplied detailed personal information, including financial income and health-related matters. They were also asked to give their perceptions of their personal general practitioner. In order to ensure confidentiality, each participant was given a code, making identification by a third party impossible. General practitioners, surgeries and hospitals were also assured anonymity by assigning them a code letter. The general practitioners and surgeries have been accommodating in agreeing to participate in this research. They have been treated with due respect and all data relating to individual general practitioners and surgeries have been assigned a code letter. This ensures that it is not possible to identify individuals or hospitals that may have been perceived negatively. At no time were patients' medical records accessed by the researcher. Each participating surgery has given written consent to be identified as a participating practice and all participating hospitals, with the exception of one have agreed to be named. However, because of the sensitive nature of some of the data relating to the surgeries and hospitals it was decided they should all remain anonymous.

Competency

Psychologists should be competent to carry out research. As this research dealt with health matters it was made clear to the participants that they could not be offered any medical advice and should contact their general practitioner. At no time was any participant offered advice. If this was sought they were referred to the general practitioner or health visitor. They were not offered nutritional or dietary advice of any kind.

Debrief

At the end of the six months post partum visit all participants were debriefed. This meant reiterating what the research was about and that it was planned to collate results, which would be published. Confidentiality would be maintained and it was confirmed that the participant was still agreeable to her information being used as part of the study. She was also thanked for taking part and given the opportunity to ask questions about the research. Debriefing is an important aspect of any research because the participant must leave the study as sound as when they entered. The self-esteem of the participants was protected by ensuring that no value judgements or subjective statements were made regarding any personal information or comments made by the participants. They were not given any information about other participants or their infants. Participants were treated with respect and courtesy at all times.

3.6 The Pilot Study

Method of Recruitment for pilot study

Initial pilot recruitment was via introductions at the surgery when prospective participants attended their first antenatal appointment. In the event this proved clumsy and time-consuming as it meant having to be notified by the general practitioner concerned, via the receptionist, of any prospective participants. It was then decided to attend the surgery and wait in an anteroom until the consultation was over and approach the woman upon leaving the consulting room. In practice this meant waiting and listening in the anteroom for the consultation to finish and then approaching the woman as soon as she left the consulting room. This was felt to be too intimidating an approach in addition to time-consuming. There was also the possibility of reducing the reliability of the study as the women may have felt inclined to agree to participate in the formal surgery setting but be less forthcoming with perceptions of advice offered by general practitioners. Thus it was decided to approach prospective participants by telephone once doctors had obtained permission from the patients to make their telephone number available for the research. The general practitioner passed on the name to the senior receptionist who completed a form with personal details of the prospective participant. Weekly contact was made with the senior receptionist and any completed forms were collected from the surgery. This was found to be the best approach and worked in all cases with the exception of one surgery, where recruitment was carried out via the midwives at the local hospital. In this case named midwives approached prospective participants during their first antenatal appointment. If the woman was agreeable, a form was completed with personal details including name, address, telephone number and expected date of confinement. These were then passed on via postal services, so that the prospective participant could be contacted by telephone and an appointment made to explain the research in detail during a visit to the woman's home.

Duration of pilot study

The pilot study commenced in September 1996 and was completed in April 1998. The pilot study took almost two years to complete, as initial recruitment was slow due to general practitioners forgetting to approach prospective participants and that not many women in their first pregnancy attended the surgery during this period. All participants in the pilot study were patients at Northlands Surgery.

Number of pilot participants

There were six participants, recruited as follows:

1 in September 1996

1 in October 1996

1 in December 1996

3 in March 1997

Social class

It was necessary to collate the participants' socio-economic details, such as occupation, income and age. Such information could be compared, for example with food expenditure, age of participant at time of conception, weight of baby, and so on, in order to highlight differences between participants. To do this the participants needed to be categorised in some way and the most logical categorisation was considered to be by social class. There are difficulties however in assigning social class as there is considerable class mobility at the time of this study and incomes vary greatly within and between the classes. However, it was decided to take the partner's occupation as the class indicator using the Registrar General's Classification of Occupations (Table 3.1, source: Reid, 1989). One participant had no partner and was assigned a class using her own occupation. This was chosen as it is the most widely used by Social Trends and the Office of Population Censuses and Surveys.

Table 3.1 Registrar-General's Classification of Occupations.

Class	Type of Occupations
I	Professional and higher administrative e.g. lawyers, architects, doctors, managers, university teachers
II	Intermediate professionals and administrative e.g. shopkeepers, farmers, actors, musicians, teachers
III	Skilled (a) Non-manual e.g. draughtsmen, shop assistants, clerks (b) Manual e.g. electricians, coalminers
IV	Semi-skilled e.g. milk roundsmen, bus conductors, telephone operators, fishermen, farm workers
V	Unskilled e.g. nightwatchmen, porters, refuse collectors, cleaners, labourers

Socio-economic data of pilot participants

Table 3.2 Socio-economic data of the six participants in the pilot study

Age#	Occupation	Partner's occupation	Annual income	Weekly food costs	Social class	B/F
28	Textile buyer	RAF pilot	32K	£70	I	Yes
30	Production worker	Production worker	11K	£30	V	No
20	Nanny	Car worker	20K	£20*	III	Yes
29	Shop assistant	Sales rep	15K	£35	III	Yes
26	Secretary	JCB operator	20K	£50	III	Yes
28	Secretary	Pipe-worker	22K	£50	III	Yes

*This participant and her partner were living with parents so there was no expenditure on food, but a contribution of £20.00 per week was made to the household budget.

B/F – Breastfeeding – one participant breastfed for two weeks, one for three months and three for four months.

- Age of participant at time of conception

For the main study it was decided to amalgamate some of the classes in order to produce more meaningful results. Classes I and II were grouped together as the differences in income and occupation were slight. Classes IV and V were amalgamated for the same reasons. This meant that the numbers in the three classes were more consistent – Class I & II = 13, Class III = 17 and Class IV&V = 9, thus providing a more robust data set for analyses.

Interview Procedure

Following agreement to participate in the research, the pilot participants were contacted by telephone, when an initial appointment was made to meet and discuss the research in detail during a visit to the patient's home. This was for the patient's convenience and enabled the interviews to be carried out in a more relaxed environment than at the surgery. During the first visit the research was explained in detail, following the format of the Patient Information Sheet (appendix VIII). The participant was given the opportunity to ask questions and then two copies of the Consent Form were signed – one to be retained by the participant and one by the researcher (appendix X). A Letter of Acknowledgement was then given to the participant, pointing out a contact telephone number if she had any questions at any time (appendix IX). A diet diary was explained, assuring the participant that it was not in any way judgemental and that it would remain strictly confidential (appendix XI). In addition, it was pointed out that the participant's general practitioner would not see the diet diary. This was in case any participant felt her general practitioner would be critical of what she was eating and so give false information in the diary. An appointment was made to visit the woman again the following week to collect the diary and go through the interview/questionnaire procedure. During this next visit a Likert scale questionnaire (appendix V) was completed in addition to an interviewer administered questionnaire (appendix II). On one occasion it was found that a participant was semi-literate, so future interviews were carried out with the offer to assist in filling in the Likert scale questionnaire. In any event, the interviewer administered questionnaire was completed on behalf of the participant as it allowed for additional note-taking. At the end of the visit a further appointment was made to visit the participant just before the estimated delivery date. In the event, one participant was delivered prematurely and thus information had to be collected retrospectively, making it invalid. Retrospective accounts are often inaccurate due to distortions in memory recall. Therefore, future second interviews were carried out four weeks before the estimated date of confinement. These second interviews followed the same format as the first interviews. Participants were telephoned one week prior to the appointment to check that all was well with the pregnancy and they were still willing to participate. The final interviews were carried out in exactly the same way at six months post partum.

Food Diary

Completion of a diet diary was explained to each participant so that she fully understood what was required of her and to allow for any literacy problems in reading the instructions at the top of the diary (appendix XI). A copy was left, for the participant to complete during the following week. This was a seven-day diet diary designed for use during the three time periods. Participants were requested to record everything they ate, with approximate amounts, although they were not required to weigh food. An example of a day's recorded intake was included with the diary and it was made clear that this did not represent a day's recommended intake of food whilst pregnant. The wording of the diary took account of individual variations in names for meals. Breakfast, mid-morning, lunch, afternoon, evening meal and bedtime snacks were used to avoid any ambiguity. The diary was of original design and was used in both the pilot and main studies without alteration.

Initially it was intended to use supermarket receipts to check the honesty of the diet diaries, but in the event this proved too difficult. During the pilot study participants were asked to retain supermarket receipts, which would then be checked against the diaries, to see if the women were actually buying what they said they were eating. In the event women forgot to save the receipts, or they did not always do the shopping. In one case the participant was living with her in-laws and did not do any food shopping, while another was living with parents and supplemented the household food shopping. As this meant the shopping data were incomplete, it was abandoned before the main study because of the potential problems of collating and checking the raw data relating to large numbers of participants. It was expected such data would be incomplete and thus meaningless. It was accepted that checking the reliability of the diet diaries would be very difficult because of the problems inherent in any self-reporting system. For example, the participants may have forgotten to complete diaries at the time of eating and thus completed them retrospectively. The participants may therefore have forgotten exactly what and how much they ate at a given time. There is the additional problem of the individual estimates of portion size. For example one person may perceive a small portion of vegetable to be two dessertspoons of peas whereas another person may perceive a small portion to be four dessertspoonful of peas. To obviate this problem, portion size was discussed in detail at the time of each interview. Moreover, participants may be untruthful in their recording of food consumption in order to present themselves positively. For example, they may have omitted items such as confectionery that they may have perceived as unhealthy. There is no way of knowing how truthful or accurate the completed diaries were and the diaries had to be taken in good faith. Despite the problems associated with the accuracy of self-reported diet diaries, they were nevertheless, considered the most appropriate method of collecting nutritional data, given the constraints of the study.

Interviewer administered questionnaire design

During the early pilots only one questionnaire (Likert scale) was designed and an interview was carried out using a tape-recorder and a list of questions. These questionnaires and interviews were to be used over three time periods; one during the first trimester, the next at the end of the third trimester, and the third questionnaire when the baby turned six months of age. A diet diary was also to be utilised over the three time periods. During the pilot various amendments were made to the methodology so not every participant was interviewed in the same way. Participants 1, 2 and 3 were interviewed at the first trimester using a tape recorder, but this idea was quickly abandoned, as interviewees were self-conscious and setting up the recorder was difficult. The quality of the recordings was also poor despite trying out a number of recorders. Because the recorded interviews were self-conscious, an element of the Hawthorne Effect could have been introduced (Mayo, 1933). There was also the added burden of transcribing the tapes with limited resources of time and finance. According to Mays and Pope (1996) one hour of interviewing can take six or seven hours to transcribe. In this instance each interview took approximately six hours to transcribe and it became quickly apparent that this was an unviable method of data collection. For these reasons participants 4, 5 and 6 did not have their interviews recorded, but notes were made and these were typed up immediately after the interviews in order to ensure accurate recall. The period after an interview is crucial to the rigour and validity of the study (Patton, 2002). Had the study utilised a number of researchers there would have been the opportunity to verify data but as this was not possible the accuracy of the data was reliant on the integrity of the researcher. According to Patton (1990) validity is dependent to a great extent on the personal skills of the researcher, who should have a high degree of integrity, sensitivity and skill.

Initially a list of questions was prepared to assist with the recorded interviews. This list contained 62 questions relating to the pregnancy; socio-economic data; perceptions of a healthy diet; a measure of nutritional knowledge; physical and domestic problems affecting food choices; perceptions of food advertising and packaging. These questions proved to be too many as they gave the interview a sense of inquisition. This could have intimidated some women at the start of the procedure, resulting in attrition. Thus, in order to achieve validity, interviewer administered questionnaires were considered the most appropriate measuring instruments. Each participant was interviewed three times, once during the first trimester, once towards the end of the third trimester and once at six months post partum.

Participant evaluation of Likert Scale Questionnaire

Three participants were asked to evaluate the Likert scale questionnaire, as shown in Tables 3.3 and 3.4 below:

Table 3.3 Perception of Likert questionnaire N=3

Question	Yes	No
Was the questionnaire easy to understand?	3	0
Was it too long?	0	3
Was it too short?	0	3
Were any questions difficult to answer?	1*	2

*This referred to question 9 (2) 'If I am anxious or upset changing my eating habits during pregnancy would be Difficult – Easy'. It was explained to the participant that eating habits sometimes change when people are anxious or upset and it may be problematic adhering to particular dietary intentions.

Table 3.4 Participants comments regarding Likert scale questionnaire

Comments
The questions could be more specific – more generalised. I would have been more confident circling specific answers i.e. not just good-bad but average, not sure etc., as options. A little confusing when positive and negative changed ends of scale e.g. Question 3 (2).*

* This was deliberately built into the questionnaire to avoid Response Acquiescence Set whereby participants tend to agree rather than disagree. This has the effect of maintaining the participant's concentration and giving a central score rather than an extreme score (Coolican, 1995, Bowling, 2002).

Changes made to main study as a result of pilot study

The pilot study increased reliability and validity by bringing to the fore flaws in the method, such as:

Initial recruitment and interviews carried out at the surgery proved to be impractical for the researcher and intimidating for the participant as outlined above – Method of recruitment for pilot study. For the main study, recruitment via telephone and subsequent visits in the participants' own homes increased validity and reliability by putting the onus on the researcher to make contact rather than being reliant on the participant to make the first move. This was likely to have increased retention rates. In addition, it is likely the participants felt more relaxed and comfortable in their own home and thus more forthcoming during the interviews. It is also possible they would be more likely to comment truthfully about their perceptions of health care professionals outside the formal medical setting of the surgery. Moreover, it is possible the participants may have completed their diary more honestly if they were to discuss the content at home, rather than at the surgery, where they might believe their GP to have access to the contents.

Duplicate forms were completed at the time of the initial recruitment interview on grounds of efficiency rather than taking the original set away, to be photocopied. This saved time and expense for the research as it was not necessary to post or hand deliver the copy documents to the participant. This could have added an 'official' dimension to the research which some participants may have found threatening and thus led to higher attrition rates.

During the pilots one woman delivered prematurely, highlighting the need to make visits in the middle of the third trimester rather than at the end, in order to avoid such a situation occurring in the main study. In the event this could not be avoided in the main study as one woman delivered early in the third trimester. It would not have been viable to make visits any earlier than the middle of the third trimester as this could have invalidated data collected. For example, there may have been additional reasons for changes in eating habits during the pregnancy which may not have been identified had the participants been interviewed early in the last trimester.

The pilot study emphasised the need to discuss the completed diaries in detail with the participants. This was to clarify cooking methods, estimated portion size and quantities, and whether meals were readymade, processed foods or freshly prepared and cooked. This also had the added advantage of building up a rapport with the participant, prior to the interviewer administered questionnaire, as discussion of the diaries took the form of a conversation when interest was expressed in certain foods and personal recipes.

Collecting supermarket receipts was abandoned in the main study for the reasons outlined above – 3.6 *Food Diary.*

During the pilot it became apparent that recording interviews was not practical, and a more appropriate method was to use an interviewer administered questionnaire. Using this method ensured that required information was gathered in a clear and concise way. Due to the poor quality of recordings, valuable data may have been lost thus reducing reliability. The number of questions was reduced, excluding those considered to be inappropriate or unnecessary, thus increasing validity and therefore reliability. For example, had the questions which were considered to be intrusive been retained, some women may have felt disinclined to remain in the study. Amending the design of the research tools and conduct of the interviews in the light of the pilot study, has served to increase validity and reliability as outlined above.

3.7 Main study Procedure

Once a week the researcher contacted the participating surgeries to collect details of any prospective patients. Each participating general practitioner was supplied with bright pink referral sheets. A copy of the referral sheet is shown in appendix VII. The head receptionist at three surgeries attached the pink sheets to the patient notes prior to the initial antenatal consultation. This procedure was carried out at three surgeries. One surgery deviated from this procedure by giving out patient information sheets at the reception desk to patients attending their initial consultation. They were asked to contact the researcher directly if they wished to take part. A named midwife at the local hospital antenatal clinic, who also referred a small number of women from this surgery, referred prospective participants from the fifth surgery that is in the same town. At the initial consultation the general practitioner/midwife briefly advised the patient of the research and asked if they were willing to be contacted by the researcher with a view to taking part. If the patient was agreeable, the pink sheet was completed with their name and address, and then passed to the receptionist who added the patient's telephone number and estimated date of confinement (appendix VII). The receptionist then held the pink sheets for collection by the researcher at the first three surgeries. At hospital C the midwives posted any relevant forms to the researcher on a weekly basis. Once referral sheets had been collected, each patient was telephoned to make an appointment at their home to explain the project and to see if they wished to take part. At all times it was made clear to each woman that they were not obliged to take part. During the initial meeting an explanation of what was involved was given in sufficient detail in order to comply with medical ethical requirements. A Patient Information Sheet was prepared in accordance with the LREC, giving detailed information to prospective participants so that they were in a position to give informed consent (appendix VIII). The Patient Information Sheet was written in plain language, avoiding any technical terms, so that all information was readily understood. If the participant was agreeable, the next stage was to complete a Consent Form, which was also a requirement of the LREC (appendix X). Originally the patient was asked to sign one copy of the Consent Form and then a copy was made to give back to the patient. This proved cumbersome and inefficient and so the patient was asked to sign two copies at the initial meeting. The Patient Information Sheet, Consent Form and Letter of Thanks were all read to the participants in case any woman had literacy problems. A diet diary was left, verbal instructions having been given as to how the diary should be completed and a mutually convenient appointment was made for the following week (appendix XI). During this second visit the diary was discussed, the Likert scale questionnaire was completed and the interviewer administered questionnaire completed. The Likert scale questionnaire was completed in pen by the women themselves (appendix V). If it was obvious that any woman was having difficulty reading the questionnaire (which was the case on two occasions), a remark was made about the poor design of the questionnaire and that it was difficult to follow. The questionnaire was then tactfully read to the participant (sitting side by side to avoid a confrontational attitude) and the answers were recorded in writing by the researcher. Although some women had difficulty reading the questionnaires they were all able to write. This was apparent when they signed the initial Consent Form. Poor spelling and legibility of the completed diet diaries was not problematic as the content of the diaries was discussed with every participant during the course of the interviews. In the case of the interviewer administered questionnaires, these were read to the participants in all cases and their answers recorded on the questionnaire sheets. At the end of this visit another diary was left and an appointment was made for when the participant was eight months pregnant. This timing was chosen to allow for differences in estimated date of confinement and actual date of confinement. A diary note was made to contact the participant seven days before the appointment to check that the pregnancy was still progressing and that the participant was still in good health and willing to continue with the research. The participants were asked to complete a diet diary for one week prior to the visit. The same procedure was followed during this third visit, although the interview questions were slightly different (appendix III). As most personal details had been obtained during the first interview and nutritional knowledge measured at that time, it was not necessary to repeat the questions for the second interview. During the second interview, questions were centred on any change in eating habits and possible reasons for that change. At this time the chosen hospital for the delivery was noted and whether any visits to that hospital had been made. A record was made of any advice received by the participant regarding nutrition and whether the woman had acted upon this advice and why. A record was made of annual income as this may have changed from the time of the first interview. Intention to breastfeed and any reasons for change in intention, were recorded. Weight of the mother was taken for future analysis. At the conclusion of the interview a diet diary was left with the participant and an appointment was made for when the baby would be around six months old. A diary note was made to contact the participant seven days before this appointment. Once again a Likert scale questionnaire, which was amended to take account of breastfeeding and weaning, was completed (appendix VI). An interviewer administered questionnaire was also carried out, which took account of details of the baby's weight, gender and date of birth (appendix IV). All participants were thanked and fully debriefed. The debrief consisted of giving the mother the opportunity to ask any questions about the research and explaining that the data would be analysed and written up as a paper. It was also made clear that a copy of the final paper would be available at the surgery and once again assurance was given about confidentiality and anonymity.

3.8 Analysis of Data

Advice was sought from a medical statistician at Royal United Hospital regarding sample size and statistical analyses prior to commencement of the study. At the start of the study information was not available from which to undertake a power calculation. A power calculation tests the probability that the statistical test will reject the hypothesis tested when the alternative hypothesis is true. Initially a sample size of 50 was considered sufficient for statistical analyses as the study was viewed as a pilot for possible larger studies. Due to time constraints a sample size of 37 was chosen on a pragmatic basis in that it should be sufficient to see the large changes that are expected in the outcomes and also practical within the time frame available. Professional medical statisticians checked all statistical calculations.

The analysis for the Likert scale questionnaires during the first trimester, the third trimester and six months post partum were undertaken using a replicated analysis of variance model in SPSS 6.1.2 (Statistical Package for the Social Sciences Version 6.1.2.). Analysis of variance (ANOVA) is a statistical method, which makes comparisons between two or more means, looking for significant differences anywhere among the samples. It ascertains if any further statistical analysis is worthwhile and is a generalisation of the paired t test. The mean scores of the following sections of the questionnaire were compared over the three time periods i.e. the first trimester, third trimester and six months post partum:

1. Intentions towards eating habits.
2. Attitudes to eating habits.
3. Beliefs about eating habits.

4. Health beliefs.
5. Significant others.
6. Beliefs about significant others.
7. Influence of others on eating habits.
8. Personal control.
9. Influential factors individually.

Most questions were closed allowing for ease of data collation and analyses. Open-ended questions were in the main more difficult to analyse quantitatively and were treated as qualitative data. For example participants' perceptions of primary care professionals and hospitals regarding nutritional advice – Table 4.45. This data was collated into the number expressing an opinion and whether these opinions were negative or positive. Adjectives used to express these negative or positive opinions have been explained although there was no discourse analysis carried out as this was felt to be outside the constraints of the study. Discourse analysis is qualitative analysis of interactive speech to see how individuals construct their world (Potter & Wetherell, 1987). This was not considered necessary or appropriate in this study. A simple measure of negative and positive comments made by the participants was considered sufficient. Following the Analysis of Variance, the Friedman test (Lowry, 1999), which is a non-parametric test, was considered the most appropriate statistical test to analyse the data further. This test was chosen because the data are categorical, but have a large number of categories and are not normally distributed. In addition, the data is repeated measures, i.e. the same participants over three time points. Thus the data did not meet the criteria for a parametric test, which are:

Homogeneity of variance

Normal distribution

Interval data.

Software available at Bath Spa University College was used. Analysing the diaries took two years to complete as they were done in batches when available. The diaries were analysed by computer using Dietplan5 for Windows (Forestfield Software Ltd) and comparing Dietary Reference Values

(DRV) with Reference Nutrient Intake (RNI) tables for the relevant stages of pregnancy and post partum (DoH, 1991). Details of age, weight, height and stage of pregnancy were recorded on computer for each participant. Food consumed for each day was input on computer using the participant's self-reported estimates of consumption. For example, small, average or large portion of carrots or cauliflower; one packet of potato crips by brand and flavour; one chicken breast and method of cooking; one apple by size and whether raw or cooked. Depending on the food being analysed amounts were recorded in gms, mls, portions, slices or units. Sugar was measured by spoonfuls and milk by pints or parts thereof. The diet analysis showed how much the participants consumed over the week of a particular trimeser and worked out a daily average. This was further analysed showing the sources of energy over the seven days. Nutrient intake per day over the seven days was analysed as a percentage of RNIs and showing consumption as a percentage of DRVs. A sample of one participant's (SH27) dietary analysis can be found in appendix XIV. It was not necessary to include water in the analysis, as this has no nutritional value. An example of a completed diary by SH27 is included in appendix XV together with an example of how the data was collated prior to computer input – appendix XVI. Daily intake over seven days was totalled for each item and entered as one amount. Water was not included in the analysis The Committee on Medical Aspects of Food and Nutrition Policy (COMA, 1991) developed DRVs that are estimates of the nutrient requirements of different groups of people, such as pregnant females and lactating females aged 15-18 years. DRVs are not goals or recommendations for individuals, but estimates only. On the other hand, Reference Nutrient Intake (RNI) is the amount of a nutrient required to ensure that the needs of all members of the group (in this case pregnant women) are being met. (DoH, 1991). Based on optimum nutrient intake between 95-105 per cent of Reference Nutrient Intake (RNI), any figure below 95 per cent was considered to be a deficiency and any figure above 105 per cent was considered to be excess. These figures were chosen as it was unlikely that many people would have exactly 100 per cent RNI. Nutrient deficiencies specifically analysed were iron, iodine, riboflavin, niacin, folate, vitamin B, calcium, fibre and energy. Nutritional excesses cover thiamine, vitamin B12, vitamin B6, vitamin C, niacin, sodium (Na), calcium, and retinol (vitamin A). The amount of sodium (Na) analysed does not include that which would have been added to food during meals as this would have been difficult to estimate. It should be noted that at times throughout the dissertation mention is made of sodium chloride and sodium (Na). This is to clarify that what was consumed was sodium chloride but that actual analysis was of sodium (Na). Calorific intake was measured by portion size, i.e. small, medium or large, which were self-reported by the participants. For example, how many slices of bread, quantities of fluids, estimated size and weight of vegetables were recorded as were size of chocolate bars, number of fish fingers, size of steak etc. Participants were not required to weigh food. During the interviews the researcher looked through the diaries with the women and clarified portion size and any possible omissions, if necessary. The interviewer administered questionnaires were analysed manually, with the data being represented by bar charts, scattergraphs and tables. A detailed explanation has been given of negative and positive comments made by participants regarding perceptions of the quality of nutritional advice received from various sources and perceptions of hospital and healthcare professionals. These have been analysed statistically into negative and positive comments, - Table 4.20.

Measurement of Health

To measure the health status of the mothers in this study an analysis of self-reported diet diaries was undertaken using Recommended Daily Allowances (RDAs). This highlighted nutrient deficiencies and over-consumption but these are unlikely to give an accurate assessment of the nutritional status of the mother, for the reasons set out in section 3.6 *Food Diary*. For practical reasons, the health status of the infants in the sample could only be measured by taking the weights of the infants at birth and six months and comparing them against national averages. Neither of these measurements can give a true definition of the health status of the mother and child. In the case of the child, health can only be measured by assessing the child's development for its age and the absence of any disease. As the child cannot communicate there is no way of accurately measuring its wellbeing and state of mind. What should be borne in mind is that this study is assessing the nutritional status of the mother and child rather than measuring health by means of a standard measure such as blood samples.

National Birth Statistics

National Birth Statistics (2001) were used when comparing birthweights of the infants and ages of the mothers at time of their first pregnancy with national figures - section 5.1. These statistics were chosen because they use the Registrar General's Classification of Occupations as used in this study (Reid, 1989). Nevertheless, the National Birth Statistics have to be considered carefully for a number of reasons. A complication is that only every tenth birth is coded for social class, although standard errors have been calculated to show where the true number in the population may lie (National Statistics, 2001). The National Birth Statistics are problematic, as they only show live births within marriage. Therefore, they do not take account of established couples in long-term relationships, not married by choice. Moreover, the within marriage figures do not take account of children born of the same mother in a previous relationship, unless declared by the mother. Thus it is difficult to be sure if figures are accurate in indicating that the woman has not had a child(ren) in a previous relationship. For example, a woman may have had three children in a previous marriage, but the fourth may be the first child of a new marriage. The statistic will read as if this is the first child the woman has given birth to. Furthermore, these figures do not reveal if a woman has previously conceived and had a spontaneous abortion (miscarriage) or a termination of pregnancy. Despite the limitations of National Birth Statistics (2001) they were considered the most accurate and up-to-date birth statistics available.

3.9 Conclusion

This chapter has considered many of the issues surrounding research design, fully justifying the choices made for the design of the measuring instruments and method. In order to achieve a high standard of validity and reliability within the constraints of the study, the following design was considered most appropriate:

- An opportunity sample of 37 primagravidae was selected from five participating surgeries in North Wiltshire;
- A multi-method approach was employed using quantitative and qualitative methods comprising three interviewer administered questionnaires one of each used at the first trimester, third trimester and six months post partum; three Likert scale attitude measurement questionnaires used at the first trimester, third trimester and six months post partum; one diet diary used at the first trimester, third trimester and six months post partum;
- A pilot study was conducted before the main study in order to increase validity and reliability;
- The study was conducted with the highest degree of integrity, ensuring all ethical guidelines were met, thus protecting the welfare of all participants in the study;
- Data were analysed using descriptive and inferential statistics.

Chapter 4

Results of analyses of data

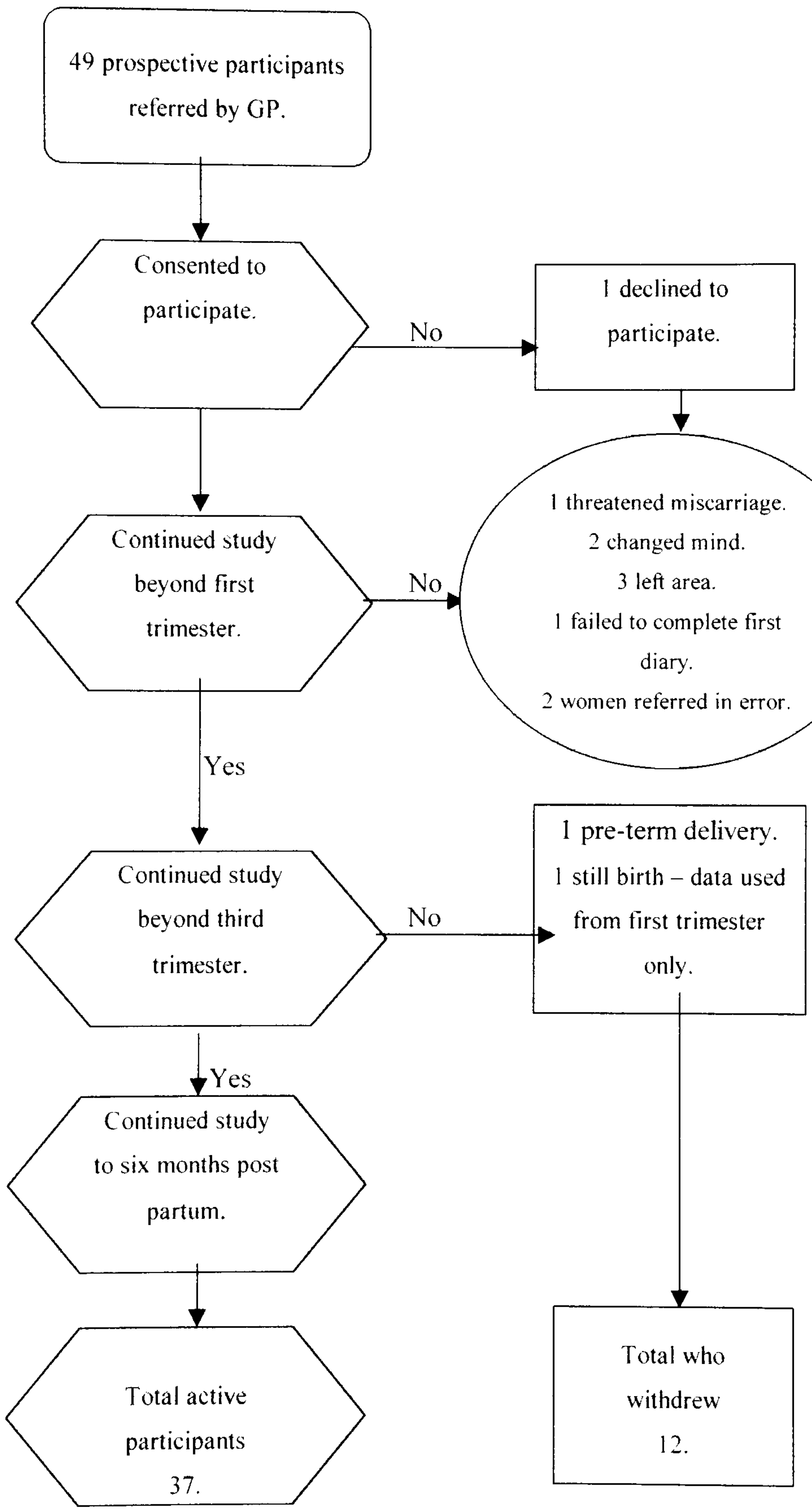
Introduction to chapter

This chapter presents and analyses data relating to the participants and their infants in the sample studied. Socio-economic data are shown, followed by analyses of intentions regarding eating habits and perceptions of the efficacy of various foods and food groups. A measure of the participants' nutritional knowledge has been carried out, followed by analyses of their food and alcohol consumption during the course of the study. The participants' nutritional status has been assessed through analyses of the diet diaries, which the participants completed during the first trimester, third trimester and at six months post partum. Sources of nutritional advice and participant perceptions of nutritional advice received during the course of the pregnancy and six months post partum have been assessed. Breastfeeding data were analysed, in particular the incidence and duration of breastfeeding followed by nutritional perceptions regarding breastfeeding. Finally, perceptions of hospital experience regarding breastfeeding were assessed. The data have been analysed using descriptive statistics throughout and inferential statistical analyses have been carried out where appropriate.

4.1 Socio-economic data of participants

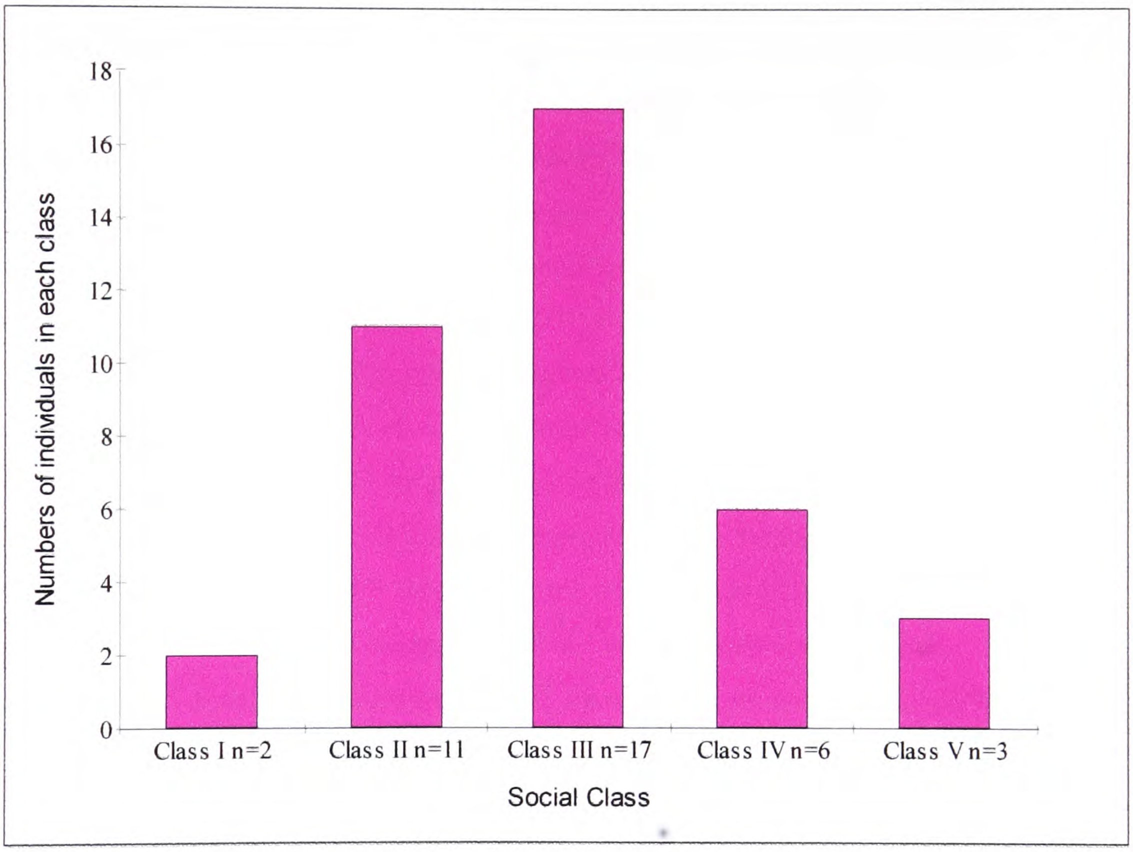
From the original 49 participants recruited, there were ultimately 37 participants who completed the study (Figure 4.1). For some of the analyses, data for 39 women have been used as one mother, whose infant was stillborn, and another mother, who had a pre-term delivery, recorded valid data that could be used up to the third trimester. Both of these women were willing to remain as participants but, as they delivered early, there were no opportunities to complete diaries and so data were incomplete. Unless otherwise stated, data from the 37 active participants who completed data collection until six months post partum were used in the analyses. Participants were lost through withdrawal, left area, pre-term delivery, stillbirth, not first pregnancy or threatened miscarriage (Figure 4.1).

Figure 4.1 Outcome of 49 participants recruited to the study.



The majority of participants were from social class III (Figure 4.2). A comparison of the upper (classes I-II), middle (class III) and lower (classes IV-V) classes (Figure 4.2) revealed that the largest proportion of participants were in social class III (44 per cent) followed by I and II (33 per cent). Sampling was across the social classes, although there are more participants from social classes I-III than classes IV-V (30 out of 39 = 77 per cent).

Figure 4.2 Analysis of the 39 participants in the sample according to social class. *



* These data were collated from responses to question 25 of the questionnaire administered during the first trimester.

Classes I and II had the oldest mothers in first pregnancy (Table 4.1). There is a significant relationship between social class and age of mother (A2 = 37.61; p = 0.00018) indicating that the higher the social class, the older the woman at the start of her first pregnancy.

Table 4.1 Social class and ages* of the 39 participants in the sample.

Social Class	16-20yrs	21-25yrs	26-30yrs	31+yrs	Total
Classes I & II	0	1	4	8	13
Class III	0	3	7	7	17
Classes IV & V	5	2	1	1	9
Total	5	6	12	16	39

* These data were collated from coded personal details and responses to question 25 of the questionnaire administered during the first trimester.

Classes I and II had the highest expenditure on food (Table 4.2), and the largest increase in Body Mass Index (BMI) during the pregnancy (Table 4.4). Classes IV and V had the smallest increase in BMI and weight gain during the pregnancy. These results suggest a relationship between social class, food expenditure and weight gain during pregnancy. Classes IV and V had the least expenditure on food, but had the highest increase in food expenditure at the third trimester. Food expenditure for classes IV and V had almost doubled at six months post partum, making this the highest increase of the classes. This increase can be accounted for as some of these participants' circumstances changed during the course of the pregnancy, in that they set up house with their partner. Social classes I and II had food expenditure that was more than double that of social classes IV and V throughout the three time periods. Social class III spent more on food than classes IV and V. Social classes I and II spent more on food during the third trimester and six months post partum than during the first trimester (Table 4.2). Of the women in classes I and II, one was buying vegetarian food for herself and partner and another participant was mostly buying food for herself only, as her partner worked away from home on an oil-rig. Social class III expenditure dropped at the third trimester, increasing at six months post partum to more than that spent in the first trimester. Of the women in class III, one lived in lodgings during the first and third trimester, so was reliant on her landlady for food shopping and cooking. This participant bore twins and was living with the childrens' father at six months post partum. Another participant in social class III was living alone without a partner and returned to the family home daily for lunch during the third trimester, which meant a reduction in food expenditure. This participant returned to live with her parents after the child was born. One participant had high food expenditure as she had two stepchildren who visited and ate at her home regularly. Another participant lived alone in a council flat during the first trimester and subsequently married her partner, moving into an RAF married quarter just after the baby was born. One participant lived with her father who shopped for three people (including the participant's partner). This participant was still living at home at six months post partum. There was a larger variation in food expenditure of the participants during the first trimester which accounts for the larger standard deviation of £19.49 (Table 4.2). For example, one woman spent £25.00 a week on food whereas another spent £100.00 a week on food. Of the participants in social classes IV and V, one was living with her parents-in-law and husband during the first trimester, but moved with her husband to a council house before the infant was born. One participant was living with her parents during the first and third trimesters. Her parents paid out £100.00 per week for food for four people. This participant was still at school and had no income. She subsequently moved into a council flat on her own, with the baby, while maintaining contact with the baby's father and her parents. Another participant also remained at home until the birth, when she moved into a council flat and maintained contact with the child's father. One participant was living with her parents during the first trimester, but moved into a council house with her partner during the third trimester. Another participant was living with a friend during the first trimester and at the time of the initial interview had no funds with which to make a contribution to the household food expenditure. She subsequently moved into a council flat with her partner during the third trimester. Another participant made no contribution towards food during the first trimester and reported that during the third trimester she was spending £60.00 a week on food, which accounts for the large standard deviation in the mean food expenditure of social classes IV and V (Table 4.2). She reported spending £40.00 per week on food at six months post partum. One lived at home until after the baby was born and made no contribution towards food during the first or third trimesters. As the data were not normally distributed, they were analysed using a Kruskal-Wallis test. There was no evidence to suggest that food expenditure differed significiantly over the first trimester, third trimester and six months post partum (Kruskal-Wallis test, A^2_2=5.871, p0.053). Analysis of income at the first trimester according to social class was significant (Kruskal-Wallis test, A^2_2=36.45, $p<0.001$) (Table 4.3).

Table 4.2 Mean weekly food expenditure per household, of the 37* participants over the first trimester, third trimester and six months post partum by social class. Standard deviations are shown in parentheses. **

Social class	First trimester	Third trimester	Six months post partum
I & II (n=12)	£57.58 (14.16)	£58.83 (13.37)	£70.16 (15.71)
III (n=17)	£54.41 (19.49)	£45.00 (13.39)	£53.35 (16.53)
IV & V (n=8)	£20.25 (13.98)	£29.88 (16.48)	£43.75 (13.49)

* Two women withdrew after the first trimester. One woman in social class II had a stillbirth and one woman in social class IV had a pre-term delivery making a total of 37 women who remained in the study to six months post partum.

** These data were collated from responses to question 27 of the questionnaire administered during the first trimester and question 27 of the questionnaire administered during the third trimester and question 38 of the questionnaire administered during the sixth month post partum.

Table 4.3 Mean gross annual income * per household, of the 39 participants at the first trimester by social class.

Social class	Mean gross annual income
I & II (n=13)	£30K
III (n=17)	£23K
IV & V (n=9)	£12K

* These data were collated from responses to question 26 of the questionnaire administered during the first trimester.

Table 4.4 shows the BMI of the participants during pregnancy and at six months post partum. All participants gained weight from conception to eighth month of pregnancy, and all had lost weight at six months post partum, but were on average, slightly heavier than just before their pregnancy.

Table 4.4 Mean of body mass index (BMI) ** of the 38 participants at conception, eighth month of pregnancy and at six months post partum by social class. Standard deviations are shown in parentheses.

Class (Number of participants in parentheses)	**Mean BMI at conception**	**Mean BMI* at eighth month of pregnancy**	**Mean BMI at six months post partum**
Class I & II (n =12)	21 (1.81)	27 (3.38)	22 (2.25)
Class III (n =17)	25 (5.04)	30 (5.36)	26 (5.23)
Class IV & V (n =9)	22 (3.14)	26 (4.17)	23 (3.56)
Total sample (n = 38)	23 (4.19)	28 (4.89)	24 (4.37)

* One woman's weight was not recorded during the eighth month of pregnancy as she was delivered preterm, thus the mean BMI at the eighth month was calculated using the weights of the 37 remaining participants. It was possible to obtain this woman's weight at six months post partum.

** These data were collated from responses to question 34 of the questionnaire administered during the first trimester, question 39 of the questionnaire administered during the third trimester and question 16 of the questionnaire administered during the sixth month post partum.

Table 4.5 indicates that weight gain for social classes I & II and III is 3 kg over the 11 kgs recommended by Feig and Naylor (1998), whereas social classes IV and V are within the suggested range. On the other hand, taking the Institute of Medicine's (1990b) guidelines for weight gains during pregnancy, it can be seen that social classes I & II and III are within the recommended range of 11.5 -16 kg and classes IV and V are 0.5 kg under the recommendations. Because the IOM's recommendations are not based on UK studies and as the UK has no firm guideline, other than that put forward by Hytten and Leitch in 1971, their recommendation of 12.5 kg can be taken as the benchmark. Nonetheless, it should be borne in mind that optimum weight gain recommendations are a matter of some debate. See Chapter 1.12 for a consideration of optimum weight gain during pregnancy. Thus, classes I & II and III can be considered to have excess weight gain and classes IV and V too little weight gain. Infants born to women in social classes IV and V all had below average birth-weight (Table 4.6).

Table 4.5 Mean weight gain ** in kilogrammes during pregnancy of the 37 participants in the sample by social class.

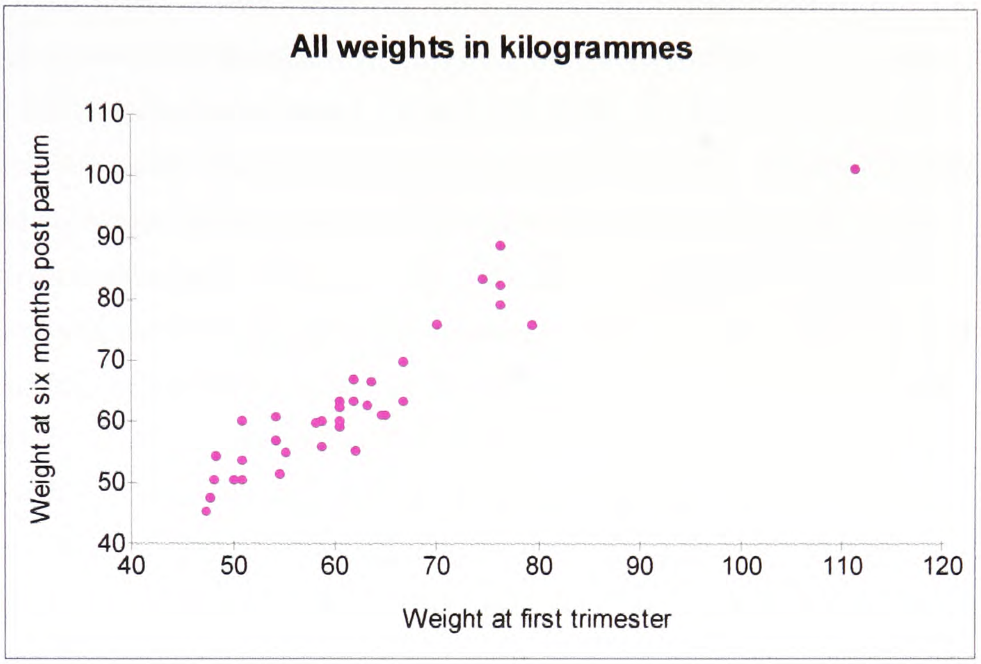
Class	Mean weight gain in kgs
Class I & II (n =12)	14
Class III (17)	14
Class IV & V (8*)	11

* Data for one participant is missing, as she was delivered prematurely and her weight was not recorded during the third trimester.

** These data were collated from responses to question 34 of the questionnaire administered during the first trimester, question 39 of the questionnaire administered during the third trimester and question 16 of the questionnaire administered at the sixth month post partum.

Figure 4.3 shows the relationship between mother's weight during the first trimester and mother's weight at six months post partum. The one outlier is because of one woman who weighed considerably more than the other women. Her weight was 112.12 kg at the first trimester and 101.60 kg at six months post partum. Valid data (n=38) were used for the statistical analysis. A Pearson's Correlation was used which produced a correlation coefficient of 0.318 significant at the p=0.05 level (2-tailed). These results suggest that there is a relationship between weight during the first trimester and weight at six months post partum. These results do not suggest cause and effect, but indicate that the greater the weight of the mother at the first trimester, the greater the weight of the mother at six months post partum.

Figure 4.3 Scattergram showing the weights, * in kilogrammes of the 38 participants in the sample during the first trimester and six months post partum.



** These data were collated from responses to question 34, question 39 and question 16 of the questionnaires administered during the first trimester, third trimester and six months post partum, respectively.

4.2 Infant data

There were 39 live births, including one set of twins and one pre-term birth. One infant has been excluded because the mother did not have the child weighed at six months. Thus the total number of infant weights analysed was 38. The average birth-weight of the infants in the sample was 3.26kg (Table 4.6). Males were slightly below average weight at birth but had overtaken the average female infants' weights at six months. There are indications that breastfed infants do not gain as much weight by six months as bottle-fed infants. The infants who were subsequently breastfed were, on average, 2g heavier at birth than the infants who were subsequently bottle-fed, but at six months the breastfed infants were 3g lighter than the bottle-fed infants.

Children born into social class I & II were the heaviest at birth and had the highest weight gain (4.62kg), whereas social class IV& V had the lowest average birth-weights and the lowest average weight gain (4.10kg). At six months, breastfed males were 19g above the average weight of 7.66kg, whereas breastfed females were 27g below the average weight at six months. Breastfed males had an average weight gain of 4.49kg compared with non-breastfed males, who had an average weight gain of 4.87kg. Breastfed females had an average weight gain of 4.22kg compared with non-breastfed females, who had an average weight increase of 4.25kg. Average birth-weights decreased down through the social classes, as did the average weight gain at six months. In particular, social class III was only 5g lighter at birth than social classes I and II and had gained 30g less than social classes I and II by six months. As the data were normally distributed, Analysis of Variance was carried out to find out if the difference between weight at birth and at six months according to social class was significant. There appeared to be no significant differences (Anova F=7.82, p=0.465). However, this analysis was based on a small sample size, so it might not have been powerful enough to find a difference if one existed.

Table 4.6 Mean weights, *** in kilogrammes of the 38 infants born to the 37 participants in the sample.

Description	Number of infants	At birth	At six months	Average weight gain
Whole sample	38	3.26	7.66	4.40
Males	17	3.23	7.84	4.61
Females	21	3.29	7.51	4.22
Bottle-fed infants	17	3.26	7.69	4.43
Bottle-fed males	5	2.93	7.80	4.87
Bottle-fed females	12	3.39	7.64	4.25
Breastfed infants	21	3.28	7.66	4.38
Breastfed males	12	3.36	7.85	4.49
Breastfed females	9	3.17	7.39	4.22
Social classes I and II	12	3.35	7.97	4.62
Social class III	18*	3.30	7.67	4.37
Social classes IV and V	8**	3.06	7.16	4.10

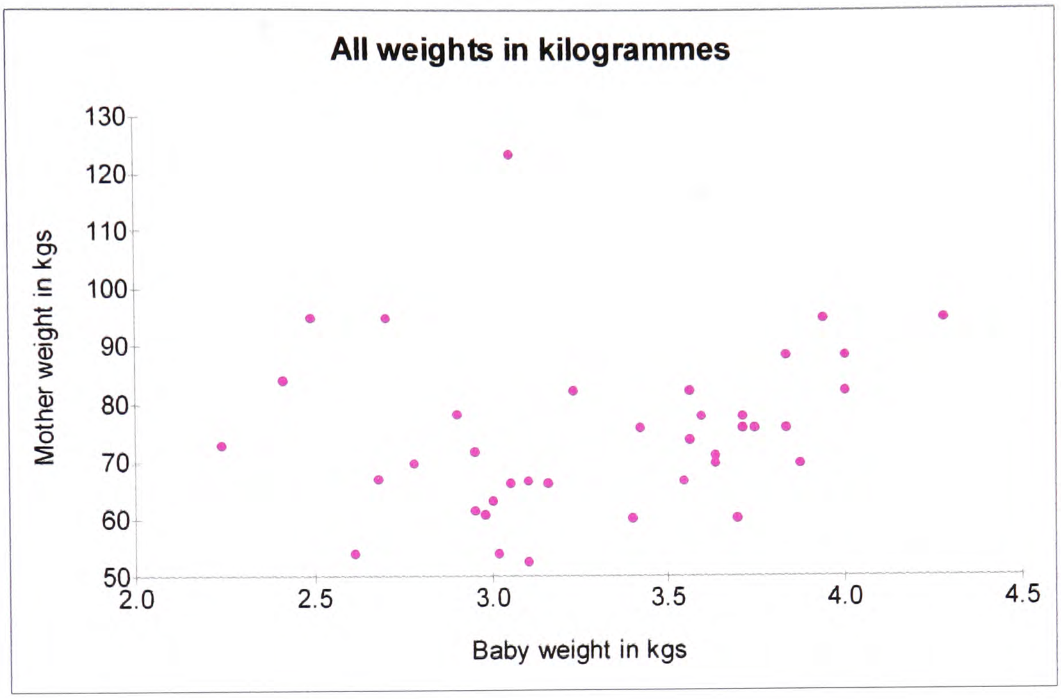
* There was one set of twins born to a mother in social class III.

** One mother did not have her child weighed during the six months post partum and so a mean was taken using the eight available weights.

*** These data were collated from responses to question 25 of the questionnaire administered during the first trimester and questions 3, 4, 5 and 6 of the questionnaire administered during the sixth month post partum.

A Pearson Correlation of the mothers' weights at nine months pregnant and the infants' birth-weights produced a coefficient of 0.181, not significant at the p=0.05 level (2-tailed). This suggests there is no significant relationship in the weight of the mother at nine months pregnant and the infant's birth-weight (Figure 4.4).

Figure 4.4 Scattergram showing correlation between weight, in kilogrammes, of 38* mothers during third trimester and baby's birth-weight. **

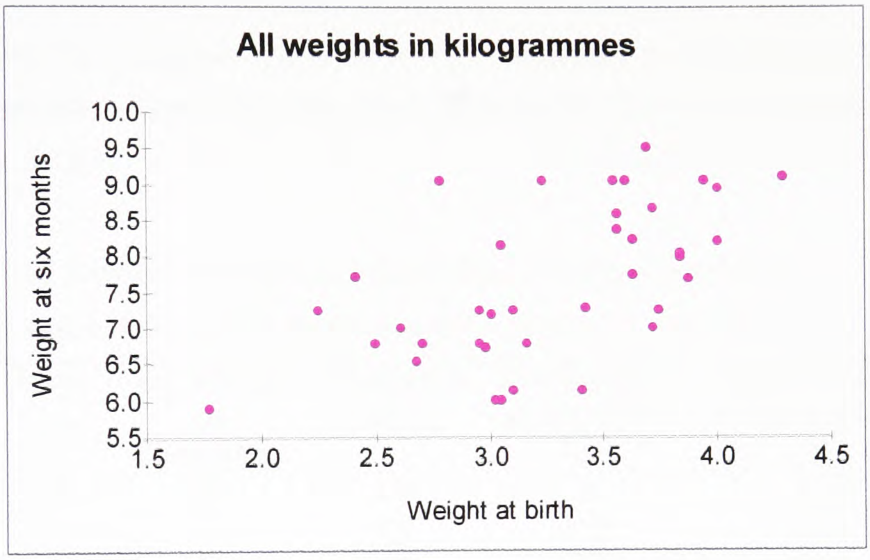


*There were actually 37 mothers, but one mother's weight at the third trimester was correlated twice, as she gave birth to twins. One data set was omitted because it was a pre-term birth and the mother did not have a record of her weight at the time of the birth. All weights are in kg.

** These data were collated from responses to question 39 of the questionnaire administered during the third trimester and question 4 of the questionnaire administered during the sixth month post partum.

A Pearson Correlation of the infants' birth-weights and weight at six months produced a coefficient of 0.534 which was significant at the p=0.01 level, 2-tailed indicating that there appears to be a strong relationship between birth-weight and weight of baby at six months (Figure 4.5).

Figure 4.5 Scattergram showing the correlation between 38* babies birth-weight in kilogrammes and their weight at six months. **



*Only valid data (N=38) were used because of one infant who had not been weighed at six months. One woman had twins making the total number of live births 39.

** These data were collated from responses to questions 4 and 5 of the questionnaire administered during the sixth month post partum.

Four participants in the sample were 18 years or under at the time of their infant's conception (Table 4.7). Although the sub-sample (n=4) was too small to make any generalisations, it was considered important to show these data as the women were possibly still growing and their own high nutritional needs could have an effect on the growing fetus. Of these four women, only one was lactating and breastfeeding her infant. Three of the babies born to these women were below the sample average birth-weight of 3.26kg. One was above the sample average birth-weight at 3.63kg. This baby was above the sample average weight at six months and the other three babies were still below the sample average weight at six months of 7.66kg. All four participants were from social class V. The four participants all had social support, with two living alone. KP/19 had most support as her live-in partner was employed, while NT/32, although living alone, had support from nearby family and supportive partner. NB/35 was living in a stable relationship with her husband, who had never worked owing to back injury and long-term clinical depression. CB/36 had no family support, lived alone and had a tenuous relationship with the child's father. Her occupation, rather than that of the child's father, assigned this participant's class. All of these participants were social class V and had basic educational qualifications, in that none was educated beyond GCSE level.

Table 4.7 Analysis of weights in kilogrammes, of infants, born to four participants in the sample who were aged 15-18 years at time of conception. *

Participant	Age at time of Conception	Breastfed infant	Birthweight of infant in kg	Baby's weight at six months in kg
NT32	15	Yes	2.95	7.28
KP19	16	No	3.63	8.25
NB35	18	No	3.02	6.01
CB36	17	No	3.10	6.16

* These data were collated from coded personal details of the participants and responses to questions 4, 5 and 6 of the questionnaire administered during the sixth month post partum.

4.3 Intentions regarding continued paid employment

Of the 39 participants, 51 per cent intended to return to paid work, 22 per cent were undecided and 27 per cent did not intend to return to paid work (Table 4.8). In the event, 62 per cent of women did not return to paid work and were caring for their infant full-time at six months post partum. These figures suggest that intentions are affected by the birth of the infant.

Table 4.8 A table to indicate the number of women in the sample of 39 participants who intended to return to paid employment, and those who actually had returned to paid employment at six months post partum. * Percentages are shown in parentheses.

Intended to return to paid employment post partum	**Number of women**	**Actual Number who returned to paid employment**
Yes	21 (51)	13
No	10 (27)	1
Undecided	8 (22)	1

* These data were collated from responses to question 2 of the questionnaire administered during the first trimester and question 24 of the questionnaire administered during the sixth month post partum.

A total of ten (26per cent) mothers returned to work part-time (Table 4.9). They were from social classes I & II, III and IV with the majority from classes I & II and III. All had gone back to their previous employment on a part-time basis, with the exception of participant JM/7, whose former employment was as an administrative assistant in an office and who was now working as a shop assistant. Five (13 per cent) mothers returned to work full-time and were from social classes I & II and III. Of the two participants in social classes I & II, one had a stillbirth and resumed employment as a bank clerk while the other participant was a Warrant Officer serving in the Army. Two of the three participants in social class III, working full-time, were employed as a quality assurance team leader and a laboratory trainer respectively and both had returned to work for financial reasons. The third participant had not intended to return to work full-time, but was asked to return and did so because she was bored at home and as her partner worked shifts it was possible to share the childcare. Of the fifteen women who returned to work, 67 per cent worked part-time while 33 per cent worked full-time. The figures suggest that social classes IV & V are the least likely to return to work. As there did not appear to be any other link between class and returning to work, further statistical analysis has not been carried out.

Table 4.9 Analysis of number of mothers from the sample of 39 participants who had returned to paid employment by six months post partum. * Percentages are shown in parentheses.

Social Class	Number in Sample	Part-time employment (percentage of class shown in brackets)	Full-time employment (percentage of class shown in brackets)
Class I & II	13	3 (27)	2 (18)
Class III	17	5 (29)	3 (18)
Class IV & V	9	2 (33)	0 (0)

* These data were collated from responses to question 25 of the questionnaire administered during the first trimester and questions 24 and 25 of the questionnaire administered during the sixth month post partum.

4.4 Analysis of intentions towards eating habits

Analysis of intentions towards eating habits suggest that beliefs do not change over time and intentions, attitudes, influential factors and perceptions about significant others do change over time (Table 4.10). The data are the means of the questionnaire scores during the first trimester, third trimester and six months post partum. The numbers in brackets are the standard deviation of those means. Analysis of the standard deviations from the mean indicated that the data were not normally distributed. The Friedman test was used to investigate any change in attitudes (two-tailed) over the first trimester, third trimester and six months post partum. Five questions were significant and these were, in order of significance; normative beliefs about significant others (chi-square 12.426, df 2, $p<0.01$); influence of others (chi-square 10.408, df 2, $p<0.01$); attitudes to eating habits (chi-square 9.579, df 2, $p<0.01$); intentions towards eating habits (chi-square 8.646, df 2, $p<0.05$); influential factors (chi-square 6.597, df 2, $p<0.05$). Of the remaining four questions, three were not significant, namely beliefs about eating habits (chi-square 2.552, df 2); health beliefs (chi-square 1.750, df 2); personal control (chi-square 1.255, df 2); with the question about significant others (subjective norms) being marginally significant (chi-square 5.119, df 2, $p<0.05$). The results would appear to indicate that intentions, attitudes, influential factors and beliefs about significant others can change over time, whereas beliefs about eating habits, health beliefs, significant others and personal control do not change over time. The section on significant others refers to the influence of significant others such as partner, parents, friends, doctor, midwife etc., whereas the section on beliefs about significant others refers to the perceived behaviour desired by those significant others. Beliefs about significant others was the most significant result. A high score indicates that the participant perceives significant others as desiring a change in the individual's eating habits. The results suggest that over the three time periods there has been a significant increase in the perception of significant others as desiring change in the eating habits of the mother. Question 7 – Influence of others on eating habits produced a significant result. A high score indicates that the individual is influenced to change eating habits by the opinions and desires of others. The results suggest there is a significant reduction in the influence of others over time. Question 2 – Attitude to eating habits was the next significant result. High scores would indicate a positive attitude towards dietary change, thus seeing dietary change as desirable and beneficial. Low scores indicate a negative attitude towards dietary change, thus viewing dietary change as undesirable and unbeneficial. The final significant result was Question 1 - Intentions towards eating habits, which indicate that over the time period there is significantly less intention to change. High scores indicate intention to change, while low scores indicate little intention to change. These results suggest that beliefs do not change over time but intentions, attitudes, influential factors and perceptions about significant others do change. It can be deduced from these results that there was less intention to change eating habits at six months post partum than at the first trimester, despite perceiving significant others as desiring change in eating habits. Attitude towards changing eating habits as being desirable and beneficial, reduced at the third trimester, indicating participants were satisfied with their eating habits at that time. There was also a reduction in the influence of others over time. These results indicate that intentions, attitudes and influence of others are not maintained indefinitely and to bring about permanent positive changes in eating habits it is necessary to address beliefs that do not appear to change over time.

Table 4.10 Analysis of means of questionnaire scores *** of intentions towards eating habits, of the 37 participants in the sample during the first trimester, third trimester and six months post partum. Standard deviations are shown in parentheses.

Variable	**First trimester**	**Third Trimester**	**Six months post partum**	**P values**
Intentions towards eating habits	17.7 (2.9)	16.7 (2.1)	16.0 (2.8)	0.013*
Attitudes towards eating habits	27.0 (4.7)	23.7 (4.7)	24.0 (6.0)	0.008**
Beliefs about eating habits	6.3 (3.8)	6.2 (2.9)	7.3 (3.3)	0.279
Health Beliefs	13.3 (.9)	12.7 (1.7)	12.8 (1.8)	0.0417
Significant Others	10.4 (3.5)	12.3 (3.7)	11.0 (3.0)	0.077
Beliefs about Significant Others	15.8 (6.5)	20.7 (7.5)	21.2 (7.3)	0.002**
Influence of Others	32.1 (5.2)	29.6 (4.2)	27.9 (5.1)	0.005**
Personal Control	37.6 (4.1)	37.5 (5.1)	36.8 (5.5)	0.534
Influential Factors	18.4 (4.4)	18.1 (4.2)	17.0 (4.9)	0.037*

* Significant at $p<0.05$

** Significant at $p<0.01$

*** These data were collated from responses to the Likert scale questionnaires administered during the first trimester, third trimester and six months post partum.

4.5 Analysis of perceptions of efficacy of various foods.

Fried foods, fatty foods and sweets were the foods most women considered to be unhealthy (Table 4.11). Specific high fat foods mentioned were crisps, chips, dairy products, sausages, butter, beef-burgers, shop pies. Specific sweet foods were, chocolate, sweets, cake, biscuits, pastries and ice cream. Miscellaneous foods that were considered unhealthy were red meat, alcohol, white bread, ready meals, takeaways, tinned food, tinned vegetables, tinned beans, white meat, pizza, potatoes, foods containing caffeine and sodium chloride. One participant considered caffeine unhealthy giving the reason that it was addictive and mood altering. This participant did not drink tea or coffee. One participant was aware that sodium chloride could be unhealthy but did not know why. The main reason fat was considered unhealthy was because of potential weight gain. Cholesterol was also a consideration with 18 per cent of women believing this was why fat was unhealthy. Other reasons as listed were considered by a small number of women (Table 4.12). Sugar was considered unhealthy, mainly because of possible tooth decay (Table 4.13).

Table 4.11 Analysis of foods, * which were perceived as unhealthy, by a number of the 39 participants in the sample. Percentages are shown in parentheses.

Food	Number
Fried foods	21 (54)
Fatty foods	18 (46)
Confectionery	15 (38)

* These data were collated from responses to question 16 of the questionnaire administered during the first trimester.

Table 4.12 Perceived reasons why fat * was considered unhealthy by a number of the 39 participants. Percentages are shown in parentheses.

Reason	Percentage
Weight gain	11 (28)
Cholesterol	7 (18)
Health problems	3 (8)
Heart problems	3 (8)
No energy from foods	1 (3)
Cancer risk	1 (3)
Goodness cooked out	1 (3)
High blood pressure	1 (3)

* These data were collated from responses to question 17 of the questionnaire administered during the first trimester.

Table 4.13 Perceived reasons why sugar * was considered unhealthy by a number of the 39 participants in the sample. Percentages are shown in parentheses.

Reason	Percentage
Tooth decay	11 (28)
Weight gain	5 (2)
Cancer risk	1 (3)
Bad for skin	1 (3)
No nutritional value	1 (3)

* These data were collated from responses to question 17 of the questionnaire administered during the first trimester.

The following perceptions of various food groups that might be consumed during pregnancy were collected during the first trimester. Foods that might be consumed during breastfeeding are analysed in Tables 4.50 and 4.51. Foods which were considered important to eat daily during pregnancy, were, in order of perceived importance, fresh fruit, fresh vegetables, animal foods, dairy products and carbohydrates (Table 4.14). A general healthy diet was considered important by 10 per cent of participants who made the following comments *:

No excess of anything;

Decent food;

General healthy diet;

Variety;

Balanced.

Foods specifically mentioned within the categories were:

Fresh fruit – none specified

Fresh vegetables – raw vegetables; watercress; green leafy vegetables; nuts; potatoes

Animal foods – meat; fish; poultry

Dairy – milk

Carbohydrates – bread, toast, pasta, rice, cereals

Miscellaneous – Marmite; baked beans

Non-specific – liquids; fibre; fat; low fat; reduced sugar; cooked food; one hot meal per day; does not matter. The one participant who said it does not matter what food is eaten came from Social Class 5.

* These comments were collated from responses to question 5 of the questionnaire used during the first trimester.

Table 4.14 Analysis of foods perceived by the 39 participants as important to eat daily during pregnancy. * Percentages are shown in parentheses.

Food	Number
Fresh fruit	37 (95)
Fresh vegetables	35 (90)
Animal foods	26 (67)
Dairy products	25 (64)
Carbohydrates	23 (59)

* These data were collated from responses to question 5 of the questionnaire administered during the first trimester.

Of the 39 participants, 74 per cent did not know the effects of Listeria, with 33 per cent having some idea that it might affect the health of the baby, while 11 per cent considered Listeria to be harmful to the mother (Table 4.15). Indications are that the women were unsure of the effects of Listeria when pregnant. Those who believed it to be potentially harmful to the baby gave the following reasons (some gave more than one reason) *:

Harmful for baby; may lose baby, not sure at what stage in pregnancy;

Abortion, damaged child;

Harm baby, not deform it but I don't know;

Could affect baby, because you are vulnerable, food poisoning;

Food poisoning; could lose baby;

Brain damage to baby.

The one participant who said it could make the mother severely sick and the one who said it could affect the mother's health, did not know what those effects might be.

* These comments were collated from responses to question 9 of the questionnaire administered during the first trimester.

Table 4.15 Perceptions of the 39 participants in the sample, of the effects of Listeria * on the baby and/or the mother. Percentages are shown in parentheses.

Effect	Number of women
Don't know/not sure	29 (74)
Harmful to baby	7 (18)
Stillbirth	2 (5)
Miscarriage	4 (10)
Diarrhoea	2 (5)
Severely sick	1 (3)
Affect mother's health	1 (3)

* These data were collated from responses to question 9 of the questionnaire administered during the first trimester.

The majority of women were aware that red meat, animal fat (i.e. lard) and dairy products were a major source of cholesterol (Table 4.16). Seafood is a major source of cholesterol, but was suggested by only 5 per cent (n=2) of participants, which may suggest a lack of awareness. A number of women expressed doubt about the cholesterol content of some foods, while others considered cholesterol to be present in the majority of foods. There was evidence of confusion, as 26 per cent of participants believed polyunsaturated fats to be an additional source of cholesterol.

Table 4.16 Analysis of foods perceived by the 39 participants to increase cholesterol *. Percentages are shown in parentheses.

Food	Percentage of participants
Butter	39 (100)
Lard	37 (95)
Cream	37 (95)
Full cream milk	34 (87)
Red meat	32 (82)
Eggs	27 (69)
Semi-skimmed milk	16 (41)
Poly-unsaturated margarine	10 (26)
Poly-unsaturated oil	10 (26)
Fish	7 (18)
Bread	7 (18)
Pasta	5 (13)
White meat	5 (13)
Vegetables	4 (10)
Skimmed milk	3 (8)
Seafood	2 (5)
Fruit	2 (5)
Poultry skin	1 (3)

* These data were collated from responses to question 14 of the questionnaire administered during the first trimester.

Seventy-four per cent of participants did not believe tinned and/or frozen foods to be better than fresh (Table 4.17). A minority (15 per cent) believed frozen food to be better than fresh; eight per cent were unsure and three per cent believed there was no difference. The following comments were made in response to the question * – 'Do you think frozen foods are healthier than fresh?'

'No, but frozen peas are as good as fresh';
'No, but frozen foods are nearly as good.'

Comments made regarding frozen foods were:
'Frozen can be fresher, not sure about tinned goods';
'Frozen is sometimes fresher, e.g. peas.'

Comments made by those who said 'maybe':

'Can be, depends on how fresh when cooked';

'If freshly picked from the garden. If shop bought then frozen/tinned foods are better';

'Maybe, for example, peas frozen when picked'.

* These comments were collated from responses to question 18 of the questionnaire administered during the first trimester.

Table 4.17 Analysis of answers given by the 39 participants in the sample, to the question asking if tinned/frozen foods were better than fresh foods *. Percentages are shown in parentheses.

Food	**Number of women**
Tinned/frozen foods not better than fresh food	29 (74)
Frozen foods better than fresh foods	6 (15)
Tinned/frozen foods maybe better than fresh foods	3 (8)
No difference between frozen/tinned foods and fresh foods	1 (3)

* These data were collated from responses to question 18 of the questionnaire administered during the first trimester.

4.6 Analysis of nutritional knowledge

The majority of women knew which foods contain Listeria, but were unaware of the possible effects of contracting Listeria (Figure 4.6). The majority of women were aware of the foods which contained high levels of cholesterol, but were unclear of the difference between saturated and unsaturated fat. Thirty-nine women completed seven nutritional questions. For the 39 participants the mean number of correct answers overall were 4.51 (SD=1.48). Thirty-four of 39 women knew which foods may contain Listeria and that salt was sodium chloride (Figure 4.6). Thirty-three women knew what the long-term effects of eating too many foods containing cholesterol, while 38 women were aware of the foods that contained high levels of cholesterol (Table 4.16). Twelve knew the possible effects of contracting Listeriosis and six women knew the difference between saturated and unsaturated fat. The correct answer to each question as a percentage was as follows:

Question 1- Which foods may contain Listeria? – 87 per cent

Question 2 - What are the possible effects of contracting Listeria during pregnancy? – 31 per cent

Question 3 – Which of the following contains sodium: salt, water, fibre? - 87 per cent

Question 4 – What can be the long-term effects on health of eating too many foods which contain cholesterol? - 85 per cent

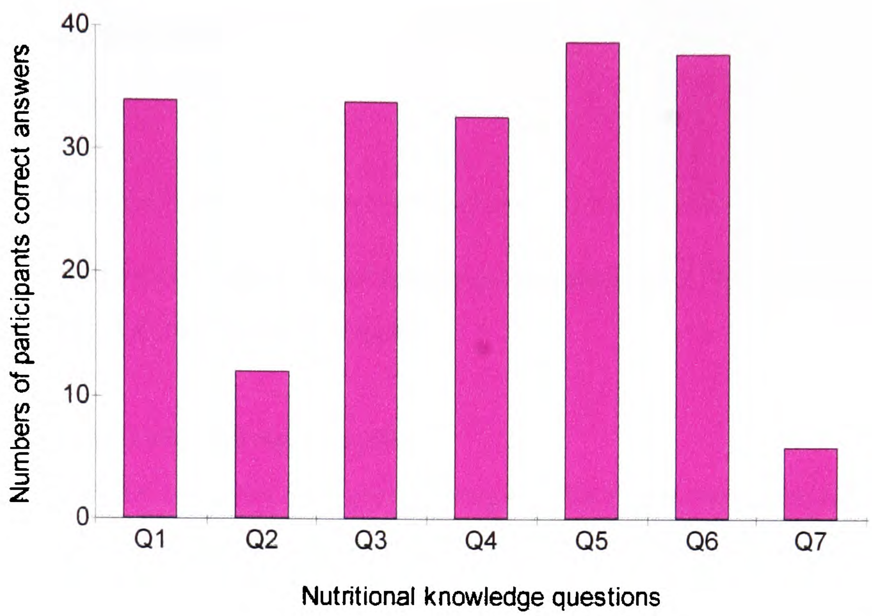
Question 5 – What is cholesterol? - 100 per cent

Question 6 - What foods contain cholesterol? - 97 per cent*

Question 7 - What is the difference between saturated and unsaturated fat? - 15 per cent

*One participant, when answering question 6, stated that she did not know and was guessing. Although she chose some foods that did contain cholesterol she indicated others that were not considered sources of cholesterol, such as skimmed milk, fish, vegetables and pasta. For that reason she was considered not to know which foods contain cholesterol. This accounts for the difference in the percentage who answered question 6 correctly and the number of participants indicating certain foods (Table 4.16). These results would suggest that although the majority of women were aware of what foods may contain cholesterol, they were confused about the differences between saturated and unsaturated fat. The majority of women knew which foods carried the risk of Listeria but there was a lack of knowledge about the effects of contracting Listeria (Table 4.15).

Figure 4.6 Level of nutritional knowledge* of the 39 participants in the sample as a percentage of questions answered correctly.



* These data were collated from responses to questions 8, 9, 11, 12, 13, 14, and 15 respectively, of the questionnaire administered during the first trimester.

The majority of women knew that soft cheese and pâté could contain Listeria (Table 4.18). Unpasteurised milk was considered a risk by 5 per cent of participants, while milk generally was considered a risk by 13 per cent. A further 5 per cent also considered bacon to be a risk. The question on Listeria required the participants to choose those that may contain Listeria from the following list: margarine; fruit; milk; soft cheese; bacon; pâté. Of those that had no idea, one was from social class III and two were from social classes IV & V. The one participant who was not sure, was from social classes IV. The remaining women knew of at least one food, which was a potential source of Listeria. These results do not suggest a relationship between class and knowledge and all classes appear to be well informed of the foods that may contain Listeria.

Table 4.18 Analysis of the knowledge of the 39 participants in the sample of the foods that may contain Listeria *. Percentages are shown in parentheses.

Food	Number of women
Soft cheese	33 (85)
Pâté	33 (85)
Un-pasteurised milk	2 (5)
Milk	5 (13)
Bacon	2 (5)
No idea	3 (8)
Not sure	1 (3)

* These data were collated from responses to question 8 of the questionnaire administered during the first trimester.

4.7 Food and alcohol consumption

During the first trimester all explanations given for change in eating habits were clinical, with nausea and food cravings being the most cited reasons. Fourteen women reported cravings during the first trimester (Table 4.19). These were – cheese and milk; egg and bacon sandwiches; crisps (four participants); grapes; toast and marmite; ice-cream and sugar; mashed potato; salmon; fish and chips; banana milkshake and popcorn; chips; steak pie; tea with milk and sugar; prawns; marshmallows; instant oats; ice cubes; salted vegetables. During trimester three the most cited explanation for change in eating habits was again clinical, with heartburn the most frequent reason. Of the two participants who were worried during the third trimester, one was concerned about a house sale that had fallen through and was eating chocolate because she was stressed, and the other participant was concerned about her husband who suffers from clinical depression. This depression had been exacerbated by the recent death of one of the husband's siblings. Another participant's sister died suddenly, shortly before the baby was born. This participant indicated she was not eating as much as a result of her bereavement. One participant had purchased a new cooker and was baking cakes because she was bored at home during the third trimester. One participant suffered from long-term depression and had a poor appetite. One participant's husband was diagnosed as diabetic and the couple both altered their eating habits as a result. At six months post partum there were more domestic reasons than clinical given for changes in eating habits. The most frequent domestic reason given was the demands of the baby, with constipation being the most cited clinical reason. At six months post partum, one woman was returning home from work late, which meant meals were later and rushed. One participant moved house when her baby was seven weeks old and for a time was unable to cook properly due to the move and settling in to the new house. Another participant (a single mother) moved away from home shortly after the baby was born and had no cooker, so returned home for meals. Two participants had new kitchens fitted, one went to her mother's home for dinner and the other relied on takeaway and microwave meals. Of the participants who suffered from depression at six months post partum, one had long-term depression, which caused loss of appetite. One breastfeeding woman experienced headaches and dizziness if she did not have breakfast. Overall, the most cited reasons for changes in eating habits over the three time periods were clinical, although the demands of the baby was the most cited reason at six months post partum.

Table 4.19 Analysis of factors that affected the eating behaviours* of the 37 participants in the sample over the first trimester, third trimester and six months post partum. Percentages are shown in parentheses.

Time period	Domestic and financial	Clinical
Trimester One		Nausea 30 (81) Constipation 12 (32) Food cravings 14 (38)
Trimester Three	Worry 2 (5) Bereavement 1 (3) New cooker 1 (3) Restricted income 2 (6)	Heartburn 21 (57) Depression 1 (3) Stomach infection 1 (3) Husband diagnosed diabetic 1 (3) Diarrhoea 1 (3) Eczema 1 (3) Nausea 1 (3)
Six months post partum	Baby's demands 5 (14) Home late 1 (3) No cooker 1 (3) Moving house 1 (3) New kitchen 2 (6)	Constipation 4 (11) Depression 2 (6) Tiredness 1 (3) Dizziness 1 (3)

*These data were collated from responses to question 7 of the questionnaire used during the first trimester, questions 1, 3, 7 and 12 of the questionnaire administered at the third trimester and questions 20, 21, 28 and 29 of the questionnaire administered during the sixth month post partum.

Analysis of the comments made by the participants regarding their eating habits at six months post partum revealed an overall negative theme (Table 4.20).

No time to eat properly - Among these comments were 'no time', 'too busy', 'tiring', 'babies demands'. One of these women said husband made her eat.

Depression – One woman suffered from depression – felt she had not received sufficient help and tablets did not help. This mother was very difficult to follow through, as she often forgot about appointments and did not get her baby weighed or take the child to the clinic. Another woman had suffered from postnatal depression and this had affected her eating habits but her mother forced her to eat.

No problems – Ten women reported no problems regarding eating habits. One had a much bigger appetite and at this stage loved vegetables, whereas prior to pregnancy she did not like vegetables of any kind. One ate more at this stage, such as bacon, sausages and burgers. She did not keep complete food diaries and during subsequent retrospective discussions about her food consumption, it transpired she consumed a diet where the main food was chipped potatoes. This participant was in Social Class V and had no educational qualifications. Her husband had never worked due to long-term clinical depression and back problems. There appeared to be a family history of social problems as the husband's mother was an alcoholic and siblings had died young. Both the participant and her husband appeared to be semi-literate and of limited intelligence.

Improved - One participant indicated she had more time to cook properly and did not waste so much food as previously. Another participant ate more carbohydrate and did not eat chocolate, as she did not wish her baby to learn bad habits. One mother perceived her diet to be healthier as she did not have time for snacks and ate regular cooked meals. Another participant went on a weight reducing diet after the birth and did not consume cakes as she had done during pregnancy.

Other – One participant considered herself to be highly organised and prepared and froze meals in advance. Another attended to the needs of the baby and consequently ate later in the evening than was her habit prior to pregnancy. One mother reported eating more food and avoiding foods that might produce colic in her infant (breastfeeding mother).

Table 4.20 Analysis of comments* made by the sample of 37 participants regarding eating habits at six months post partum. Percentages are shown in parentheses.

Comment	Number of women
No time to eat properly	18 (49)
Depression prevented eating properly	2 (5)
No difference	10 (27)
Eating habits have improved	4 (11)
Other	3 (8)

* These data were collated from responses to questions 18, 19, 20, 21, 28 and 29 of the questionnaire administered during the sixth month post partum.

Fifty-one per cent of participants (n=19) indicated they were positively influenced by taking part in the research (Table 4.21). Of those women, 50 per cent (n=9) said they thought more about what they were eating. Writing down what they had eaten made 17 per cent (n=3) think more about what they were eating. One woman (3 per cent) said she felt more aware and guilty about not eating foods which were perceived to be healthy, while another woman said it made her think about "what's good for you and what's not". A further woman said she was more aware of food and tried her best to eat the right food, while another woman said she was definitely more conscious of what she was eating. It was commented on by one woman that she was thinking more and taking part "had brought home to me the benefits of skimmed rather than whole milk". Of the women who said that they had not been influenced by taking part in the research, one woman (5 per cent) commented saying, "Leaflets were more influential".

Table 4.21 Influence of taking part in the research on food choice of the 37 participants in the sample *. Percentages are shown in parentheses.

Yes/No	Number of participants
Yes	19 (51)
No	18 (49)

* These data were collated from responses to questions 39 and 40 of the questionnaire administered during the sixth month post partum.

Analysis of alcohol consumption revealed that only two women drank alcohol during their pregnancy (Table 4.22). These women justified this on the basis of advice from the media, suggesting that some alcohol is not harmful to the fetus. No women drank alcohol while breastfeeding and another mother, although not breastfeeding, was careful about alcohol intake as she felt it was irresponsible to drink alcohol while caring for a child. The results in Table 4.22 indicate that the majority of women curtailed their consumption of alcohol until after the pregnancy and show that 29 (74 per cent) participants drank alcohol at some point during the three time periods. Nineteen (49 per cent) had one unit or less at six months post partum and 4 (10 per cent) had two units or less at this time. Three per cent of women drank three, four, five, seven or eight units per week respectively. One woman reported drinking 10 pints (20 units) of beer per week. This participant was the same woman who was receiving medication for high blood pressure. The one participant who drank three units during the first trimester consumed the same amount at the third trimester rising to five units at six months post partum. The participant who consumed six units during the first trimester did so at the third trimester, increasing to seven units at six months post partum. The sample was considered too small to justify analysis of alcohol consumption by social class.

Table 4.22 Analysis of alcohol consumption of the 37 participants during the first trimester, third trimester and six months post partum * . Percentages are shown in parentheses.

Number of units per week	Number of women First Trimester	Number of women Third Trimester	Number of women Six months post partum
1	0 (0)	0 (0)	19 (51)
2	0 (0)	0 (0)	4 (11)
3	1 (3)	1 (3)	1 (3)
4	0 (0)	0 (0)	1 (3)
5	0 (0)	0 (0)	1 (3)
6	1 (3)	1 (3)	0 (0)
7	0 (0)	0 (0)	1 (3)
8	0 (0)	0 (0)	1 (3)
20	0 (0)	0 (0)	1 (3)

* These data were collated from responses to questions 30, 31 and 32 of the questionnaire administered during the first trimester, questions 34, 35 and 36 of the questionnaire administered during the third trimester and questions 34, 35, and 36 of the questionnaire administered during the sixth month post partum.

Ten women ate specific foods on medical advice, which were in the main related to increasing iron intake (Table 4.23). Their medical practitioner gave 10 women specific nutritional advice, which in seven cases related to iron intake. No more than five per cent of the sample ate any one food(s) on medical advice, compared with 24 per cent of the sample that avoided any food(s) on advice (Table 4.24). Reasons given by the women for eating certain foods are given below:

Dried Apricots – 'for iron and fibre'.

Red meat – 'for iron'.

Extra fruit and vegetables – 'good for my health and baby. Vitamins'.

Fortified cereals – 'better than iron tablets'. 'for iron'.

Vitamin C with food – 'for iron'. It was not clear that this participant was aware that it was to assist iron absorption.

Fibre – 'helps prevent constipation'.

Table 4.23 Analysis of the foods that were eaten by some of the 37 participants on medical advice *. Percentages are shown in parentheses.

Food	Number of participants
Dried apricots	2 (5)
Red meat	2 (5)
Extra fruit and vegetables	2 (5)
Fortified cereals	2 (5)
Vitamin C with food	1 (3)
Fibre	1 (3)

* These data were collated from responses to question 22 of the questionnaire administered during the first trimester, questions 18, 19 and 21 of the questionnaire administered during the third trimester and question 12 of the questionnaire administered during the sixth month post partum.

The foods mostly avoided were soft cheeses, pâté and liver, consumption of which runs the risk of contracting Listeria (64 per cent of women; Table 4.24). A further 16 per cent of participants generally avoided foods that they were advised not to eat. Reasons for avoidance of the various foods as stated by some of the women, are shown below:

Soft cheeses: 'risk of Listeria'; 'risk to baby'; 'avoidance of problems';

Pâté: 'not good for baby'; 'Listeria'; 'avoidance of problems;' 'do what they recommend'; 'do not take chances with health of baby'.

Liver: 'not good for baby'; 'avoidance of problems'; 'high in something which is not good for baby'.

General avoidance of the above foods: 'told not to'; 'felt I should'; 'harmful to baby'; 'led to believe its important but some probably old wives' tales'; 'Listeria'.

Peanuts: 'in case of asthma/hayfever, allergy'.

Eggs: 'not good for baby'; 'avoidance of problems'; 'Listeria'; 'do what they recommend and not take chances with health of baby'.

Shellfish: 'avoidance of problems'; 'Listeria'; 'food poisoning'.

Lucozade: 'too much sugar and risk of diabetes'.

Mayonnaise: 'Listeria and food poisoning'.

Most women were aware that taking these foods could be potentially harmful to the health of their baby (Table 4.24). A few did as they were told without really knowing why. These results suggest that although most women (85 per cent) knew which foods may contain Listeria (Table 4.18) only 24 per cent of women avoided specific food within this food group – soft cheeses and pâté. As only 31 per cent knew the effects of contracting Listeria (Table 4.15), this may indicate a relationship between beliefs/knowledge and action.

Table 4.24 Analysis of foods avoided * by the 37 participants during pregnancy. Percentages are shown in parentheses.

Food	Number of participants
Soft cheeses	9 (24)
Pâté	9 (24)
Liver	6 (16)
Generally avoiding high risk foods	6 (16)
Peanuts	4 (11)
Eggs	4 (11)
Shellfish	2 (5)
Lucozade	1 (3)
Mayonnaise	1 (3)

* These data were collated from responses to question 22 of the questionnaire administered during the first trimester, question 21 of the questionnaire administered during the third trimester and questions 9,10 and 12 of the questionnaire administered during the sixth month post partum.

Dietary supplements

No more than five women (14 per cent) took dietary supplements over the three time periods (Table 4.25 (a)).

Table 4.25 (a) Number of women from the sample of 37 participants who took dietary supplements* during the first trimester, third trimester and six months post partum. Percentages are shown in parentheses.

Dietary Supplements	First trimester	Third trimester	Six months post partum
Calcium supplements	0 (0)	1 (3)	1 (3)
Mineral supplements	1 (3)	0 (0)	0 (0)
Vitamin B	1 (3)	0 (0)	0 (0)
Vitamin C	2 (5)	2 (5)	2 (5)
Vitamin E	1 (3)	0 (0)	0 (0)
Cod liver oil	0 (0)	1 (3)	0 (0)

* These data were collated from reponses to question 19 of the questionnaire administered during the first trimester, questions 11 and 21 of the questionnaire administered during the third trimester and question 32 of the questionnaire administered during the sixth month post partum.

Proprietary drugs

The most consumed proprietary medicine was multivitamins, taken by five participants (14 per cent) during the first trimester. Medicine for the relief of heartburn and indigestion was the most consumed proprietary medicine during the third trimester – 13 participants (36 per cent). At six months post partum only six participants (17 per cent) took proprietary medicines, which were multivitamins and iron preparations (Table 4.25(b)). One participant used Remigel on prescription as Gaviscon™ made her nauseous. The participant who used a Bach™ flower remedy did so to counteract the effects of nausea.

Table 4.25 (b) Number of women from the sample of 37 participants who took proprietary drugs* during the first trimester, third trimester and six months post partum. Percentages are shown in parentheses.

Proprietary drug	First trimester	Third trimester	Six months post partum
Multivitamin preparations	5 (14)	2 (5)	5 (14)
Iron preparations	0 (0)	4 (11)	1 (3)
Gaviscon™	0 (0)	10 (27)	0 (0)
Rennies™	0 (0)	1 (3)	0 (0)
Remigel	0 (0)	1 (3)	0 (0)
Asilone™	0 (0)	1 (3)	0 (0)
Bach™ flower remedy	1 (3)	0 (0)	0 (0)

* These data were collated from responses to question 19 of the questionnaire administered during the first trimester, questions 11 and 21 of the questionnaire administered during the third trimester and questions 31 and 32 of the questionnaire administered during the sixth month post partum.

Prescribed drugs

Two women took prescribed drugs during the first trimester – one for the relief of asthma and two prescribed painkillers for the second woman who suffers from rheumatoid arthritis (Table 4.25(c)). During the third trimester prescribed drugs were taken by three women - the one asthmatic participant, one participant who took penicillin for an undisclosed infection and the participant with rheumatoid arthritis who took six prescribed drugs for pain relief, thrush and hayfever. At six months post partum the most frequently prescribed medicine was the contraceptive pill, taken by 30 per cent of the women (Table 4.25(c)). The other prescribed drugs were for four women – the asthmatic participant, painkillers for the participant with rheumatoid arthritis, antidepressants for one participant and drugs to lower blood pressure for the fourth participant. A participant who has rheumatoid arthritis took Co-proxamol on prescription as a painkiller. This participant also took anti-inflammatories at six months post partum. In addition, she took folic acid on prescription throughout the pregnancy. One participant who has asthma, utilised Salbutamol and Beclometasone. One participant took penicillin during the third trimester, for an undisclosed infection. At six months post partum, one participant, who suffers from clinical depression, was taking Sertraline. She did not take any medication during the course of her pregnancy. One participant who had hypertension following the birth of her infant took Ramipril. Overall, few women took proprietary or prescribed drugs, other than for heartburn and contraception and/or if they had a specific medical condition.

Table 4.25 (c) Number of women from the sample of 37 participants who took prescribed drugs** during the first trimester, third trimester and six months post partum. Percentages are shown in parentheses.

Prescribed Drugs	First Trimester	Third Trimester	Six months post partum
Co-proxamol (for pain)	1 (3)	0	0
Salbutamol & Beclometasone (inhalers for asthma)	1 (3)	1 (3)	1 (3)
Penicillin	0	2 (5)	0
Sertraline (for depression)	0	0	1 (3)
Contraceptive pill	0	0	11 (30)
Ibuprofen (for pain)	1 (3)	1 (3)	1 (3)
Ramipril (for blood pressure)	0	0	1 (3)
Beclometasone (nasal spray for hayfever)	0	1 (3)	0
Dothiepinhydrochloride (for hayfever)	0	1 (3)	0
Sodium-cromoglycate (aqueous eyedrops)	0	1 (3)	0
Clotrimazole cream and pessaries (for thrush)	0	1 (3)	0

* Folic acid consumption during the first trimester is not included here as it has been analysed in detail in Table 4.26.

** These data were collated from responses to question 19 of the questionnaire administered during the first trimester, questions 11 and 21 of the questionnaire administered during the third trimester and questions 31 and 32 of the questionnaire administered during the sixth month post partum.

Folate supplements

Folate supplements were taken by 32 (82 per cent) of the women. Nineteen (59 per cent) of those women did so on the advice of their general practitioner (Table 4.26). Of those remaining, 13 (41 per cent) took folate on the advice of family members and/or the media. Two women did not take folate, on the advice of their general practitioner – the asthmatic participant and the participant with rheumatoid arthritis. Of the seven women who did not take folate, two took Pregnacare, on the advice of their general practitioner and two took Pregnacare of their own volition. This is a proprietary multivitamin compound containing folate. The remaining three women did not take folate supplements as no one advised them to do so. These three women were in the lowest social class. These results suggest that only 23 (59 per cent) of the participants were specifically advised by their general practitioner about folate supplementation during pregnancy. This leaves 16 (41 per cent) of the participants who did not receive specific advice regarding folate dietary supplementation during pregnancy from any medical source.

Table 4.26 Analysis of reasons of the 39 participants in the sample for consumption/non-consumption of folate supplements **** before conception and/or during the first trimester. Percentages are shown in parentheses.

Number who took folate	On what advice	Number did not take folate	On what advice
23 (59)	Doctor	1 (3)	Doctor (asthmatic)
1 (3)	Naturopath	1 (3) Doctor advised Pregnacare**	Doctor (rheumatoid arthritis)
1 (3)	Father*	4 (12)***	No advice (Surgery 1)
4 (10)	Media	1 (3)	No advice (Surgery 4)
1 (3)	Mother		
2 (5)	General knowledge		

*This participant has taken a number of vitamin supplements for years on advice of her father.

** Pregnacare is a proprietary multi-vitamin supplement specifically for use during pregnancy and is available without a medical prescription.

*** Two of these participants took Pregnacare of their own volition.

**** These data were collated from responses to question 19 and 20 of the questionnaire administered during the first trimester.

Planned/unplanned pregnancies and folate consumption–

There were 28 (72 per cent) planned pregnancies and 11 (28 per cent) unplanned pregnancies (Table 4.27). Of the planned pregnancies, 23 (82 per cent) took folate supplements prior to pregnancy and three took folate once pregnant. The remaining two took Pregnacare. Of the 11 (28 per cent) unplanned pregnancies, seven (65 per cent) took folate once pregnant, two did not take folate on the advice of their GP and two did not take folate at all. There does not appear to be a link between social class and folate consumption, apart from social classes IV & V, which had four unplanned pregnancies. None of the women with unplanned pregnancies in social classes IV and V took folate supplements at any time during their pregnancy (Table 4.28).

Table 4.27 Analysis of the 39 participants in the sample planned/unplanned pregnancies and consumption of folic acid supplements *. Percentages are shown in parentheses.

	Before pregnancy	Once pregnant	Not at all	Total
Planned	23 (82)	3 (11)	2 (7)	28
Unplanned	0 (0)	7 (64)	4 (36)	11
Total	23 (59)	10 (26)	6 (15)	39

* These data were collated from responses to questions 1, 19 and 20 of the questionnaire administered during the first trimester.

Table 4.28 Analysis of folic acid consumption of the 39 participants in the sample according to planned/unplanned pregnancy and social class *. Percentages are shown in parentheses.

Social Class	Number in Sample	Planned Pregnancy	Unplanned Pregnancy	Folic Acid Supplements	No Folic Acid Supplements
I & II	13	12 (92)	1 (8)	13 (100)	0 (0)
III	17	11 (65)	6 (35)	15 (88)	2 (12)
IV & V	9	5 (56)	4 (44)	5 (56)	4 (44)

* These data were collated from responses to questions 1, 19, 20 and 25 of the questionnaire administered during the first trimester.

4.8 Analyses of nutrition

The nutrients with the highest incidence of deficiency were fibre followed by iron and iodine (Table 4.29). Trimester one and six months post partum were the periods of greatest deficiency, with six months post partum having the greatest percentage of deficiencies in these nutrients. Nutrient intake was based on optimum nutrient intake between 95-105 per cent of Reference Nutrient Intake (RNI). Any figure below 95 per cent was considered to be a deficiency while any figure above 105 per cent was considered to be excess intake (see chapter 3.8). Analysis of the food diaries highlighted a considerable deficit of dietary folate that has not been included in the nutritional analysis. This is because 33 women took folate tablets either prior to conception, and/or during the first trimester. These intakes would not show up in the nutritional analysis.

Due to the sample size and multiple testing, it was not considered appropriate to carry out further statistical analyses other than frequencies and percentages. There were considerable deficits of monounsaturated and polyunsaturated fats over the three time periods with a slight reduction at the third trimester, (62 and 57 per cent respectively at the first trimester) increasing at six months post partum. Retinol and protein deficits were also considerable (54 and 57 per cent respectively at the first trimester) and dropped at the third trimester, increasing at six months post partum. There was a considerable increase in energy, fat and carbohydrate deficiencies at six months post partum. Conversely, vitamins B6 and B12 dropped considerably over the time periods, with only slight deficiency at six months post partum. These results show that deficiencies reduce during the third trimester and increase at six months post partum. In a number of cases these deficiencies at six months post partum are in excess of those experienced during the first trimester.

Table 4.29 Number of women from the sample of 37 participants with nutritional deficiencies* during the first trimester, third trimester and six months post partum. Percentages are shown in parentheses.

Nutrient	First Trimester	Third Trimester	Six months post partum
Iron	29 (78)	26 (70)	31 (84)
Iodine	28 (75)	23 (62)	31 (84)
Riboflavin	13 (35)	5 (13)	8 (22)
Niacin	10 (27)	3 (8)	9 (24)
Vitamin B6	5 (14)	1 (3)	1 (3)
Vitamin B12	6 (16)	2 (5)	3 (8)
Calcium	13 (35)	5 (13)	18 (49)
Fibre	31 (84)	28 (76)	33 (89)
Energy	14 (38)	12 (32)	24 (65)
Fat	16 (43)	11 (30)	20 (54)
Saturated Fat	14 (38)	8 (22)	17 (46)
Monounsaturated Fat	23 (62)	21 (57)	29 (78)
Polyunsaturated Fat	21 (57)	22 (59)	24 (65)
Carbohydrate	11 (30)	10 (27)	26 (70)
Retinol	20 (54)	12 (33)	17 (46)
Protein	21 (57)	17 (46)	20 (54)
Thiamine	3 (9)	1 (3)	2 (5)
Sodium (Na)	3 (9)	1 (3)	2 (5)

* These data were collated from nutritional analyses of an averaged dietary assessment of each participant using Dietplan5 for Windows (Forestfield Software Ltd).

Social classes IV & V had the greatest percentage of deficiencies over the three periods with 16 out of 18 named nutrients (89 per cent) at the first trimester, 14 out of 18 named nutrients (78 per cent) and 14 out of 18 named nutrients (78 per cent) at six months post partum (Table 4.30). There are indications that there is a link between social class and nutrition, with the lowest classes (IV & V) having the greatest incidences of deficiencies over the three time periods, (Table 4.30) and social classes I & II having the greatest incidences of over consumption over the three time periods (Table 4.32). These indications would suggest that the higher the social class, the more risk of over nutrition and the lower the social class, the more risk of nutrient deficiency.

Table 4.30 Analysis of the highest percentage of deficiencies in each nutrient within the sample of 37 participants during the first trimester, third trimester and six months post partum, by social class*. Percentage of the named deficiency within the class is in parentheses.

Nutrient	Trimester One	Trimester Three	Six months Post Partum
Iron	IV & V (88)	III (82)	III (88)
Iodine	IV & V (88)	IV & V (88)	IV & V (100)
Riboflavin	IV & V (63)	IV & V (25)	IV & V (25)
Niacin	IV & V (50)	IV & V (25)	IV & V (50)
Vitamin B6	IV & V (25)	IV & V (13)	IV & V (13)
Vitamin B12	IV & V (25)	IV & V (25)	IV & V (13)
Calcium	IV & V (63)	IV & V (25)	IV & V (63)
Fibre	IV & V (100)	IV & V (88)	IV & V (100)
Energy	I & II (73)	IV & V (50)	IV & V (75)
Fat	IV & V (63)	IV & V (38)	I & II (67)
Saturated Fat	IV & V (50)	I & II (33)	I & II (50)
Monounsaturated Fat	IV & V (75)	I & II (67)	I & II (92)
Polyunsaturated Fat	IV & V (88)	IV & V (75)	I & II (75); IV & V (75)
Carbohydrate	IV & V (75)	IV & V (38)	IV & V (100)
Retinol	III (71)	III (47)	IV & V (75)
Protein	IV & V (88)	IV & V (63)	IV & V (88)
Thiamine	IV & V (25)	IV & V (13)	IV & V (13)
Sodium (Na)	IV & V (13)	IV & V (13)	IV & V (13)

* These data were collated from nutritional analyses of an averaged dietary assessment of each participant using Dietplan5 for Windows (Forestfield Software Ltd) and from responses to question 25 of the questionnaire used during the first trimester.

Two participants were deficient in all named nutrients. One of these participants did not keep complete diaries, therefore her nutrient deficiencies have not been analysed in detail as she had considerable unrecorded food intake. This participant was in social class 5. The other participant (CD/4) was a vegetarian and an analysis of the nutrient intake of this participant is shown as a percentage of RNI (Reference Nutrient Intake) along with JD/24, who was the only other vegetarian mother in the cohort (Table 4.31). Analysis of the diet diaries of the two breastfeeding, vegetarian mothers suggests that the cause of the nutrient deficiencies experienced by participant CD/4 were due to her not eating processed food, although levels of sodium (Na), thiamine and vitamin B6 were high (Table 4.31). She was deficient in most nutrients, particularly fibre, iron and iodine (Table 4.31) and no nutrients were near optimum consumption. JD/24 had over-consumption of most nutrients over the three time periods. Thiamine at 1742.7 per cent was more than 17 times the optimum daily amount at the first trimester and 15 times the optimum daily amount at six months post partum. During the third trimester, JD/24 had consumed 80.4 per cent more than the RNI for sodium (Na). At six months' post partum, JD/24 was deficient in iron and niacin, with niacin at 96.4 per cent being close to the optimum level. There was over-consumption of the other nutrients, with sodium (Na) at more than twice the recommended amount. Riboflavin, vitamin B6 and vitamin B12 were also more than twice the recommended amount and thiamine was more than 15 times the recommended amount. Further analysis of her food diary suggests the source of this high intake was due to proprietary breakfast cereals, which are vitamin enriched. This participant ate processed foods and consumed a considerable amount of cheese, which is high in fat and sodium chloride and canned baked beans, which are also high in sodium chloride.

Table 4.31 Comparison of percentage Reference Nutrient Intake (RNI) ** of two breastfeeding, vegetarian mothers (participants CD/4 and JD/24) during the first trimester, third trimester and six months post partum.

	F/T*	**F/T***	**T/T***	**T/T***	**SMPP***	**SMPP***
	CD/4	**JD/24**	**CD/4**	**JD/24**	**CD/4**	**JD/24**
Energy	74.4	92.7	62.3	103.2	60.3	119.6
Protein	65.8	93.4	63.9	113.3	44.8	106.8
Fat	78.7	87.6	60.9	98.6	73.1	119.7
Carbohydrate	82.3	103.6	69.1	112.2	62.6	133.8
Fibre	61.3	104.5	86.1	103.0	79.3	103.8
Sodium (Na)	128.6	153.7	112.9	180.4	107.8	226.9
Calcium	157.2	192.2	114.2	321.0	65.5	162.2
Iron	61.8	77.7	72.1	121.3	63.1	87.4
Iodine	96.0	73.6	75.3	161.5	85.9	164.7
Retinol	257.6	95.3	104.2	137.5	61.9	157.4
Thiamine	142.9	1742.7	166.2	655.3	123.6	1568.0
Riboflavin	101.7	158.4	88.2	275.1	63.8	259.4
Niacin	80.8	122.2	86.6	116.7	38.6	96.4
Vitamin B6	153.9	213.7	141.1	250.5	114.1	234.1
Vitamin B12	75.2	228.1	73.3	451.6	27.0	294.9

*F/T = First trimester

T/T = Third trimester

SMPP = Six months post partum

** * These data were collated from nutritional analyses of an averaged dietary assessment of each participant's daily food consumption using Dietplan5 for Windows (Forestfield Software Ltd).

During the first trimester 89 per cent of women had excess sodium (Na), making this the most over-consumed nutrient (Table 4.32). Sodium (Na) consumption rose from 89 per cent to 97 per cent in the first trimester, dropping down to 95 per cent at six months' post partum. Overall, sodium (Na) was the most over-consumed nutrient. There was a high consumption of thiamine and 86 per cent of women had excess during the first trimester. This rose to 97 per cent in the third trimester, dropping down to 92 per cent at six months' post partum. Vitamin B6 consumption rose from 81per cent in the first trimester to 97 per cent in the third trimester, remaining at 97 per cent at six months' post partum. Vitamin B12 consumption rose in the third trimester from 81 per cent to 95 per cent and dropped back to 92 per cent at six months post partum. Calcium consumption rose from 62 per cent in the first trimester to 84 per cent in the third trimester and dropped down to 43 per cent at six months post partum. At the third trimester, the high levels of sodium (Na), thiamine and Vitamins B6 and B12 would cross the placenta to the fetus via the mother's bloodstream. Analyses of the diet diaries indicate that most women with over-consumption of nutrients had eaten fortified breakfast cereals on a daily basis. No more than 19 per cent of women had optimum consumption of any one nutrient at any one period (Table 4.34).

Table 4.32 Number of women from the 37 participants in the sample who had over-consumption of nutrients based on Reference Nutrient Intake (RNI)* during the first trimester, third trimester and six months post partum. Percentages are shown in parentheses

Nutrient	First Trimester	Third Trimester	Six months post partum
Iron	5 (14)	10 (27)	4 (11)
Iodine	5 (14)	10 (27)	4 (11)
Riboflavin	20 (54)	31 (84)	24 (65)
Niacin	26 (70)	33 (89)	24 (65)
Vitamin B6	30 (81)	36 (97)	36 (97)
Vitamin B12	30 (81)	35 (95)	34 (92)
Calcium	23 (62)	31 (84)	16 (43)
Fibre	5 (13)	4 (11)	1 (3)
Energy	18 (49)	23 (62)	7 (19)
Fat	21 (57)	23 (62)	14 (38)
Saturated Fat	21 (57)	25 (67)	13 (35)
Monounsaturated Fat	8 (22)	13 (35)	6 (16)
Polyunsaturated Fat	15 (40)	14 (38)	9 (24)
Carbohydrate	21 (57)	23 (62)	8 (22)
Retinol	14 (38)	20 (54)	17 (46)
Protein	12 (32)	18 (49)	10 (27)
Thiamine	32 (86)	36 (97)	34 (92)
Sodium (Na)	33 (89)	36 (97)	35 (95)

* These data were collated from nutritional analyses of an averaged dietary assessment of each participant's daily food consumption using Dietplan5 for Windows (Forestfield Software Ltd).

Social classes I, II and III had excessive amounts of nine out of 18 nutrients (50 per cent) (Table 4.33). Excesses over the three time periods were confined to these classes with the exception of six months post partum when social classes IV & V had excess intake of saturated fat.

Table 4.33 Analysis of the social classes of the 37 participants in the sample at the first trimester, third trimester and six months post partum, with the highest percentage of excesses in each nutrient. Percentages from each class are shown in parentheses *.

Nutrient	Trimester One	Trimester Three	Six months post partum
Iron	I & II (25)	I & II (58)	I & II (17)
Iodine	I& II (17)	III (35)	III (18)
Riboflavin	III (65)	I & II (92)	III (71)
Niacin	III (82)	III (94)	III (82)
Vitamin B6	III (88)	I & II (100) III (100)	I & 2 (100) III (100)
Vitamin B12	I & II (83)	III (100)	III (94)
Calcium	I & II (75)	I & II (92)	I & II (50)
Fibre	I & II (33)	I & II (17)	III (6)
Energy	III (65)	III (71)	III (29)
Fat	III (71)	III (76)	III (47)
Saturated Fat	III (59)	III (76)	IV & V (38)
Monounsaturated Fat	III (29)	III (41)	III (29)
Polyunsaturated Fat	III (53)	III (47)	III (35)
Carbohydrate	I & II (67)	I & II (67)	III (35)
Retinol	I & II (50)	I & II (67)	I & II (58)
Protein	I & II (42)	III (59)	III (35)
Thiamine	I & II (92)	I & II (100); III (100)	I & II (100)
Sodium (Na)	III (94)	I & II (100);III (100)	I & II (100)

* These data were collated from nutritional analyses of an averaged dietary assessment of each participant's daily food consumption using Dietplan5 for Windows (Forestfield Software Ltd) and from responses to question 25 of the questionnaire used during the first trimester.

A maximum of seven women (19 per cent) had optimum amounts of a named nutrient at any given time (Table 4.34). Mono-unsaturated fat had the most optimum consumption during the first trimester (n=6, 16 per cent). During the third trimester retinol and fibre had the highest optimum consumption (n=5, 13 per cent) and saturated fat and protein had the highest optimum consumption (n=7, 19 per cent) at six months post partum. No participants consumed optimum amounts of fat during the first trimester. No participants consumed optimum amounts of vitamins B6, B12 and sodium chloride during the third trimester and six months post partum. These results show that the majority of women had either a deficiency or over-consumption of nutrients at any given time. Social classes I and II had the highest optimum nutrient intake during the first trimester, with 8 out of 18 nutrients (44 per cent) (Table 4.35). During the third trimester, social classes III, IV and V had the highest optimum nutrient intake in 5 out of 18 nutrients (28 per cent). At six months post partum, social classes 4 and 5 had the highest optimum nutrient intake, with 7 out of 18 nutrients (39 per cent). Data for nutrients with the highest number of undernutrition, over nutrition and optimum nutrition during the first trimester, third trimester and at six months post partum are summarised in Table 4.36.

Table 4.34 Number of participants in the sample of 37 participants with optimum nutrient intake* * at first trimester, third trimester and six months post partum. Percentages are in parentheses.

Nutrient	**First Trimester**	**Third Trimester**	**Six Months Post Partum**
Iron	3 (8)	2 (5)	2 (5)
Iodine	4 (11)	4 (11)	1 (3)
Riboflavin	4 (11)	1 (3)	5 (14)
Niacin	1 (3)	1 (3)	4 (11)
Vitamin B6	2 (5)	0 (0)	0 (0)
Vitamin B12	1 (3)	1 (3)	2 (6)
Calcium	1 (3)	1 (3)	2 (6)
Fibre	1 (3)	5 (13)	3 (8)
Energy	5 (13)	2 (5)	4 (12)
Fat	0 (0)	2 (5)	3 (8)
Saturated Fat	2 (5)	4 (11)	7 (19)
Monounsaturated Fat	6 (16)	3 (8)	2 (6)
Polyunsaturated Fat	1 (3)	1 (2)	4 (11)
Carbohydrate	5 (13)	4 (11)	3 (8)
Retinol	3 (8)	5 (13)	3 (8)
Protein	4 (11)	2 (5)	7 (19)
Thiamine	2 (5)	0 (0)	1 (3)
Sodium (Na)	1 (2)	0 (0)	0 (0)

*Optimum intake is considered to be between 95-105% of RNI (Reference Nutrient Intake)

* * These data were collated from nutritional analyses of an averaged dietary assessment of each participant's daily food consumption using Dietplan5 for Windows (Forestfield Software Ltd).

Table 4.35 Analysis of highest percentage of optimum intake in each nutrient of the 37 participants in the sample during the first trimester, third trimester and six months post partum, by social class *. Percentages are shown in parentheses.

Nutrient	First Trimester	Third Trimester	Six Months Post Partum
Iron	IV & V (13)	III (12)	IV & V (13)
Iodine	III (18)	I & II (17)	III (6)
Riboflavin	IV & V (13)	III (6)	IV & V (25)
Niacin	I & II (8)	III (6)	IV & V5 (25)
Vitamin B6	IV & V (8)	0 (0)	0 (0)
Vitamin B12	III (6)	0 (0)	0 (0)
Calcium	IV & V (13)	III (6)	III (12)
Fibre	I & II (8)	I & II (25)	I & II (17)
Energy	I & II (25)	I & II (25)	I & II (17)
Fat	0 (0)	IV & V (13)	IV & V (13)
Saturated Fat	I & II (8)	IV & V (13)	IV & V (25)
Monounsaturated Fat	III (18)	IV & V (13)	IV & V (13)
Polyunsaturated Fat	I & II (8)	III (6)	I & II (25)
Carbohydrate	III (18)	IV & V (13)	I & II (25)
Retinol	I & II (25)	IV & V (25)	IV & V (13)
Protein	III (18)	I & II (17)	I & II (25)
Thiamine	I & II (8)	0 (0)	III (6)
Sodium (Na)	I & II (8)	0 (0)	0 (0)

* These data were collated from nutritional analyses of an averaged dietary assessment of each participant's daily food consumption using Dietplan5 for Windows (Forestfield Software Ltd) and from responses to question 25 of the questionnaire used during the first trimester.

Table 4.36 Summary of the nutrients with the highest number of the 37 participants with under nutrition, over nutrition and optimum nutrition during the first trimester, third trimester and six months post partum * (percentages are shown in parentheses).

Trimester	Under nutrition	Over nutrition	Optimum nutrition
Trimester One	Fibre 31 (84) Iron 29 (78) Iodine 28 (75)	Sodium (Na) 33 (89) Thiamine 33 (86) Vitamin B6 30 (81) Vitamin B12 30 (81)	Mono-unsaturated fat 6 (16) Energy 5 (13) Carbohydrate 5 (13) Iodine 4 (11) Riboflavin 4 (11) Protein 4 (11)
Trimester Three	Fibre 28 (76) Iron 26 (70) Iodine 23 (62)	Sodium (Na) 36 (97) Thiamine 36 (97) Vitamin B6 36 (97) Vitamin B12 35 (95) Niacin 33 (89)	Fibre 5 (13) Retinol 5 (13) Iodine 4 (11) Saturated Fat 4 (11) Carbohydrate 4 (11) Mono-unsaturated fat 3 (8)
Six months post partum	Fibre 33 (89) Iron 31 (84) Iodine 31 (84)	Sodium (Na) 35 (95) Vitamin B6 36 (97) Vitamin B12 34 (92)	Protein 7 (19) Saturated Fat 7 (19) Riboflavin 5 (14) Energy 4 (12)

* These data were collated from nutritional analyses of an averaged dietary assessment of each participant's daily food consumption using Dietplan5 for Windows (Forestfield Software Ltd).

4.9 Sources of nutritional advice

The majority of nutritional advice was given to 21 (54 per cent) participants by general practitioners (Table 4.37). Eleven (28 per cent) participants received specific nutritional advice during the first trimester. During the second trimester, nutritional advice was received from hospital staff and midwives by 17(46 per cent) participants and 10 (27 per cent) participants at the booking-in appointments. The majority of advice (54 per cent) was obtained from GPs, followed by the patient's own research by reading (33 per cent) (Table 4.37). Midwives provided advice for 23 per cent of the women, and family and friends made up the remainder. Four women (10 per cent) stated that they received no advice at all. Doctors gave nutritional advice during the first trimester to 11 women, representing 28 per cent of the cohort and of those, two received leaflets only. Midwives gave advice to seven women, two of whom were given leaflets only, representing 18 per cent of the cohort. Family and friends (other) gave advice to six (15 per cent) participants. These figures suggest that 21 women received no nutritional advice from medical practitioners during the first trimester and 12 women received no nutritional advice at all. There is no way of knowing how accurate these figures are because they are based on retrospective accounts and individual perceptions of the participants. It is possible some women may have forgotten that advice was offered and from which source.

Table 4.37 Number of women from the sample of 37 participants who received general nutritional advice from various sources during pregnancy and post partum *. Percentages are shown in parentheses.

Source	Number
General practitioner	21 (54)
Reading	13 (33)
Friend	11 (28)
Mother	11 (26)
Midwife	9 (23)
Partner	5 (13)
No-one	4 (10)
Sister-in-law	2 (5)
Sister	1 (3)

* These data were collated from responses to questions 21 and 22 of the questionnaire administered during the first trimester, questions 18 and 19 of the questionnaire administered during the third trimester and questions 12 and 13 of the questionnaire administered during the sixth month post partum.

Advice was received from four sources during the first trimester and third trimesters (Table 4.38 and Table 4.39). The only advice received from the hospital was leaflets in 47 per cent of cases. In the case of midwives, 20 per cent of participants received leaflets only and from doctors 50 per cent of women received leaflets and/or books only. An examination of the comments of the participants suggests that midwives provide the most detailed source of nutritional advice during the third trimester.

1 - Hospital

Of the 17 women who received advice from hospital midwives/nurses, eight were given leaflets covering breastfeeding and foods to avoid. One woman received a book, whilst another received a pregnancy pack. One woman was advised to avoid eggs and another to avoid soft cheeses and liver because of Listeria. Another participant was advised to avoid peanuts and not to drink too much alcohol. This participant had an acute stomach infection at the time of the hospital booking-in appointment and was told to avoid fruit. One woman was told to eat more foods containing iron such as red meat, and more fruit and vegetables. One woman commented that the leaflet she received was the same as that already given to her by her general practitioner and another was supposed to have been given a leaflet by the hospital, but never received it.

2 - Midwife

Of the 10 women who were advised by the midwife, two received leaflets only. One was advised to eat dried apricots for iron deficiency and another was told to eat meat. One woman commented that the midwives 'were brilliant, told me off for too much sugar, they would answer any questions and I could ring them anytime.' Two were advised to avoid liver and mould-ripened cheese, while another was given advice about calcium and vitamin C. Another woman was advised about salmonella and pâté, whilst one participant was told to eat a balanced diet with fruit, vegetables and calcium.

3 – General practitioner

Of the eight women who received advice from their GP two received leaflets, one received a book and another received *Emma's Diary*, which is a guide to pregnancy produced by the the Royal College of General Practitioners (Mackonochie, 1997). One participant commented that the GP was 'surprised we turned up, nobody bothers'. This was for a general advice appointment with both partners in attendance. Two GPs explained about liver and Vitamin A, while one of them mentioned mouldy cheese – comment from one mother 'brilliant'. One participant reported that only the GP gave fairly detailed information – to take more calcium and avoid certain foods. On the other hand, one woman commented that no advice was forthcoming until she was three months pregnant and the GP was not very helpful. Another was told to eat a balanced diet, with fruit, vegetables and calcium. One woman was able to ask her GP about eating sweets as she had a trace of glucose in her urine.

4 - Parent-craft classes

Two women attended parent-craft classes and had no comments to make other than one went at 12 weeks and the other at 30 weeks.

Table 4.38 Number of women from the sample of 37 participants who received nutritional advice from specific sources during the first and third trimesters *. Percentages are shown in parentheses.

Source	**Number of women**
Hospital	17 (46)
Midwife	10 (27)
General practitioner	8 (22)
Parent-craft classes	2 (5)

* These data were collated from responses to question 21 of the questionnaire administered during the first trimester and questions 18 and 19 of the questionnaire administered during the third trimester.

The health visitor was the main source of advice post partum for 57 per cent of the participants, followed by the midwife at 22 per cent (Table 4.39). Although these practitioners were available for advice, some mothers felt this was not given, other than leaflets and books to read. Three women received nutritional advice specifically for themselves as well as for the baby. The other women received nutritional advice for the baby only.

Table 4.39 Number of women in the sample of 37 participants who received nutritional advice from specific sources post partum *. Percentages are shown in parentheses.

Source of advice	Number
Health visitor	21 (57)
Midwife	8 (22)
Mother	4 (11)
Doctor	2 (5)
Other mothers	1 (2)
Dietician	1 (2)
Sister	1 (2)

* These data were collated from responses to question 13 of the questionnaire administered during the sixth month post partum.

Eight per cent of women received advice regarding their own diet (Table 4.40). In all three cases the women were breastfeeding and the advice was directly related to milk production. Advice for infant feeding was given in 46 per cent of cases.

Table 4.40 Number of women in the sample of 37 participants who received nutritional advice post partum * for mother and/or infant. Percentages are shown in parentheses.

Advice	Number
Advice for mother	3 (8)
Advice for infant feeding	17 (46)

* These data were collated from responses to question 12 of the questionnaire administered during the sixth month post partum.

4.10 Perceptions of patient satisfaction with nutritional advice offered by primary care professionals

Thirty-nine patients' satisfaction levels have been analysed using a 7-point Likert scale, with 1 as unsatisfied and 7 satisfied. The satisfaction scores were totalled for each patient – the higher the score the more satisfaction. The scores were then worked out as a percentage of the total possible score for each general practitioner. For example, GP A at surgery one would have a possible score of 42 (6x7) and the actual score of 19 worked out as 45 per cent. Ten per cent of participants declined to give a satisfaction score for the nutritional advice they had received overall, as they considered they had not received any advice (Table 4.41). Twenty-three per cent (n=9) of women were dissatisfied with the level of nutritional advice they received, while 15 per cent (n=6) had a score of four, indicating they were neither satisfied nor dissatisfied. Of the remaining women, 51 per cent (n =20) had scores between 5 and 7, indicating over half the participants were satisfied with the level of nutritional advice they received.

Table 4.41 Analysis of 7-point Likert scale measure of satisfaction* with overall received nutritional advice of the 39 participants in the sample **. Percentages are shown in parentheses.

Satisfaction score	Number of participants
0	4 (10)
1	1 (3)
2	5 (13)
3	3 (8)
4	·6 (15)
5	6 (15)
6	7 (18)
7	7 (18)

*1 being unsatisfied and 7 being satisfied.

** These data were collated from responses to question 23 administered during the first trimester.

Surgery One had six GPs and provided the greatest number of participants (20) (Table 4.42). This surgery had the lowest patient satisfaction score and the second lowest percentage of patients who were offered nutritional advice. Surgery Four had the lowest percentage of patients who were offered nutritional advice, but as this sub-sample consisted of just one participant, this result can be discounted. Surgery Two had one GP and provided six participants. This surgery had the highest patient satisfaction score and the highest percentage of patients who were offered nutritional advice. The participant who had the stillbirth was from Surgery Five and the premature birth was from Surgery Two. The results indicated that Surgery Two had the highest satisfaction score and highest percentage of patients offered nutritional advice. Surgery One, who supplied most participants, had the lowest satisfaction score, and second lowest percentage of patients offered nutritional advice. The lowest percentage - 0 - was from data obtained from the one patient supplied by Surgery Four. Surgeries One, Three and Four are relatively large practices, with a number of GPs. One patient from Surgery Three indicated she was 100 per cent satisfied although she indicated she had not received any nutritional advice. This patient suffered from chronic depression and it may have been that she was not concentrating on the answers she gave during the interview or was not concerned that she had not received any nutritional advice. Surgeries Two and Five are both small practices, with no more than two GPs. It appears that there may be a relationship between satisfaction and level of nutritional advice offered, with patients attending small practices having higher satisfaction scores and a higher percentage being offered nutritional advice. However, more evidence is needed to establish if such a relationship exists.

Table 4.42 Analysis of recruitment details at each surgery * and level of patient satisfaction ** with nutritional advice offered to the 39 participants in the sample.

Surgery	Number Recruited	General Practitioner	Mean Satisfaction Score (shown as a percentage)	Patients Offered Nutritional advice from GP (shown as a percentage)
One	6	A	45	17
One	7	B	69	29
One	3	C	57	33
One	2	D	57	50
One	2	E	50	0
Two	6	F	81	83
Three	3	G	76	33
Three	2	H	86	100
Three	2	I	14	0
Three	1	J	100	0
Four	1	K	57	0
Five	4	L	57	75

*In order to protect doctors' anonymity they have been assigned an alphabetical letter as means of identification and each surgery has been given a number.

** These data were collated from coded personal details and responses to questions 21, 22 and 23 of the questionnaire administered during the first trimester.

Those who expressed an opinion regarding service from general practitioners were from a variety of surgeries (Table 4.43). Comments were made about midwives in one town only. Hospital Four had a 100 per cent dissatisfaction score, but as there was only one participant who commented out of the eight who were delivered at this hospital, this cannot be considered valid data. Hospital One had 67 per cent positive comments, making this the hospital with the highest percentage of positive comments. Hospital Three had 100 per cent satisfaction score, but as only one participant from the sample was delivered there, this cannot be considered valid data. Hospital Two has also been discounted as it had only three deliveries. Hospital Five, with the highest percentage of negative comments, is a large general hospital and Hospital One with the highest percentage of positive comments, is a maternity hospital. These results would suggest that participants have a more positive perception of maternity hospitals.

Table 4.43 Perceptions of 32 participants in the sample who expressed an opinion of primary care professionals and hospitals regarding nutritional advice *. Perceptions are shown as a percentage.

Professional/Hospital	Number expressing an opinion	Negative perception	Positive perception
GP	4	100	-
Midwives in One Town	2	-	100
Health Visitor	2	-	100
Hospital One	12	33	67
Hospital Two	3	33	67
Hospital Three	1	-	100
Hospital Four	1	100	-
Hospital Five	7	71	29

* These data were collated from responses to question 1 and 2 of the questionnaire administered during the sixth month post partum.

The majority of participants were delivered at Hospital Five (14 participants) (Table 4.44). Hospitals Four and Five were two large general hospitals and mothers who are delivered there and stay for any length of time, usually do so because of some form of complication. In some instances this was a matter of choice. Some of the women felt safer having their baby at a large general hospital in case of complications and then transferring to a maternity hospital for their lying-in period. In other cases the women had their baby at the general hospital on medical advice and then transferred to the maternity hospital or returned home and were under the care of their local midwife. Eight women were transferred from their hospital of delivery to another hospital (Table 4.44). Hospital One is a maternity hospital, while Hospitals Two and Three are small general hospitals with maternity units.

Table 4.44 Number of the 38* participants in the sample delivered at each hospital *.

Hospital	Number of Women
Delivered at Hospital Four and transferred to Hospital Two	1
Delivered at Hospital Four and transferred to Hospital One	2
Delivered at Hospital Five and transferred to Hospital One	5
Delivered at Hospital One	9
Delivered at Hospital Two	6
Delivered at Hospital Three	1
Delivered at Hospital Four	5
Delivered at Hospital Five	9

*includes one premature birth and excludes one stillbirth.

** These data were collated from responses to question 1 of the questionnaire administered during the sixth month post partum.

Eight of the 38 women made comments regarding their stay in hospital, - the remaining 30 participants were non-committal (Table 4.45). Positive adjectives used to describe their hospital stay were 'excellent', 'brilliant', 'fantastic' and 'nothing too much trouble'. Negative adjectives were 'not great' and 'disappointing'. However, it should be borne in mind that these perceptions may be based on the participants' experiences with just one or two individual nurses or midwives as the stay in hospital is usually short.

Table 4.45 Analysis of perceptions* of hospital stay post partum of the 38 participants in the sample.

Hospital	Perception 'Excellent'	Perception 'Disappointing'
One	3	0
Two	2	1
Three	1	0
Four	0	0
Five	0	1

* These data were collated from responses to question 2 of the questionnaire administered during the sixth month post partum.

Fifty-three per cent of participants were dissatisfied with the nutritional advice offered during their pregnancy and post partum (Table 4.46). No positive comments were made. Five women felt there was a general lack of nutritional advice. These women had strong feelings about the lack of nutritional advice and this was directed at GPs and midwives alike. Perceptions of doctors' attitudes were negative, for example, one mother was very angry that the GP had told her not to rush out and buy a pram during the early stages of the pregnancy. Some participants felt there was a need to be articulate and literate in order to obtain advice. Advice was sought rather than offered.

Table 4.46 Analysis of comments* made by the sample of 38 participants regarding perceptions of nutritional advice offered during pregnancy and post partum. Percentages are shown in parentheses.

Perception of advice	Number of participants
Insufficient advice	8 (21)
Insufficient discussion	5 (13)
Could have been more specific	2 (5)
Wanted to know what to eat	3 (8)
Wanted advice earlier	2 (5)

* These data were collated from responses to questions 22, 23 and 24 of the questionnaire administered during the first trimester, questions 19 and 20 of the questions administered during the third trimester and questions 12 and 13 of the questionnaire administered during the sixth month post partum.

4.11 Breastfeeding data

Overall 30 (79 per cent) of the sample of 38 participants intended to breastfeed and 20 of those participants (53 per cent) were successful (Table 4.47). Fifteen (39 per cent) of those participants breastfed for four months or more and the remaining five (13 per cent) breastfed for periods of between three and a half weeks and eleven weeks. The remaining 18 participants gave a number of reasons for not starting or continuing to breastfeed. The most frequent reason was that the baby was not satisfied – 9 women (50 per cent). Four women (22 per cent) gave lack of milk as a reason for not breastfeeding. One hundred per cent of social classes I and II intended to breastfeed and 75 per cent actually did. Seventy-six per cent of mothers in social class III intended to breastfeed, with an actual figure of 47 per cent of participants who did. One participant in social class III had twins who she breastfed for about five weeks. Social classes IV & V had 56 per cent of mothers intending to breastfeed and 33 per cent actually did. One mother, in social class IV, had a premature birth and gave this as her reason for not breastfeeding. She declined to express milk. These figures show that there appears to be a higher level of intention towards breastfeeding in social classes 1 and 2 than in social classes III, IV and V and in all social classes the actual number breastfeeding was less than intended. Chi-square analysis of intention to breastfeed and social class produced a figure of 0.75 and a p-value of 0.69. Using a $p \leq 0.05$ level of significance (two-tailed) with 2 degrees of freedom produced a critical value of 5.99, therefore the results were not significant, indicating there is no significant relationship between social class and intention to breastfeed in this study. Further chi-square analysis of social class and actual breastfeeding produced a figure of 1.20 with a p value of 0.55 and using 2 degrees of freedom, indicating there is no relationship between social class and actual breastfeeding in this study.

Table 4.47 Number of breastfeeding mothers * in the sample of 38 participants according to social class. Percentages are shown in parentheses.

Social class	Number in sample	Number of mothers intending to breastfeed	Number of mothers who actually breastfed
I & II	12	12 (100)	9 (75)
III	17	13 (76)	8 (47)
IV & V	9	5 (56)	3 (33)

* These data were collated from responses to question 28 of the questionnaire administered during the third trimester and questions 6 and 7 of the questionnaire administered during the sixth month post partum.

The periods of breastfeeding varied from woman to woman (Table 4.48). The majority of breastfeeding women (70 per cent) carried on past six months, with 30 per cent of women breastfeeding for differing periods. Of the six women who stopped breastfeeding before six months, each had a different reason for giving up. The participant who stopped at three and a half weeks did so because the baby was not satisfied. The one participant who breastfed for five weeks had twins and fed both infants.

Table 4.48 Duration of breastfeeding of the 20 breastfeeding* participants in the sample **.

Duration	No of participants
3 ½ weeks	1
5 weeks	1
6 weeks	1
8 weeks	1
11 weeks	1
4 months	1
4 ½ months	1
6 months +	13

* Participants were considered to have breastfed if they did so for at least 3 ½ weeks after the birth.
** These data were collated from responses to question 6 and 7 and 8 of the questionnaire administered during the sixth month post partum.

Some women gave more than one reason for not breastfeeding (Table 4.49). The commonest reason (45 per cent) for discontinuing breastfeeding was that the baby was not satisfied and the mothers either chose, or were advised by the health professionals, to fully bottle-feed the infant. Twenty per cent of women stated that their reason for not breastfeeding was little or no lactation, while 15 per cent considered a caesarean birth to have prevented them from breastfeeding. Fifteen per cent of mothers found their babies were becoming distressed and using too much energy at the breast – baby using too much energy or too small. The remainder of the reasons were suggestive of the mothers not wishing to breastfeed for psychological reasons, for example, horrible, too tired. Current recommendations are that exclusive breastfeeding should continue until six months (WHO, 2001). See chapters 1.16 and 5.5. Exclusive breastfeeding is defined as no food or liquid, including water should be fed to infants for the first six months of life, other than breastmilk (WHO, 2001). No mother in this sample exclusively breastfed their infant for six months and all babies were being weaned by six months.

Table 4.49 Perceived reasons of the 17 participants in the sample of 39 for not starting or continuing to breastfeed*.

Reason	Number of women
Baby not satisfied	9
No milk	4
Caesarean	3
Long labour	2
Did not like it	2
Did not want to	2
Baby using too much energy	2
Painful	2
Baby too small	1
Did not think I could	1
Too tired (mother)	1
Horrible	1

* These data were collated from responses to question 6, 7 and 8 of the questionnaire administered during the sixth month post partum.

4.12 Perceptions of what a breastfeeding woman should eat

Analyses of perceptions of what a breastfeeding woman should eat show that the participants' perceptions changed over the course of time. At the first trimester 35 per cent acknowledged that they had no idea and this had reduced to 3 per cent by six months post partum. Sixteen participants (43 per cent) believed that their perceptions of what a breastfeeding woman should eat were beneficial for the baby and passing on of nutrients (Table 4.50). Nine women (24 per cent) believed it to be a generally healthy balanced diet, although they were vague in their interpretation of what this constituted. During the first trimester 35 per cent of the sample had no perception, or were not aware of, what constituted an appropriate diet for a breastfeeding woman. This had reduced to 3 per cent at six months post partum. There was some increase in the percentage of women who thought fresh fruit, vegetables and protein were desirable and a slight decrease in those who thought carbohydrate important. One woman said it was important not to eat too many sprouts or onions and one breastfeeding mother said it was important to eat more fruit and vegetables although she actually failed to achieve this. There was a reduction in the percentage of women who thought strong/spicy foods should be avoided, from 16 per cent to 5 per cent. One woman said the diet for a breastfeeding mother should be no different to that of a 'normal' diet. Another woman said any filling food should be consumed. Of the two women who said full-fat milk/fatty foods should be consumed, the one breastfeeding woman said that this was not what she actually consumed. These figures suggest that women became more aware of the nutritional needs of the mother in relation to breastfeeding.

Table 4.50 Perceptions of the 37 participants in the sample of what a breastfeeding woman should eat *. Percentages are shown in parentheses.

Comment	Number of women at first trimester	Number of women at six months post partum
Don't know/Not sure	13 (35)	1 (3)
Does not matter	1 (3)	0 (0)
Fresh fruit	18 (49)	25 (68)
Fresh vegetables	18 (49)	28 (76)
Dairy products	8 (22)	13 (35)
Meat, fish, protein	13 (35)	14 (38)
Carbohydrates	12 (30)	10 (27)
No strong/spicy food	6 (16)	2 (5)
No burgers	0 (0)	1 (3)
No acid foods e.g. tomatoes	1 (3)	0 (0)
No alcohol	2 (5)	2 (5)
Limited alcohol	0 (0)	1 (3)
No peanuts	0 (0)	1 (3)
As pregnancy but more calories	0 (0)	1 (3)
Balanced, healthy diet	2 (5)	8 (22)
Fluids	0 (0)	9 (24)
Limited fat	0 (0)	1 (3)
Full-fat milk/fatty foods	0 (0)	2 (5)
Fibre	0 (0)	2 (5)
Decaffeinated tea/coffee	0 (0)	1 (3)
No coffee	0 (0)	1 (3)

* These data were collated from responses to question 5b of the questionnaire administered during the first trimester and question 11 of the questionnaire administered during the sixth month post partum.

Forty-three per cent of participants believed their perception of healthy food to be beneficial for the child (Table 4.51). One woman commented that her perception of a healthy diet was not what she actually consumed. Nine women (24 per cent) believed a balanced diet to be healthy, but did not indicate whether for them or for their infant, making the total health reasons for mother and/or child 77 per cent. The participant who said that it alters milk did not say whether this was for better or worse.

Table 4.51 Reasons why chosen foods were considered appropriate* for breastfeeding women by the 37 participants in the sample as at six months post partum **. Percentages are shown in parentheses.

Reason	Number of women
Good for baby/passing on nutrients	16 (43)
Balanced diet/healthy	9 (24)
Energy (for mother)	2 (5)
Advised to eat and drink more by midwife	1 (3)
Alters milk	1 (3)
Read that it helps milk production	1 (3)
Declined to give a reason	7 (19)

*Based on perceptions of healthy food and not what the women were actually eating.

** These data were collated from responses to question 11b of the questionnaire administered during the sixth month post partum.

4.13 Perceptions of hospital experience regarding breastfeeding

An examination of the participants' perceptions regarding their hospital experience, in relation to breastfeeding outcome, suggests that support during the early stages of breastfeeding is likely to lead to a positive outcome. Some women had no comments to make of their hospital experience regarding breastfeeding. Three women felt there was no pressure to breastfeed, while five women felt there was (Table 4.52). Seven women felt isolated, in that the midwives left them alone and were unsupportive. Hospital One had the highest number of breastfeeding mothers and the greatest number of positive comments. In contrast, Hospital Five had the greatest number of negative comments and the least number (1) of breastfeeding mothers. Although

Hospital Two had the highest percentage of breastfeeding mothers, there was only one comment (negative) regarding breastfeeding in hospital. These results suggest that support is the most important factor leading to a positive outcome during the early days of breastfeeding, whereas a feeling of isolation is indicative of a poor outcome.

Table 4.52 Analyses of perceptions of some of the 38 women in the sample of hospital experience regarding breastfeeding **. Number of women delivered at each hospital are shown in parentheses. Percentages of participants breastfeeding are shown in parentheses.

Perception	**H1 (16)***	**H2 (7)**	**H3 (1)**	**H4 (5)**	**H5 (9)**	**Total**
No pressure	2	0	0	0	1	3
Supportive	4	0	0	0	0	4
Understanding	1	0	0	0	0	1
Isolated	1	1	0	1	4	7
Pressurised	3	0	0	0	2	5
Felt Guilty	0	0	0	0	1	1
Breastfeeding	9 (56)	5 (71)	0 (0)	1 (20)	1 (11)	16
Bottlefeeding	7 (44)	2 (29)	1 (100)	4 (80)	8 (89)	22

*H = Hospital

H1 is a maternity hospital; H2 and H3 are both small general hospitals with maternity units; H4 and H5 are large general hospitals.

** These data were collated from responses to question 2 of the questionnaire administered during the sixth month post partum.

This chapter has analysed socio-economic factors, intentions, perceptions and knowledge regarding food and nutrition during pregnancy and post partum. Analyses of nutrient consumption have been carried out highlighting nutrient deficiencies and excesses. Sources of nutritional advice and perceptions of primary care professionals have been assessed, followed by analyses of data relating to breastfeeding. Chapter 5 discusses the findings of these analyses.

Chapter 5
Discussion of Results

Introduction

This chapter discusses the implications of the results on the health of the pregnant woman and the developing fetus and child, exploring the possible explanations for the findings. The discussion commences with an interpretation of the socio-economic data of the mother and child considering in particular, the implications of socio-economic variables when drawing inferences from the data. The chapter continues with an examination of the results relating to individual and class differences in weight gain of mother and child. Differences in weight gain of breastfed and bottlefed babies are debated, including reasons for decisions not to breastfeed or continue to breastfeed. Intentions towards eating habits during pregnancy and post partum are contemplated, followed by a discussion of the nutritional knowledge of the participants in relation to nutrition during pregnancy and six months post partum. There follows an examination of the reasons for changes in the eating habits of the participants over the course of the pregnancy and six months post partum. There is a discussion of the participants' perceptions of their stay in hospital for the delivery, with an examination of the effect such perceptions may have on breastfeeding success. The chapter concludes with consideration of the limitations of the study.

5.1 Socio-economic details of participants

Opportunity sampling provided participants from across the social classes, although most were recruited from social class III, as measured using the Registrar General's Classification of Occupations (Reid, 1989) (Figure 4.2). The results suggest that class might affect age at start of first pregnancy, in that the higher the social class of the participants, the older the women at the start of the first pregnancy (Table 4.1). The majority of women were over the age of 26 years at the time of conception, with sixteen in the 31+ years age group at the time of conception. These results are similar to National Birth Statistics, which also uses the Registrar General's Classification of Occupations (National Statistics, 2001) and which show a sharp increase from 33.7

thousand women in 1991, to 47.1 thousand women in 2001, who were aged 31+ years at the start of their first pregnancy and were in the non-manual classes. In the manual classes nationally, there was a slight decrease from 71.7 thousand at age 31+, at start of first pregnancy, to 70.8 thousand in 2001, at start of first pregnancy (National Statistics, 2001). The majority of married mothers nationally, across the social classes, were aged over 30 years at the commencement of their first pregnancy. The National Birth Statistics (National Statistics, 2001) figures do not bear out the findings of this research, that age at start of first pregnancy increases with social class. However, the study undertaken here had a very small sample, from a limited geographical area, therefore results are not necessarily representative of the wider population. Moreover, only one participant volunteered the information that she had undergone a pregnancy termination at aged 16 years. Two women in the sample had suffered spontaneous abortions prior to the current pregnancy. The majority of women in this sample were married at the time of conception, and one married shortly before the birth of her infant. All the women who were aged between 16-20 years at the time of conception were from social classes IV and V (Table 4.1). For example, one mother had recently left school and was living at home, but not working and in receipt of Social Security Benefits. Thus she was assigned social class V. Had she remained at school and not received Social Security Benefits, she would have taken the social class of her parents (social class III in this case). This mother received considerable social and financial support but this is not reflected in her class assignment. Another mother was married to her partner and living in social housing. Her partner was long-term unemployed through poor physical and mental health. This family was dependant entirely on Social Security Benefits and there was evidence of poor social support, in that there was a history of alcoholism and poor physical and mental health in the immediate family. One mother in social class V had been employed as a contract cleaner at a nearby RAF station. The child's father was a serving member of Her Majesty's Forces and maintained contact after the birth, although the couple did not officially cohabit. This mother was also living in social housing and reliant on Benefits. Conversely, another mother in very similar circumstances, in that she had been employed as a contract cleaner at the RAF base and the child's father was also a serving member of Her Majesty's Forces, was in social class III. This was because she had married the child's father and was living in an RAF married quarter. One mother in social class V set up home, in social housing with her partner (they had been living in their respective family homes whilst on the local housing waiting list). This participant's partner was a farm worker on a low wage and the participant returned to work as a production worker on a twilight shift, in a local factory to augment the household income. There were social problems in that the participant suffered from chronic depression, which was not alleviated by the birth of her child. She frequently forgot to get the baby weighed at the local clinic and on two occasions did not keep appointments pertaining to this research. This resulted in reminder telephone calls and further appointments being made. The final mother in this age group also set up home with her partner in social housing. She did not work and her partner was employed as a forklift truck driver. Over the course of the pregnancy and subsequent birth this elevated her social class from V to IV. The only other evidence of class mobility was in the case of the participants who took the class of their partner once they were cohabiting. The majority of the participants in the sample were married and those who were not chose to cohabit with the child's father, with a few exceptions. In one case the baby's father did not wish to become involved and the relationship ended. This participant was initially living alone with considerable social and financial support from her family. Subsequently, she moved back into the family home with the baby. One woman in social class II, although remaining within that social class, had a considerable increase in income over the course of the pregnancy and birth. This was due to the expansion of her beauty therapy business and she intimated her income had risen from £50,000 to £60,000 over the course of the pregnancy. This was unusual as most participants' incomes reduced, as they either gave up work or were working part-time. Examination of these results serves to highlight the difficulties in accurately differentiating between individual socio-economic circumstances, using social class as an indicator of personal circumstances.

5.2 Weight gain and food expenditure

It was very difficult to produce reliable calculations of mean expenditure figures on food, particularly in the lower social classes where there appears to have been more class mobility over the course of the pregnancy and six months post partum. There is evidence to suggest an association between food expenditure, class and increase in BMI (Tables 4.2, 4.3 and 4.4). The data indicate that the mean BMI figures for each class are within the normal range (BMI 19-25), but standard deviations are highest in classes III, IV and V (Table 4.4). Indications are that the lower classes were eating less than those in the higher social classes, as shown by the variations in increase in BMI over the course of the pregnancy. There may be a number of reasons for this. Women may have been eating according to appetite. Those in the higher social classes may have been making more effort to eat quality foods and in so doing were eating more. On the other hand, those in the lower classes may also have been eating more quality food, but in so doing were limiting the quantity of food through financial constraints. This is difficult to assess, but social classes IV and V, for whatever reason, experienced the most nutrient deficiencies. The increase in BMI in social classes I and II may be because they were weight watching prior to the pregnancy, whereas those in the lower social classes may have always eaten a calorie restricted diet. Nevertheless, classes IV and V had below average weight gain during the pregnancy (Institute of Medicine, 1990b), while classes I, II and III had above average weight gain (Tables 4.4 and 4.5). It is difficult to assess those with optimum weight gain during pregnancy due to the conflicting estimates and the lack of firm guidelines for the UK (Hytten & Leitch, 1971; Feig & Naylor, 1998; Institute of Medicine 1990b). There is evidence that teenage mothers give birth to babies who are of small birthweight (Scholl & Hediger, 1993; Lenders McElrath & Scholl, 2000)

5.3 Teenage mothers

Four of the women in the sample were 18 years or under at the time of conception. Three of the babies born to these women were below the sample average birthweight of 3.26 kg, and were still below the sample average at six months. Those participants were all from social class V (Table 4.7). These results suggest that further research should be carried out using a larger sample, to see if below average birthweight can be generalised to social class V. Most pregnant women in the UK are unlikely to be deficient in nutrients (except folate and iron) during pregnancy (DoH, 2002). However, there are nutritionally vulnerable groups that require closer attention, such as teenage girls. Such women may be still growing, dieting in order to change their body shape or have limited funds to purchase nutritious food. In England and Wales the most recent target is a reduction of 50 per cent in the pregnancy rate in teenagers aged less than 18 years by 2010 (DoH, Health of the Nation, 1992; Social Exclusion Unit, 1999). Even though teenage pregnancies may be reduced, such pregnancies will continue, and it is therefore essential that the nutritional status of such women is addressed. Thus, it is important to tackle the poor eating habits of some women, whether because of financial constraints or because of dissatisfaction with their body shape.

5.4 Weights of infants

All babies in the sample were in the 3-3.5 kg class for birthweight. In 2001 35.7 per cent of babies born in the UK were in this bracket (National Statistics, 2001) (Table 4.6). Of the babies born in the UK during 2001 (39.7 per cent) were in the 3.5+ kg bracket. This means that the babies within the sample were below the weight of 39.7 per cent of babies born in the UK during 2001. Babies born in the South West of England during 2001 had 43.4 per cent at 3.5 kg and 34.8 per cent between 3–3.5 kg. It appears from the average weights of babies in this sample, that babies born in this area of South West England are below the average weight when compared with the UK and South West of England as a whole. However, in view of the small sample size, these results may not be representative of the wider population of Wiltshire. It is difficult to identify possible reasons why the babies in the sample were below the average birthweight. The results show that the average birthweight within the sample, decreased down through the social classes, and the difference was most apparent between social classes I and II and IV and V (Table 4.6). These findings reflect those of the Acheson Report (1998), that babies born into the lower social classes are more likely to have lower birthweights than those in the higher social classes (Acheson Report, 1998). It is suggested that 130g is the average difference (National Statistics, 1997). This was not apparent in this sample, as the difference between social classes I and II and IV and V was 29g. The Acheson Report (1998) suggests obesity is more prevalent in the lower social classes (Prescott-Clarke & Primatesta, 1997). This was not evident within this sample. In fact, the women in the lower social classes had lower average BMI than the upper social classes (Table 4.4). However, one confounding factor may have been that most of the women in class V in this sample were teenagers and thus still growing in addition to possibly deliberately maintaining a low weight. Findings from the National Diet and Nutrition Survey (2000) indicate that 16 per cent of 15-18 year old girls indicated they were dieting to lose weight. However, these statistics must be treated with caution as only 70 per cent consented to anthropometric measurements (height, weight, mid arm, waist and hip circumferences) being taken. Thus a greater number of 15-18 year old girls than the statistics indicate may have been underweight (BMI of 20 or less) and/or dieting to lose weight and for personal reasons did not wish this information made known. There is evidence that BMI before conception is associated with birthweight of the infant (Mancuso, et al. 1991; Galtier-Dereure et al. 2000). If this were so, then it would be expected that obese (obesity is defined as BMI > 30) women, who are mainly in the lower social classes, would have heavier babies than in the upper social classes (DoH, 1994). This does not appear to be the case and poses the question why babies in the lower social classes tend to be lighter at birth, and thus more at risk of life-threatening disease in later life. This is an important aspect of nutrition in pregnancy which needs further investigation. It is possible that it is not necessarily the BMI and the resulting birthweight which is important, but the quality of nutrition in utero. Thus it is the quality rather than the quantity of food, which is important (Ravelli et al., 1998; Campbell et al., 1996). Only one woman in this sample was obese, and she lost considerable weight due to increased activity after the child was born. There were differences in the weight gains of breastfed and bottle fed infants.

5.5 Breastfeeding

Babies who were breastfed did not appear to gain as much weight as those who were bottlefed (Table 4.6). Breastfed males overtook the sample average at six months by 19g, but this may have been confounded by the fact that these babies were on average, 10g heavier at birth than the whole sample. Breastfed females were, on average, 27g lighter at six months than the whole sample, but this may be confounded by the fact that they were, on average, 9g lighter at birth. Nevertheless, breastfed infants did not overall gain as much as their bottlefed counterparts. For example, breastfed males gained 4.49 kg, compared with bottlefed males, who gained 4.87 kg. Breastfed females gained 4.22 kg, compared with 4.25 kg gained by bottlefed females (Table 4.6). These results are important in light of the government's initiative, in line with UNICEF's recommendations, that babies should be exclusively breastfed for six months after birth. Exclusive breastfeeding is defined as feeding no other food or liquid, including water, other than human breast milk to the infant until it is six months old (WHO 2001). There are a number of possible reasons for this apparent weight difference. The quality of the breast milk may contain less fat and energy than the formula milk. Weight gained through breastfeeding may be optimal and formula fed infants may be over-nourished. This may have consequences for future health, and bottlefeeding may lay down the foundations for child obesity. It would be worth pursuing an investigation into length of breastfeeding and subsequent BMI in later childhood. The majority of participants in this sample had considerable iron deficiency postnatally which, if exclusively breastfeeding, could indicate the infants were lacking in iron. Healthy babies double their birthweight by six months (Weaver and Prentice, 2003) and all babies in the sample had doubled their birthweight by six months, and no baby was of low birth weight (<2.5kg) (Table 4.6). Even though breastfeeding is increasingly recognised for long term health, breastfeeding in the UK is less likely to be undertaken by mothers in the lower socio-economic classes (Foster, Lader & Cheeseborough, 1997; The Acheson Report, 1998). These findings are upheld by the results of this study, as there was more then twice the number breastfeeding in social classes I and II compared with social classes IV & V (Table 4.47). Many women did not initially know what a breastfeeding woman should eat, but this changed by the time their infant was born, indicating that by the time of the birth, women had received information regarding diet for breastfeeding. A number of women realised the importance of avoiding certain foods because of the possible effects on the baby's digestive system. This suggests that women are on the whole well informed if they are breastfeeding. Of interest, is that although one woman believed that she should consume full-fat milk whilst pregnant and breastfeeding, this was not what she actually consumed, indicating that there was a gap between beliefs and actions in this instance. It would only be necessary to replace low fat milk with whole milk if the mother had a low BMI prior to pregnancy or was not gaining sufficient weight during the course of the pregnancy (Gray & Buttriss, 1994). Although no reason was given for not consuming the full-fat milk, this participant was a vegetarian and stated that she found it complicated catering for different tastes in food. The household comprised the participant, her partner and her infant. This participant believed that her child should eat chicken when weaned and was so concerned about meeting the household's dietary needs and preferences that she was seriously considering becoming a white meat eater once again.

No infant in this sample was exclusively breastfed and all were being weaned. The benefits of exclusive breastfeeding for the first six months are not conclusive and more research needs to be conducted in this area. Exclusive breastfeeding may not be as beneficial as initially suggested by WHO (2001). The expert consultation recommends that breast-milk production and composition from mothers with a BMI <18.5 and the adequacy of breastmilk be analysed and assessed for meeting infant requirements to six months. The average BMI in this sample was 23, with the lowest average in classes 1 and 2 and an average BMI of 21. These classes combined had the greatest BMI increase over the course of the pregnancy and the heaviest babies. There would be problems in assessing composition and adequacy of breastmilk without possibly causing psychological damage to the mother. For example, a mother may be very keen to breastfeed and then become upset to learn that her milk was inadequate. The main benefits of exclusive breastfeeding for six months appear to be reduced incidence of gastro-infection, as might be experienced through poor hygiene when preparing formula feeds (American Academy of Pediatrics, 1997; Heinig & Dewey, 1997). There was a decline in intention to breastfeed down the social scale, together with a decline in actual breastfeeding rates according to social class (Table 4.47). These results were not statistically significant but may have been with a larger sample. Of those participants who did not start or continue to breastfeed, thirteen gave lack of milk or baby unsatisfied as their reason, while the remaining reasons (n=9) were psychologically-based rather than physical reasons (Table 4.49). Reasons such as 'horrible'; 'too tired'; 'did not think I could'; 'did not like it'; may be linked to the initial interaction with the midwife and the level of support offered at this time. In some cases, women were encouraged to bottle feed and this may have been because the midwives had no time to spend with the mother, rather than because of a lack of milk. One teenage mother, who was determined to breastfeed and did so for six months, indicated that midwives at the hospital encouraged her to breastfeed. The results of perceptions of hospital stay regarding breastfeeding indicate that support during the early stages of breastfeeding is likely to lead to a positive outcome (Table 4.52). Maternity hospitals are more likely to produce a positive outcome than a large, general hospital. This may be because midwives have more time to help the new mothers. If midwives are very busy, as appeared to be the case in the large hospitals, then it may be that the midwife herself is stressed, and this may be transmitted to the mother. This is worth exploring further by measuring stress levels and working conditions of midwives in large hospitals and maternity hospitals. Seven women in the sample felt isolated and unsupported. This is an important point, as the hormonal changes after the birth may make the new mother over-sensitive and tearful. This appears to be an area that has received little, if any attention, and most research relates to post natal depression (Parry, et al., 2003). This may be compounded by the fact that these are inexperienced new mothers, where fear of the unknown may be mixed with the initial euphoria. These findings emphasise the importance of the Baby Friendly Initiative. Three of the hospitals in this study have full accreditation as Baby Friendly Hospitals and were highly rated by the participants. All three hospitals belong to the same Primary Care Trust. The two larger general hospitals do not have Baby Friendly Awards. This research has highlighted the importance of the Baby Friendly Initiative in improving rates of breastfeeding. What does need further investigation/research is how best to assess the quality of breastmilk and so advise those women whose milk is of poor quality. It may be that some of the women in the sample had poor quality milk which was a factor in their failure to continue to successfully breastfeed the infant. Nutritional policies should be developed to help women to improve the nutritional quality of breastmilk before the child is born. Positive perceptions of the participants' initial breastfeeding experiences were related to successful breastfeeding. However, the numbers intending to breastfeed outweighed the actual, suggesting that the initial breastfeeding experiences may bring about a change in intention with regard to breastfeeding.

5.6 Intentions towards eating habits

The findings of this research suggest that beliefs do not change over time but intentions, attitudes, influential factors and perceptions do change (Table 4.10). This means that what the participants believed about eating habits at the start of the pregnancy did not change over the course of the pregnancy. Thus, beliefs about nutrition in pregnancy should be addressed before the start of a pregnancy, that is, during fulltime education, as it is unlikely many women will attend pre-pregnancy education classes unless they are actively planning to become pregnant. Moreover, subjective norm beliefs about significant others, personal control and health beliefs do not change whereas the influence of significant others changes over time, as do normative beliefs about significant others. This means that as the pregnancy progressed the participants perceived significant others as desiring a change in eating habits but the individual was not influenced to change by that significant other although, as the pregnancy progressed the participants had less intention to change their eating habits. This may be because they changed their eating habits during the early stages of the pregnancy and felt no reason to alter their eating habits further. Conversely, they may have become more confident in their eating habits and no longer felt the need to change. As nausea subsided they may have felt pleased to have their appetite back and just ate what they wanted. Attitudes towards eating habits also changed in that the participants were more satisfied with their eating habits at the end of the pregnancy. Again, this could be due to nausea, or because the women changed their eating habits, and so felt there was no further need to do so. The influence of significant others lessened over time, so despite the significant other being more desirous of change, this had little impact on the diet of the participant, even though the participant was more aware that the significant other wanted the change. These results indicate that as a pregnancy progresses, women are less inclined to heed the advice or desires of significant others. Nevertheless, intentions, attitudes, influence of others and perceptions can change over time. On the other hand eating habits, health beliefs, influence of significant others and personal control did not change over time. This suggests that such variables are entrenched and may have formed early in the individual's life. For example, there is evidence that eating habits are cultural and learned in childhood and it is very difficult to break these habits. Iphofen (2003) identifies strong cultural influences in food choices. Factors such as social, psychological and economic factors would affect consumption more than nutritional factors. Thus cultural factors need to be addressed in order to change eating behaviours. Health beliefs also have cultural factors and these need to be addressed at an early stage. To bring about changes in eating habits, a behavioural model needs to be developed which addresses barriers to action which are health beliefs, existing eating habits, beliefs about significant others and personal control. The variables, which changed over time, did so in a negative way, in that they became less influential as time progressed. Therefore, as the pregnancy progresses and post partum, women are less likely to change. Thus a new theoretical model should work backwards. Most models work forwards, for example, attitudes are the result of beliefs. Working in reverse, we can address beliefs by changing attitudes. To break down the barriers and impediments to dietary change, the model needs to be looked at in reverse. At the heart of the Theory of Planned Behaviour is the belief that elective behaviour is determined by intentions. These intentions are based on motivations that are in turn based on attitudes (Conner & Sparks, 2001). Attitudes are based on beliefs. The research currently under discussion is concerned with the health beliefs of the participants specifically related to nutrition during pregnancy. Health beliefs are based on perceived susceptibility and perceived severity of an illness (Conner, 1993). It is not illness, but the perceived effect on the healthy development of the infant, depending on the standard of nutrition in utero and six months post partum, which is of concern here. If the participant does not believe that what she eats affects the well-being of her child, then she is unlikely to change her eating habits. One problem with food choice is that some people have more difficulty in refraining from eating certain foods, whilst other people have constraints, for example, financial, preventing them from eating what they want (Conner & Sparks, 2001). Conner et al., (1994) assessed the attitudes towards healthy eating of respondents from a number of general practices. Findings herein have suggested that intentions may have changed over the six month time period between each time points when attitudes were measured. There is clear evidence that intentions have changed over the three time points. If the model is applied early enough, that is during full-time education, then the unchanging variables can be affected by the changing variables.

5.7 Nutritional knowledge

Most of the women in the sample were aware of what foods were considered to be less beneficial to their health, in particular those containing high levels of fat and sugar (Tables 4.11, 4.12 and 4.13). They knew that fast foods such as beef burgers, shop pies and chips, for example, contained high amounts of fat. Most women considered the reason these foods might result in health problems was because of potential obesity. The effects of cholesterol content in these foods were a consideration for just 18 per cent of participants (Table 4.12). This suggests a lack of awareness of the sources of cholesterol. Most of the women in the sample were aware that too much fat, in particular saturated fats, and sugars are unhealthy, but were unclear as to why (Figure 4.6 and Tables 4.11, 4.12 and 4.13). Shellfish, such as prawns, are a major source of cholesterol but only two women were aware of this. Most knew that dairy products were the major source of cholesterol. This suggests that women have no clear understanding of why some foods are considered unhealthy. Most comments about what constitutes a healthy diet were fairly general. Most of the sample realised the importance of eating fresh fruit and vegetables, but analysis of food diaries suggested most women did not eat enough, although this did not show up in the nutritional analysis as a cause for concern. Many women in the sample were deficient in iron, which they could have obtained from red meat as haem iron and iodine, which they could have obtained from fish (Table 4.29). This suggests that public health information may be biased towards fresh fruit and vegetables because of the protection the antioxidants contained therein can give from cancers and heart disease. There may be insufficient advice regarding the benefits of dark green vegetables as an alternative source of iron and iodine as many women do not eat red meat and fish. Moreover, dark green vegetables are a valuable source of folic acid. There was further confusion about the effects of Listeria. Most women in the sample knew about foods to avoid that may contain Listeria (Table 4.18). Not many women indicated that they avoided these foods and few women understood the consequences of contracting Listeria (Tables 4.24 and 4.15). Early health education should provide clear reasons why certain foods are unhealthy, so that women understand the reasons behind their actions. The majority of the women in the sample seem to have followed the advice because of what they were told or because of what they read in the leaflets they received during the early part of the pregnancy (Tables 4.23 and 4.24). Many of the women in the sample believed that tinned/frozen foods were not as healthy as fresh (Table 4.17). This would suggest that most of the women considered fresh foods to be better. In practice, most women in the sample consumed a mixture of fresh, frozen and tinned foods. When the nutritional knowledge of the women was assessed, two questions proved to be problematic (Figure 4.6). Participants were unclear about the effects of Listeria (Question 2) and the difference between saturated and unsaturated fat. These need to be explained to women in clear and simple terms so that they understand the reasons behind avoidance and consumption of the relative foods. If the women understand the reasons for action then it is possible they will be more motivated to action regarding nutrition during pregnancy. There was no apparent class difference in the level of knowledge with the exception of one woman in social class V. This result suggests further investigation is necessary to clarify reasons behind nutritional deficiencies found in the lower social classes. Such investigation should include examination of cultural factors (Iphofen, 2003).

5.8 Reasons for changes in eating habits

Eleven savoury foods containing high amounts of sodium chloride, for example, cheese, bacon, marmite and steak pie, were cited as cravings (Table 4.19). Four women cited sugar and sweet foods as cravings. It is possible that the foods high in sodium chloride appealed to the women because of the nausea they experienced, and were less likely to exacerbate nausea than sweet foods. Cravings may be because the women are hungry after the nausea. Those that did experience cravings may have been nutrient deficient or the cravings were psychological. Nausea affected most women's appetite during the early stages of the pregnancy. There are a number of suggestions put forward as to why women experience nausea in early pregnancy, the most current being the result of the change in hormone balance (Sherman & Flaxman, 2002; Lagiou et al., 2003). Once the hormones settle down the nausea subsides. During the third trimester, the most frequently cited reason for a change in eating habits was heartburn during the latter stages of pregnancy. Most women were able to relieve the heartburn through the use of proprietary medication, although a small number drank milk before retiring, to reduce the effects of the heartburn when lying down. Although the medicines consumed were considered suitable for pregnant women, it would be more appropriate if women were to address the problem through diet. Consideration should be given to educating women in how to control heartburn in the latter stages of pregnancy, rather than developing the habit of resorting to proprietary medicines. For example, not eating too late in the evening before retiring as lying down after a heavy meal may induce heartburn. Some women were advised by their medical practitioners to drink milk to help alleviate heartburn but not every woman in the sample employed this remedy.

Demands of the infant

Although only five women specifically mentioned their baby's demands as affecting their eating habits, subsequent analysis of individual comments revealed that almost half the women indicated they had no time to eat properly (Tables 4.19 and 4.20). A small number of participants were working and found that attending to the baby took up considerable time and so there was little time for cooking. This was the same for breastfeeding and bottlefeeding mothers alike. A number of women had increased activity, in that they attended mother and baby clubs/activities and socialised with other mothers which seemed to take up a lot of time. Those women who did not experience problems were older and intimated they were well organised and did not appear to be involved in so many mother/baby activities. Observation of the domestic conditions suggested that these mothers were more settled and domesticated although this is extremely subjective and open to bias. One of these women believed her diet had improved as she had more time to cook properly and so did not waste so much food. Of the women who reported no problems, one said she ate more in the form of bacon, sausages and burgers. This participant was from social class V and there were a number of social problems. This participant, who did not believe that it mattered what food was eaten during the course of the pregnancy, lived in poor socio-economic circumstances and was a classic example of such women referred to in The Acheson Report (1998). It is important that all women receive the necessary education before and during the pregnancy. It is difficult for doctors and midwives to target possible candidates for extra nutritional education as this involves making a value judgement. Thus, some criteria need to be laid down, including social class, whether employed/unemployed and in receipt of Social Security Benefits.

Depression

The two women in the sample with depression believed that their depression affected their eating habits post partum (Table 4.19). One woman, whose depression was postnatal, and therefore acute, had social support from her mother who ensured the participant ate properly. The other participant suffered from chronic depression prior to the pregnancy and lived in poor socio-economic circumstances. This participant reported a feeling of isolation and that she was not receiving the help she should with regard to the depression. Her depression appeared to be affecting the well-being of the child as she did not attend the clinic on a regular basis and the child's progress was not being monitored sufficiently as she forgot to keep appointments to get the baby weighed. This raised an ethical issue as to whether this participant's partner or general practitioner should be alerted to her negative feelings. After due consideration it was considered to be a breach of confidentiality to do so, as subsequent discussion with the participant, revealed that she was under the care of her doctor and her family was aware of her depression. Moreover, the health visitor called regularly, thus the infant's progress was being monitored. This participant lived in relatively remote, rural, social housing without access to private transport. For the well-being of this mother and her child, and those in similar circumstances, attention should be given to the disadvantages of placing such people in rural housing and thus limiting their access to medical and social amenities and economical food choices. Help needs to be given to new mothers so they can produce quick and efficient meals while caring for their infant, so that good habits learned in the early stages of pregnancy are maintained. This help could take the form of cookery demonstrations at clinics or mother and baby groups. A cookery book with quick, healthy and economical recipes, to include microwave cooking, could be produced under government subsidy and given out with the bounty pack the mother receives after the birth. Bounty packs contain free samples and advertisement leaflets and are given to each new mother while in hospital. Breakfasts and lunches should not be problematic as these could consist of cereal and milk with fruit, while lunch might be a sandwich with fruit. These are nutritious, while being quick and easy to prepare. A difficulty could arise if the food is not to hand and there is no time for shopping. Thus women and men might be taught how to plan ahead and what foods to keep in reserve. There are benefits to be had in planning a week's menu in advance. Evening meals are more problematic, as this tends to be the main meal of the day and is cooked around the time when the baby can be tired and fractious. The mother and father are also tired at the end of the day and this can result in little attention being given to the nutritional quality of the food being prepared. Moreover, as a result, there may be a greater consumption of processed foods that are higher in saturated fats and sugars (Food Standards Agency, 2003). These poor habits leave the woman open to the potential risk of reduced nutritional stores, which may adversely affect the healthy development of subsequent pregnancies. Moreover poor eating habits may adversely affect the woman's immune system, jeopardising the health of the fetus in utero or the infant via breastfeeding. Just over half of the participants believed their eating habits to have been influenced by taking part in the research (Table 4.21). This could have been due to positive reinforcement, in that they were receiving attention regarding their diet over the course of the pregnancy. This is similar to the Hawthorne Effect (Mayo, 1933), where performance improved because of the attention the participants were receiving. Some women indicated that they were more aware of what they were eating. This may suggest that if eating habits were monitored over the course of a pregnancy, a positive change in eating habits might be brought about.

Alcohol

Most women in the sample said they gave up alcohol for the duration of the pregnancy, although there was evidence of confusion in the participants of how much, if any, alcohol was safe to drink (Table 4.22). Leaflets and pamphlets regarding safe alcohol consumption during pregnancy were said to be unclear as to what constitutes a unit. There is a need for clear guidelines as to what constitutes a unit. If alcohol is being consumed outside the house, such as in a bar/public house, where standard measures are used by law, then this is easier to calculate than when measures are poured privately. Those in the sample who did not give up alcohol entirely, based their actions on current recommendations that limited amounts of alcohol were not considered harmful to the development of the fetus. This information was obtained through the media. No woman drank sufficient amounts of alcohol during the pregnancy, or while breastfeeding, to give cause for concern. Only one of the participants gave cause for concern regarding her alcohol consumption post partum, which was estimated to be about 10 pints of lager per week, the equivalent of 20 units. This participant suffered from hypertension after the birth, which could have been exacerbated by her alcohol consumption, as high alcohol intake is known to raise blood pressure (Suter, Sierro & Verro, 2002). The fact that this participant indicated she consumed more than the recommended weekly number of alcohol units presented an ethical dilemma as to whether her GP be informed or confidentiality be respected. In this instance confidentiality was respected, as this was what the participant had been assured of at the beginning of the study. Moreover the participant was under the direct care of her GP and receiving prescribed medication to control the hypertension. The health of the infant did not appear to be in jeopardy as the participant indicated she had the child weighed and saw the Health Visitor on a regular basis.

Foods eaten on medical advice

The majority of foods eaten on medical advice were to boost iron stores, although this only related to eleven of 37 women (Table 4.23). This suggests that some doctors feel there is a need to consume extra iron during pregnancy through diet rather than by means of supplements. This contradicts some of the current feeling that the anaemia, during pregnancy, is not true anaemia but due to dilution because of increase in blood volume (Letsky, 1991; Thomas, 2001). No general practitioners prescribed iron preparations during pregnancy, although some women chose to buy proprietary multivitamins, including iron, over the course of the pregnancy (Table 4.25(b)). This has implications for the health of the mother and child in the light of recent research, which suggests that vitamin preparations may be harmful as there is the risk of over consumption (Food Standards Agency, 2003). Not many women took supplements over the whole of the three time periods (Table 4.25(a)). Most were consumed during the first trimester and very few were consumed at six months post partum. Five women took supplements during the first trimester and three at six months post partum. These figures suggest that women are more concerned with their nutritional status when first pregnant than at six months post partum. This may be because they are no longer pregnant and only took the supplements in the first place for the sake of the growing child, rather than their own health status. On the other hand this may imply that women are more aware of nutritional needs at the beginning of a pregnancy and this could be tied into the Theory of Planned Behaviour (Ajzen, 1991). Most women seemed to be aware of what foods to avoid because of the risk of Listeria or over consumption of Vitamin A. What was apparent was vagueness of what they should eat and responses tended to be fairly general, such as 'for health'. The idea of a healthy diet is subjective and one person's perception of a healthy diet might be entirely different to another person. The concept of health is in itself subjective and perceptions of what constitutes health would vary from person to person (Brannon & Feist, 1992). For example, people may consider themselves to be unhealthy if they have high blood pressure, even though they experience no symptoms, while other people in the same situation may consider themselves healthy because they do not experience any symptoms.

On analysing the diet diaries there was evidence across the sample of over-consumption of various nutrients (Table 4.32). Analysis of the food diaries showed this appeared to be related to consumption of fortified breakfast cereals. In some cases the over-consumption was excessive, suggesting that it is more likely to be fortified foods which can lead to over-consumption rather than vitamin supplements. If women were to consume supplements and fortified breakfast cereals together, then there is a serious risk of over-consumption, which could jeopardise the health of the mother and child.

Consumption of medicines

The most consumed preparation was Gaviscon™, which is a proprietary compound for the relief of heartburn (Table 4.25(b)). Ten women took this during the third trimester. Few women took prescribed drugs, suggesting they considered themselves to be in good health, or chose not to consult their GP about ailments (Table 4.25(c)). Most of the drugs were prescribed for chronic complaints such as rheumatoid arthritis, asthma and hayfever, which were not in any way related to the pregnancy. During the course of this research, participants' medical records were not accessed and a possible follow-up might be to find out what medical complaints, if any, the participants presented at the surgeries during the course of their pregnancy. They may have had various conditions for which they were not prescribed medication. It is also possible they felt in good health with no reason to visit the GP. Conversely, they may have had various ailments for which they chose not to seek medical help, in order not to have medication prescribed. It would be interesting to find out if there was a reduction in the number of visits to their GP (other than antenatal checks) during the pregnancy and the reasons for any such difference.

Folate Supplements

Most women took folate supplements (Table 4.26). Overall these results would suggest that as the majority of women were aware of the need to take folate supplements, before and during the early stages of pregnancy, there may be a link between beliefs and actions. However, these results suggest that women are more likely to take folate supplements if the pregnancy is planned. The majority of women were aware of the need for folate supplements during pregnancy, evidenced by the fact that the majority actually took folate supplements. Just over half the women were specifically advised to take folic supplements by their general practitioners (Table 4.26). This suggests a gap in the information being given to women during the early stages of pregnancy. It is possible that the women were told to take folate supplements but may have forgotten. There is therefore a need to ensure information is fully understood, together with the possible consequences of not following medical advice. The results indicated that three women did not take folate supplements because no one specifically told them to do so (Table 4.26). All were from social class V and in the youngest age band (16-20). Although the number is small, these women were from socio-economically deprived backgrounds and the results suggest this group needs to be specifically targeted with pregnancy nutritional information. These results suggest that these women would be susceptible to specific advice and would be amenable to following what their GP/midwife told them to do rather than advised them to do. These three women specifically said "no one told me to" and would therefore benefit from specific instructions. One problem with folate consumption in this study was the difficulty of accurate measurement of daily consumption. This was because most women were taking supplements and so any dietary intake measures would be inaccurate. Some women took fortified bread and cereals in addition to folate rich foods, such as Brussels sprouts, spinach and fortified bread and cereals (Gray & Buttriss, 1994). If they were consuming these foods in addition to folate supplements it is possible they may have ingested too much folate. This could conceal any vitamin B12 deficiency (Food Standards Agency, 2003). There were four unplanned pregnancies in social classes IV and V and none of these women took folate supplements at any time during their pregnancy, although one did not do so on the advice of her GP as she is asthmatic (Table 4.28). This is further evidence suggesting a gap in the information/knowledge being passed from the GP to the patient.

5.9 Analysis of nutrition

Fibre, iron and iodine were the nutrients with the highest deficiencies over the first trimester, third trimester and six months post partum (Table 4.29). Although fibre deficiency would not directly affect the fetus, it has implications for the mother, who may develop haemorrhoids as a result of excessive straining due to constipation, coupled with the pressure of the fetus on the rectum. Although there was considerable fibre deficiency, few women admitted to suffering from constipation, and it is not known whether this was due to embarrassment or was not considered to be a problem. A considerable number of women appear to have limited their iron intake over the three time periods, with the highest incidence at six months post partum. However evidence of iron deficiency is limited as it is based on a nutritional analysis of only one week's self-reported food diary at each time point, which may have inaccuracies in reporting. To ascertain whether the food intake was resulting in an actual iron deficiency then blood tests would be necessary to obtain accurate evidence. Iron deficiencies may be a result of erratic eating habits, coupled with the fact that many women were bottle feeding and thus had recommenced menstruation. The fact that the participants' reported food intake indicated that they may be at risk of being deficient in iron at six months post partum would have consequences for the health of the mother and future children, in that she will not have the requisite iron stores to adequately serve a new pregnancy.

The symptoms of iron deficiency are lethargy and tiredness which could have repercussions for the whole family. Because the mother is tired and lacking in energy she may resort to processed and nutritionally poor food, which is quick to prepare but will adversely affect the subsequent health of all members of the family. The problem then becomes circular, in that iron deficiency = tiredness = consumption of processed food = poor nutrition of family members, which may then be passed on to any subsequent pregnancies and then on to the next generation in utero. Iodine also had high numbers of deficiency over the three time periods, with the highest number at six months post partum. Iodine is not automatically added to sodium chloride in the UK and most sodium chloride for sale in the UK does not have iodine added. It is important that iodine is added to sodium chloride in order to increase iodine consumption. This should include sodium chloride which is added to processed foods such as meat products, cheese, potato crisps and not just sodium chloride sold as table salt. Many people do not add sodium chloride to their food in an effort to cut sodium chloride consumption or because there is sufficient sodium chloride in the processed foods they consume.

Other nutrients, where the amounts were problematic, were monounsaturated and polyunsaturated fats, which were deficient in a considerable number of women over the three time periods. As fewer were deficient in saturated fat, this suggests women are consuming the wrong type of fats or foods. There were class differences in nutrient deficiencies, and women in the lower social classes had the greatest number of deficiencies over the three time periods. This may be due to the quantity and quality of the food they consumed (Table 4.30). The results of this study indicated that two women were deficient in all named nutrients. One participant from social class V failed to complete diet diaries and these had to be completed retrospectively during the course of each interview. It is highly possible that much of this data is inaccurate as there may have been under-reporting or over-reporting of what she actually ate. This participant intimated that her staple diet was chips, bread and tea. Protein tended to be in the form of bacon, sausages, beef burgers, fish fingers, chicken nuggets and the occasional roast chicken with stuffing. Vegetables tended to be peas, carrots and potatoes. There did not appear to be any fruit or fruit juice consumed. In the main, this diet is very high in saturated fat, but this has not shown up in the analysis because of under-reporting. This family used to walk to the shops every day and purchase their food on a daily basis, suggesting they had the benefit of daily exercise. This daily purchasing of food may indicate lack of menu planning and exercising of household economy. This family had very little money to spend and would benefit from education in management of a household food budget. The other participant was a vegetarian from social class II and had been educated to graduate degree level. These results suggest that class is not necessarily an indicator of appropriate eating during pregnancy. This participant chose not to eat processed foods and indicated she found little time to prepare meals after the baby was born. She would snack on nuts and dried fruits when time was short. Despite eating average quantities of food, she was deficient in all nutrients, but particularly in fibre, iron and iodine (Table 4.31). These deficiencies are similar to the other participants. This was a breastfeeding participant who was deficient in calcium. The deficiency of calcium is cause for concern as this may affect the optimum development of the skeleton and may lay down the foundations for osteoporosis in females in later life (Janakiraman, et al. 2003). The fact that she had over-consumed sodium (Na), thiamine and vitamin B6, suggests that her diet was not varied enough and she was eating too many foods of similar nutritional value. One product she consumed on a regular basis was Tahini which is a sesame seed paste with added sodium chloride. The thiamine and B6 may have come from over-consumption of homemade muesli. On the other hand, another vegetarian had high consumption of all nutrients, in particular, sodium (Na), which was eighteen times over the Recommended Daily Allowance (RDA) for sodium (Na) consumption (Table 4.31). This appears to be because she consumed considerable quantities of cheese and canned baked beans, which contain high amounts of sodium chloride. As these two vegetarian mothers were breastfeeding, the infants would be receiving too much of some vitamins and insufficient of others. This is cause for concern, particularly the high quantities of sodium (Na), which can lead to high blood pressure and heart disease in later life (Suter, Sierro & Vetter, 2002). The RDA for sodium (Na) is 1600mg

On average, people in the UK consume 9g of sodium chloride containing 3500mg of sodium (Na) (Food Standards Agency, 2003). Participant JD/24, who was not a vegetarian, consumed 2459mg during the first trimester, 2887mg at the third trimester and 3630mg at six months post partum. This mother was breastfeeding and sodium (Na) consumption was higher than at any other time period. This may have implications for the calcium being passed to the infant, as high sodium (Na) consumption can increase calcium excretion (Food Standards Agency, 2003). Excess intake of sodium (Na) was apparent in a number of women in the sample and was the nutrient with the greatest excess consumption (Table 4.32). This suggests that policies to reduce sodium chloride in food do not appear to have been effective. There were no class differences in excess sodium (Na), suggesting that it is not just cheaper food that is problematic (Acheson Report 1998). The problem may be that sodium chloride is required for flavour and many foods would not be palatable without the addition of sodium chloride. Other means of flavouring food need to be considered and there is a need for firm guidelines on the addition of sodium chloride in processed foods. If there were widespread reduction in sodium chloride addition, then palates would become more accustomed to less sodium chloride. Thiamine was also problematic and one vegetarian breastfeeding mother also had high levels of thiamine at each time period. The RDA for thiamine is 1mg, but this mother had consumed 13.52mg per day during the first trimester, 5.61mg during the third trimester and 15.62mg at six months post partum. However, there is little available research to suggest that over-consumption of thiamine is harmful (Leuschner, 1992; Gokhale, 1996). Because of these very large quantities of thiamine, which appear to be as a result of consuming fortified breakfast cereals, more research should be carried out to investigate possible side effects. This vegetarian, breastfeeding participant, also consumed large quantities of calcium. Dietary Reference Values (DRVs) for calcium are 700mg per day during the first and third trimesters and 1250mg per day during lactation. JD/24 consumed 1346mg per day during the first trimester, 2247mg per day during the third trimester and 2028 mg per day at six months post partum. The symptoms of over-consumption of calcium are stomach pain and diarrhoea (Food Standards

Agency, 2003). This participant did not report any such symptoms. In light of the high doses that can be consumed by some women during pregnancy, it is important that further research is carried out into the effects of over-consumption, as this may have consequences later in life. Generally, sodium (Na), thiamine and calcium were consumed in excessive quantities by a large number of women (Table 4.32). Other nutrients that were consumed in large quantities, but to a lesser extent, were riboflavin, niacin, vitamin B6, vitamin B12, fat, saturated fat and carbohydrate. The toxic effects of riboflavin are unknown, due to lack of research evidence, although urine may turn yellow (Food Standards Agency, 2003). Too much niacin may cause skin flushes and liver damage if high dosage (3000-9000mg per day) is long-term (Food Standards Agency, 2003). There is insufficient evidence regarding the effects of too much vitamin B6, but over-consumption of vitamin B12 is known to cause loss of feeling in the extremities. This is known as peripheral neuropathy and can usually be reversed once the high dosage is stopped, although in some cases the effects appear to have been irreversible (Food Standards Agency, 2003). These results suggest there would be merit in conducting a study which closely monitored the consumption levels of various nutrients in pregnant women to ascertain if these levels are general. Only social classes I, II and III experienced over-nutrition at all three time periods, except at six months post partum, when social classes IV and V had excess intake of saturated fat (Table 4.33). The effects of saturated fat are well known and these results suggest that these women may have resorted to cheap processed food that has a high saturated fat content. This may have been for reasons of convenience as well as economy. Very few women had optimum amounts of nutrient intake, which could be due to the problems of measurement. People eat different amounts of food over time and so nutrient assessment needs to be made over a period of days (Food Standards Agency, 2003). Dietary Reference Values are guidelines only and are not exact recommendations (Department of Health, 1991). Thus, it is possible that someone may have eaten well or not, depending on individual circumstances, over a particular number of days and so accurate measurement would not be possible on a daily basis. For example, some women were interviewed at Christmas, when their daily diet differed from that which they normally consumed. At other times they may have been busy or feeling unwell which would have affected their nutrient consumption. Some women supplied diet diaries, which showed evidence of attendance at social occasions such as weddings, christenings and parties where food consumption differed from the norm. In view of these day-to-day variations, it would be useful to examine the diets of pregnant women in detail over the full course of the pregnancy and six months post partum. Such an exercise is not without serious methodological difficulties, not least of which is the high attrition rate that would be expected in such a lengthy study.

5.10 Sources of nutritional advice

As the majority of nutritional advice was received from the GPs, this suggests that most nutritional advice was received during the early stages of the pregnancy, most likely during the initial visit (Table 4.37). Advice appeared to be general, as only eleven participants received specific nutritional advice at this time. However, it is possible that advice was offered, but the participants did not register the advice or forgot that they had received it. During the third trimester 27 women received nutritional advice from the hospital staff and midwives (Table 4.38). The remainder of women were reliant on the advice of family and friends, and what they themselves read in pregnancy books and magazines. Four women indicated they received no advice from any source. This may have been through social isolation and/or inability or disinclination to read up on nutrition during pregnancy. These results are cause for concern, in that only just over half the women received nutritional advice during the first trimester, which is a time of great nutritional importance in the pregnancy. Thirty women received advice from friends and family, and it is possible that some of this advice was inaccurate (Table 4.37). This suggests a need for ensuring all women receive accurate and clear advice from their GP, or other professional source, during the early stages of the pregnancy. An examination of one surgery's information pack for newly pregnant women showed that it contained a letter from the local maternity hospital inviting the mother to contact a midwife at any time if she had any concerns. This requires effort on the part of the mother and may be off-putting if she is inarticulate. Moreover, if it is difficult to travel to the midwife, contact would have to be made by telephone and some mothers may lack confidence in using such a method of seeking advice, especially when dealing with large organisations, such as the National Health Service (NHS). There were other primary care trust leaflets such as *HIV test*; *Tests in pregnancy; Down's Syndrome and your baby; Your choices during pregnancy; Choosing who will care for you during pregnancy*. All were photocopies in black type on a white background. A NHS health promotion leaflet entitled *Protect children from passive smoking* was in blue type on a white background. There were two double-sided A4 sheets about food consumption during pregnancy. These sheets suggested what to eat during pregnancy, in layman's terms and this simple language made the advice easy to follow. However, the print style and presentation was not eye-catching, and may have put off the poor reader, as it had the appearance of an official document, although this observation was not made by any of the participants. The final enclosure was Emma's Diary (Mackonochie, 2003). This was not included by some surgeries, as it is believed by some to promote bottle-feeding. This was the only eye-catching item in the pack, as it had drawings and photographs of happy women and made use of colour. Advice received from the hospitals was varied and inconsistent, in that not every woman received the same leaflets or packs. Advice from midwives was similarly varied and included advice on foods to avoid. As the majority of women in the sample did not attend the hospital or midwives until the second trimester, much of the advice, particularly on foods to avoid, was received too late. Analyses of consultations with the participants GPs suggested participants tended not to have contact with the GPs after the initial consultation unless there was some specific ailment. One problem is that women carry out home pregnancy tests, and often do not attend their general practitioner until they are quite a few weeks pregnant, causing delays in relaying nutritional advice. Very little nutritional advice was received post partum. Most information was advice on feeding the baby, and only three women received advice specifically for themselves (Table 4.39). This needs to be addressed immediately in view of the poor post partum nutritional status of many of the women in the sample. Just over half the women were satisfied with the level of nutritional advice they received and this could have been for a number of reasons (Table 4.41). The participants may have felt confident about their eating habits; they may not have considered nutrition during pregnancy important; they may not have cared about nutrition during pregnancy. Whatever the reasons, this leaves almost half who were dissatisfied, suggesting a lack of communication between the health professionals and the patient. The problem may be one of responsibility, as there is shared care between the general practitioner and the midwives. As the women present at the surgery in the first instance, then it would be practical for the general practitioners to take responsibility for ensuring the participant receives sufficient advice before she leaves the surgery. There may not be time during the consultation to provide this advice, therefore a nurse or other health professional should be designated the role of advisor once the initial consultation is over and, if required, by visit to the mother's home. This health professional should be trained to offer advice in a clear and coherent manner. Time should be set aside for questions and full explanations given in simple terms for the reasons for avoidance or recommended consumption of various foods. If participants know the reasons for behaviour then this is more likely to affect their attitudes and thus their beliefs. Results suggested that small general practices were perceived more positively than large general practices (Table 4.42). There may be a number of reasons for this. Because the surgeries are small, the general practitioners may know their patients better than in a large surgery. It was observed in small surgeries that doctors came out of the consulting rooms to greet and escort each patient to the consulting room. In some large practices it was observed that a buzzer summoned the next patient, who then went along to the consulting room. In small surgeries there may be less patients per general practitioner, allowing for longer consultations, thus giving the general practitioner the opportunity to allay any fears the patient may have. Generally, women were disappointed with the level of nutritional advice they received. These results suggest that women expect advice to be offered rather than sought. This is important, because if advice is not offered there are many who will not seek it for a number of reasons (e.g. in awe of health professionals; don't want to appear stupid). Thus some women will miss out on valuable nutritional advice during the course of their pregnancy.

5.11 Perceptions of hospitals

Perceptions of hospitals suggest that maternity hospitals were rated more positively (Table 4.43). This may have been because the women did not stay in the large hospitals for any considerable length of time, and so did not build up a relationship or rapport with the midwives. There was a general feeling that the large hospitals were extremely busy, and midwives had little time to spend with the participants or their infants. Maternity hospitals are specifically set up to care for the mothers and their infants, and have the time to advise new mothers on how best to care for their babies, including assisting with breastfeeding. One mother was very keen to breastfeed but her child would not suckle. One of the midwives suggested dunking the mother and baby in the birthing pool, and the baby suckled straight afterwards. This mother had no further problems with breastfeeding. This is an indication of the time the midwives have to spend with the mothers, compared to the large hospitals where time is limited. Such individual care in the maternity hospitals is bound to affect perceptions and result in a more positive outcome with regard to breastfeeding. This is similar to the Hawthorne Effect (Mayo, 1933) where production increased as a result of the attention. Some women felt the general practitioners attitudes were negative and this may suggest that to the doctors it is routine whereas it is a major event for the newly pregnant woman. This may indicate a need for the general practitioners to remind themselves of the importance of the event for the new mother and so change their attitude so that the mother's experience of the consultation is more positive. A positive experience may be more likely to result in retention of advice.

5.12 Limitations of the study

The fact that there was only one researcher may have introduced an element of bias when conducting interviews. Having more than one researcher eliminates experimenter bias, but might result in other bias, although in this case every step was taken to remain as objective as possible. Because of the small sample size (n=37) it was not possible to be representative of primagravid women in general and the study must be viewed as a pilot study for a larger project.

Attrition was not a problem and retention rates were good, although on occasion general practitioners referred prospective participants who were unsuitable because it was not their first pregnancy. There was an element of bias in recruitment by the GPs, and one GP admitted to only asking those considered to be appropriate candidates. This was very subjective, and young women of low socio-economic status, who might have provided rich data, may have been overlooked. This GP admitted to choosing middle class women because they would be intelligent and articulate. This makes the assumption that those of low socio-economic status are not intelligent or articulate. Recruitment was very slow due to the wait for pregnant women to present at the surgery, from where they were initially recruited. Had the study taken place at an antenatal clinic, there would have been a large sample available. However, the benefits of this approach would be outweighed by the fact that many of the participants would have passed their first trimester and valuable data would have been lost. There is the added disadvantage that many women choose not to attend antenatal clinics.

There were problems with GPs forgetting to refer prospective participants, but this was resolved by placing the responsibility on the head receptionist to remind the GP. In most cases this worked reasonably well, but it is clear that a number of women were not approached. This was evident from conversations with some participants, who indicated that friends who were also pregnant and attended the same surgeries, were not approached. The senior receptionists were extremely helpful and were central to the successful recruitment of participants. Deviation from the agreed methodology resulted in no recruitment from one surgery. A midwife at the antenatal clinic at the local hospital referred one patient at that surgery. This surgery devised their own recruitment method, as outlined in Chapter Three and it is unclear if this was for the convenience of the receptionists or GPs. It was anticipated that this deviation would result in poor recruitment but it was decided not to press the matter. The general practitioners were accommodating in agreeing to provide prospective patients. However, their first duty is to their patient, and if this research interfered in any way with the efficient administration at the practice, then any changes or deviations must be accepted.

Analysis of data did not present many problems, other than it was labour intensive and many hours were spent analysing diet diaries. When comparing the software RDAs with the DoH guidelines, a discrepancy was noted with regard to protein. As a result, the calculations for protein were incorrect, as the RDA in pregnancy was stated to be 93.4g. This meant adjusting the figures in line with the DoH guidelines, which suggest an RDA of 51g during pregnancy. The DoH guidelines have been used in analyses, as they are government guidelines, based on the results of valid and reliable research. Nevertheless, this discrepancy has resulted in many hours manually recalculating protein consumption. Some women took folic acid and/or multivitamin supplements and these would not have shown up in the nutritional analysis for each participant. Thus, it is possible that the nutritional status of some women is inaccurate. Moreover, it was difficult to estimate the size of individual portions, as food was not weighed and there may have been discrepancies between what the women reported and what they actually consumed. In addition the analysis of food consumption did not take account of sodium chloride that may have been added to food as table salt.

Analyses of perceptions may have been subjective because any ambiguities could not be checked as there was only one researcher.

Much of the literature relating to nutrition in pregnancy depended on animal studies, which cannot be directly applied to humans but it is appreciated that there are serious ethical issues using human participants for medical research. Nevertheless, findings from the animal research should be considered as a first step towards human research, rather than generalising the findings to humans. A considerable amount of the research was non-European, and many of the results cannot be applied to the United Kingdom, or other parts of Europe, because of cultural differences in food consumption.

In essence therefore the limitations of the study were:

- inherent subjectivity of this type of study
- small sample size
- restricted numbers in social classes
- GP bias in selection
- catchment area of sample
- contradictory levels of RDAs
- difficulty of accurately interpreting nutrients in diet.

Despite these limitations the research has found a number of areas worthy of further research and areas where practice can be improved, which will benefit policy makers, researchers and future pregnant women and their children.

Chapter Six

Conclusions and Recommendations

Introduction

Suggestions for possible future areas of research are offered. In addition, suggestions are made for policies to improve nutritional advice and education, with particular reference to pregnancy and the health of the developing infant. This study has been successful, in that the aims have been achieved. The perceptions of diet and nutrition and the self-reported food consumption, based on diet diaries, of the primagravidae participants during pregnancy and post partum, have been established and the nutritional knowledge and nutritional status of the women have been measured. Moreover, the intended and actual behaviour with regard to nutrition and breastfeeding have been measured, including identifying barriers to action.

This chapter draws together the findings of this research by making recommendations for further research and policy practice.

6.1 Literature review

A review of the recent literature surrounding fetal nutrition and breastfeeding has served to identify areas of controversy and gaps in that research. There is a need for more European, human, research that can be directly related to women in the UK. In addition, there is a need for a lot more research, specifically in the UK. Moreover, in the light of recent research, suggesting that vitamin and mineral supplementation may be harmful, the DoH needs to review current RDAs that have not been altered since 1991 (DoH, 1991). This is particularly important in the light of findings of this study, which show that there have been, in some instances, excessive consumption of thiamine and sodium chloride. Little is known of the effects of over-consumption of thiamine (Food Standards Agency, 2003). Although there is abundant research regarding the ill effects of over-consumption of sodium chloride, there is little if any, research of the effects on the developing fetus. It is possible that some women may be over-consuming folic acid by eating fortified breakfast cereals and bread, in addition to taking folic acid supplements during the early stages of pregnancy. There is a need therefore, to investigate possible side effects of over-consumption of folic acid. A large number of women in this sample suffered from iron deficiency throughout the course of the pregnancy and six months post partum. There is wide debate concerning the benefits of supplementation, thus more research is required in order to reach a definitive conclusion. By so doing, women can be offered well-founded advice based on valid research findings. Much of Vitamin D research has centred on ethnic minorities who, for reasons of culture, may have insufficient reserves. Therefore some UK women, who for reasons of diet and lifestyle may be at risk of Vitamin D deficiency, are being overlooked. This is important, as a good supply of Vitamin D is important for calcium absorption. There appears to be little research that addresses the calcium needs of pregnant adolescents who have their own calcium requirements, in addition to those of the fetus. Iodine deficiency was prevalent within this sample, but it appears to have received little attention with regard to fetal and maternal nutrition in the UK. This is despite a breadth of research which suggests that the effects of iodine deficiency can result in poor intellectual development (Poskitt, 2003). Many people do not eat iodine rich foods such as fish, from choice. Therefore, there is an urgent need for a government policy advocating compulsory iodine supplementation of table salt (sodium chloride) as recommended by UNICEF (UNICEF, 2001, Ibrahim et al., 2003).

Based on recommendations by UNICEF and WHO, exclusive breastfeeding for the first six months of life is recommended in the UK. In the light of the nutritional deficiencies found at six months post partum, in most of the participants in this sample, the benefits of exclusive breastfeeding should be reassessed.

6.2 The Theory of Planned Behaviour

The Theory of Planned Behaviour was considered the most appropriate theoretical model for this research. The findings of this study suggest certain modifications to the theory as a whole, for the purposes of beliefs and actions regarding eating behaviour during pregnancy. The original model is shown in

Figure 6.1 and the modified version of the Theory of Planned Behaviour is shown in Figure 6.2.

Figure 6.1 Original model of the Theory of Planned Behaviour

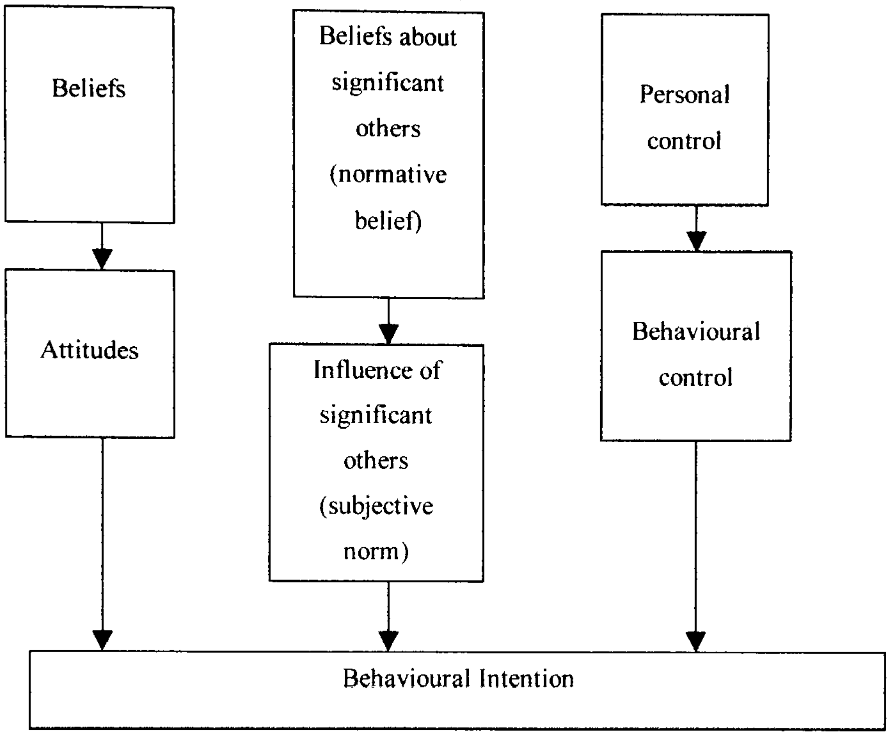
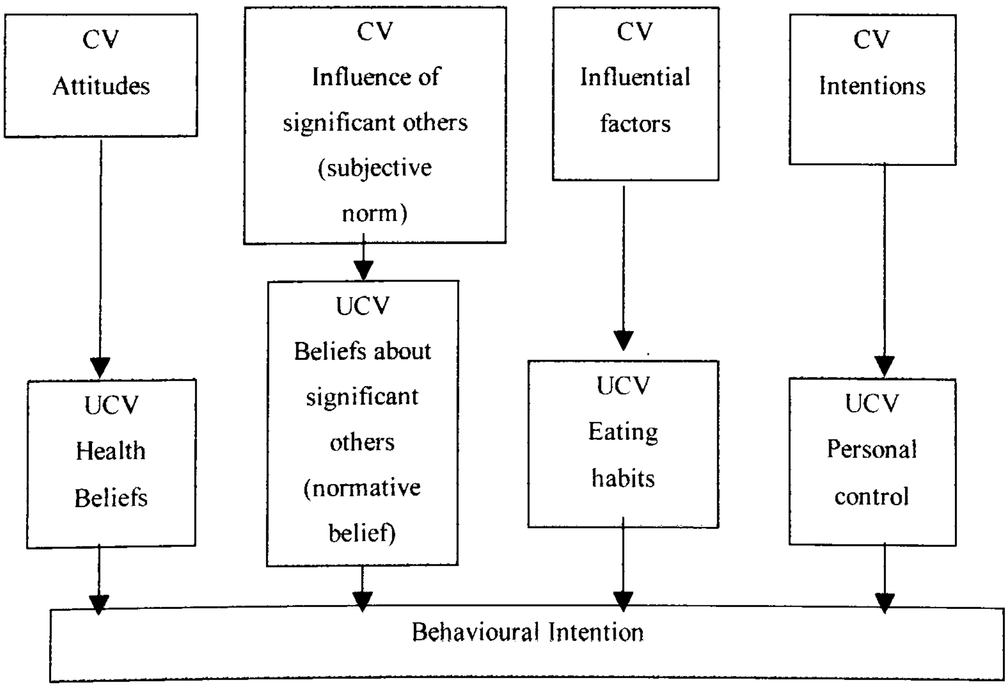


Figure 6.2 Modified version of the Theory of Planned Behaviour



CV = Changing variable

UCV = Unchanging variable

This study used a variation of a questionnaire designed by Connor and Sparks (1995) who added control beliefs to their example of a health behaviour questionnaire. Control beliefs are items that make it easy or difficult to carry out the desired behaviour (Ajzen & Driver, 1992). Question 9 of the Likert scale questionnaire used in this study addressed control beliefs. The modified version of the Theory of Planned Behaviour suggested in Figure 6.2 differs from the original model, which suggests that behavioural intention is based upon attitudes, which in turn are based upon beliefs. Attitudes, influential factors, influence of significant others and intentions are all changing variables on which the unchanging variables (i.e. health beliefs, eating habits, beliefs about significant others and personal control) are dependent. For example, early in the pregnancy women had intentions to change eating habits but these intentions lessened over time, for whatever reason. According to the original model of the Theory of Planned Behaviour these intentions would have been affected by attitudes that were in turn affected by beliefs. This study found that attitudes can change over time but beliefs about eating habits do not change. Therefore, if we address attitudes early in life they can be changed before they become entrenched as beliefs. Beliefs about significant others changed and as explained in section 4.4 this was the most significant result. In essence the participants belief that their significant others desired a changed in the participants' eating habits became stronger over time. On the other hand, the influence of the significant others lessened over time. This may suggest that there is a need to address beliefs about significant others early in life before significant others become less influential in changing the individual's behaviour. For example, eating behaviours should be addressed early in primary school and not left to secondary education when the young individual will not be motivated to change their eating behaviour despite being aware that significant others are desirous of such change. Influential factors also changed becoming less important over time. Influential factors such as knowledge/education, stress factors such as anxiety, lack of time and what others are eating became less important over time. Thus we need to instil the knowledge, empower individuals as a measure towards reducing stress and show by example of eating habits (for example teachers and older peers) before eating habits become entrenched. Personal control did not change significantly over time, whereas intentions towards eating habits did. It is possible that if we address intentions by empowering people through education and appropriate role models we can give them a heightened sense of personal control. These changing variables, if addressed early enough, such as during full-time education, can affect health beliefs, eating habits, beliefs about significant others and personal control before they become entrenched. Addressing these variables when a woman is pregnant is too late. These variables should be addressed through educational measures in the school curriculum which are mandatory for all pupils. Moreover, all behaviours are learned and one of the most powerful theories of learning is Social Learning Theory (Bandura, 1974). According to this theory we learn through vicarious reinforcement, that is, we are more likely to imitate behaviour we see being rewarded. Thus, if we read books and see films that send out a message that what we eat makes us attractive and successful, then we are more likely to imitate that behaviour. If, on the other hand, we see the negative side of a poor diet, then we are less likely to imitate that behaviour. By moulding or changing attitudes early enough we can teach health beliefs before they become unchangeable. Influential factors can have a profound effect on eating habits as they affect motivation to comply. Children are especially susceptible to the influence of role models presented through the media and advertising (Sustain, 2001). Too often advertising promotes unhealthy high fat foods by means of a happy families message, which affects not only the consumer but the person responsible for purchasing the food – in this case usually the mother (Sustain, 2001). The Sustain (2001) study found little evidence of genuine healthy food promotion on television. Fruit and vegetables are not usually advertised, but fatty and sugary foods are advertised and these have proportions up to 11 times higher than recommended in official guidelines (Sustain, 2001). Moreover, bottlefeeding was advocated in an episode of the soap opera, Coronation Street (Granada Television, July, 2003). A relatively attractive and successful character was seen bottlefeeding her baby, thus sending out the message that attractive and successful women bottlefeed. Positive role models such as high profile sportsmen David Beckham and Stephen Redgrave could be used to promote healthy eating habits in childhood, which would then become entrenched. As Iphofen (2003) suggests, food choices are not merely for nutrition but are culturally entrenched in the dynamics of family life. Advertising has become part of our culture therefore positive changes to food advertising may be instrumental in changing our cultural food choices. It is important to address male health beliefs as they are the future partners and thus significant others of pregnant women. Beliefs about significant others (the subjective norm of the Theory of Planned Behaviour (Ajzen, 1985) do not change over time, although the influence of the significant other does so in the early stages of the pregnancy. Thus, thenewly pregnant woman may be influenced by the beliefs of her partner, prior to and during the early stages of pregnancy. Behavioural intentions are affected by personal control. If a person believes they have little control over their actions then they will not be motivated to intend to change their behaviour. If, as the results of this study suggest, personal control does not change over time, then intentions will not change if the person feels they have little personal control over their actions. Intentions did change over time, in this case negatively, in that intentions to change reduced over time. To address the issue of personal control, and thus intentions, people need to be empowered, thus altering their locus of control from external to internal. In the case of external locus of control there are factors, which do in reality limit their choices, such as financial constraints, and time factors, as found at six months post partum. The reduction in change over the time periods may have been because the baby was no longer a physical part of the mother and the mothers felt their responsibility to eat well was over. These findings have consequences for the continuing health of the mother and any future children she may bear. In essence therefore, instead of beliefs affecting attitudes this study suggests that attitudes affect beliefs. For example, through parental and educational socialisation the child will be exposed to attitudes that will affect beliefs that influence behavioural intention. Infuental factors such as health education within the home, school and media may affect eating habits. As discussed in 2.2 of this thesis habits become entrenched. According to Iphofen (2003), eating habits are cultural, thus if we are fed a diet high in fruit and vegetables at home and school we may be more likely to carry these habits through to adulthood. On the other hand, if it is the social norm to eat a high fat, processed diet at home and school during childhood, then this is what we are likely to consume in adulthood because it is the cultural norm (Iphofen, 2003). This study has shown the influence of significant others lessens over time although this may only be in this sample. Nonetheless if it is the case that the influence of significant others lessens over time generally, then significant others such as parents and teachers need to instil good eating habits and beliefs early in childhood. Beliefs about significant others affected behavioural intention in this study. It may therefore be appropriate to manipulate intentions towards eating a healthy diet during childhood through educational measures. Thus if the child believes that the educational significant other (the teacher) desires that they should eat certain foods then this may positively affect behavioural intention. There is also the importance of eating well while breastfeeding, as this directly affects the health of the infant. Most women were aware of what not to eat and most did avoid foods such as pâté, seafood and unpasteurised cheeses. Such nutritional advice was given to the mother early in the pregnancy. At six months post partum there was evidence that women were aware that they were not eating as well as they should, and time was the major barrier to their intention to eat well. Results suggest there is a need for post pregnancy food education/recommendations for healthy eating when time and money are limited.

6.3 Eating habits

Fibre, iron and iodine were the nutrients with the highest number of deficiencies over the three time periods. Vegetarian mothers showed high levels of sodium, and deficiencies in important nutrients. Sodium (Na) was the most over-consumed nutrient by the participants, followed by thiamine and calcium. Some women also took multivitamin supplements during the course of their pregnancy, which might mean they had over-consumption of nutrients that could be detrimental to their own health and the health of the infant.

Analysis of the food diaries of the women within the sample, indicates that over-consumption of nutrients, such as thiamine and sodium (Na), is related to consumption of fortified breakfast cereals.

6.4 Changes in eating habits

The most prominent reasons for changes in eating habits were nausea during the first trimester and the demands of the infant post partum, which resulted in less time to consider food choices. Alcohol was not problematic within the sample, as most women gave this up for the duration of the pregnancy. Nevertheless, this research has highlighted a need for clearer guidelines regarding the exact measure of a unit of alcohol. Some GPs are concerned, despite research evidence to the contrary, that there is a need for iron supplementation through diet (Letsky, 1991; Thomas, 2001). Women are more concerned with nutritional health in the early stages of pregnancy, and nutritional health post partum appears to be neglected. Evidence from the reported experiences of the participants, within the sample, suggests that not all women are receiving advice directly from health professional regarding folate supplementation. There is a need to address this disparity without delay, particularly where at risk women and infants, such as those in low socio-economic circumstances, are concerned.

6.5 Nutritional knowledge

Results from this study suggest there is evidence of confusion regarding consumption, or avoidance, of certain foods during pregnancy. Most women were aware that certain foods were healthy, or unhealthy, but unclear as to why. For example, most women were unaware of the consequences of contracting Listeria during pregnancy, and of the difference between saturated and unsaturated fat. There was a general vagueness of nutritional knowledge across the social classes, and analyses of diet diaries indicated that some women did not eat certain food despite these being recommended during pregnancy. This suggests that gaps in the knowledge should be addressed without delay.

6.6 Nutritional advice

The main source of health professional nutritional advice came from the GP during the early stages of pregnancy and this advice applied to just over half the participants within the sample. Most advice was received from friends and family. Some advice was unclear, and some women felt that advice was sought rather than offered. There is a need for clear and unambiguous nutritional advice to be offered by health professionals during the early stages of pregnancy, ensuring all women receive the same level of advice. Health professionals should be proactive rather than reactive. Smaller surgeries were perceived more positively than larger ones. The reason(s) for these perceptions should be investigated to establish if it was the size of the surgeries, the influence of family and friends, the professional relationship between the GP and patient or some other factor.

6.7 Breastfeeding

Evidence from this study suggests that small maternity hospitals that have full Baby Friendly accreditation are perceived more positively than large general hospitals without accreditation. This appears to result in higher uptake of breastfeeding. A study should be conducted to establish if reasons for non-accreditation are a matter of funding or some other factor(s).

6.8 Recommendations for future research

1. More European, specifically UK, human studies should be carried out into the effects of nutritional deficiencies during pregnancy and post partum in order to establish the precise nutritional needs of pregnant women and infants in the UK.
2. A large study, which is representative of the population of the UK should be carried out, examining the nutritional status of vegetarian women during pregnancy and post partum, to compare their nutritional needs with non vegetarian women. Such a study should have a 10 per cent proportionally representative sample of the population of pregnant women in each health authority in the UK.

3. The possible benefits and/or adverse effects of nutritional supplements during pregnancy and post partum should be investigated, with particular emphasis on the effects of over-consumption of such supplements. This investigation should include an examination of the benefits of food fortification such as bread and cereals.
4. Modifications to the Theory of Planned Behaviour in relation to fetal and maternal nutrition should be undertaken by social scientists as how it is currently presented does not take into account the effect of attitudes on beliefs.
5. Food flavourings, other than sodium chloride for processed food, should be investigated as possible alternatives, in order to reduce the sodium (Na) content of processed food.

6.9 Recommendations for policy

1. Table salt (sodium chloride) and sodium chloride added to processed food should be iodised as a matter of policy, in line with UNICEF (2001) recommendations as a means of reducing possible iodine deficiency in the UK.
2. Recommendation of exclusive breastfeeding for the first six months of life in the UK should be reassessed by the DoH, as the health of the mother and infant may be compromised in the light of the findings of this study which suggest that many women have nutritional deficits post partum.
3. Educational policies which ensure nutritional education is mandatory within schools throughout the period of full-time education, should be implemented and enforced. These should be specific rather than general, ensuring each child of school age receives adequate nutritional education so that appropriate health beliefs become entrenched early on.

6.10 Recommendations for health care professional practice

1. Leaflets and other written nutritional information for pregnant women should be written in clear and simple terms, illustrated where possible,

and presented in eye-catching pregnancy packs. This written information should be augmented by a nutritional consultation with a health professional at the time of the initial antenatal consultation.

2. Patient perceptions of their experience of large and small medical practices should be investigated, with a view to offering suggestions for improvements in consultation practises if necessary.
3. More large general hospitals should work towards Baby Friendly accreditation in order to improve rates of breastfeeding in the UK.
4. An educational programme that specifically targets new mothers should be devised. This should include practical advice on how to cope with the demands of their infant, whilst maintaining good nutritional levels for themselves and their partner. Such a programme should provide advice on menu-planning, advance shopping and time-saving food preparation.

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Appendix I

Draft Questionnaire for use in pilot study

1. Is this your first pregnancy?
2. When is your baby due?
3. Do you intend to breastfeed?
4. Do you have a paid job?
5. Does your partner have a paid job?
6. What is your paid job?
7. What is your partner's paid job?
8. Do you intend to carry on doing paid work after the baby is born?
9. How many people are there in your household?
10. Who does the shopping in your family?
11. Do you or this person shop for all the people in the household?
12. How is the shopping planned? Once a week or more often?
13. Is a list made?
14. Are the meals planned before shopping?
15. Do you have a weekly menu?
16. Who decides what you will eat?
17. Do you all like basically the same things?
18. If not, who makes decisions about food choices?
19. What do you usually eat for breakfast?
20. And the rest of the household?
21. What about lunch?
22. If it is eaten out, is it a packed lunch or bought?
23. If bought, what type of meal?
24. If cooking or making packed lunches, do you prepare them for other members of the household?
25. If not, what arrangements do individuals make?
26. Who decides about the evening meal?
27. Who decides what to have?
28. Who prepares it?
29. Does everyone eat together?
30. Do you enjoy cooking?
31. What sort of food do you buy?
32. Would you be willing to keep your supermarket receipts for me for the duration of this research?
33. What do you think is a healthy diet?
34. Do you take folate supplements?
35. Are you avoiding foods which contain listeria?
36. Have you changed your eating habits since becoming pregnant?
37. If so, in what way?
38. Why?
39. Is nausea or morning sickness a problem?
40. Have you had any food cravings?
41. What do you think about convenience foods?
42. What is your definition of convenience foods?
43. What are your feelings about food advertising?

44. Do you read labels on food packaging?
45. Are you concerned about beef products?
46. Are you concerned about foods which might be high in cholesterol?
47. Which foods in particular?
48. Do you eat butter, cream or eggs in your household?
49. What about you as an individual?
50. Would you be willing to keep a food diary for me please?
51. Do you spend a regular sum on food shopping each week?
52. If so, how much?
53. If not, how much would you think you spend?
54. What do you look for when buying a product? Price, brand name, taste?
55. Do you eat differently at weekends?
56. How old are you?
57. How old is your partner?
58. What is your family income?
59. Was the pregnancy planned?
60. Do you have a partner?
61. How long have you been together?
62. How does your partner feel about the pregnancy?

Appendix II

Questionnaire for use at first trimester

Coded personal details
Occupation
Due date

1. Was the pregnancy planned?
   Yes
   No

2. Are you intending to carry on with paid employment after the baby is born?
   Yes Part-time Full-time
   No
   Maybe

3. Are you intending to breastfeed the baby?
   Yes
   No
   Maybe

4. What are your reasons for your choice regarding breastfeeding?
   ....
   ....
   ....

5. What foods do you consider important to eat daily?
   a. During pregnancy fresh fruit; fresh veg; dairy products; meat; fish; bread; fat; alcohol; sugar; chocolate; pasta; biscuits; cakes; other.

   b. Breastfeeding fresh fruit; fresh veg; dairy products; meat; fish; bread; fat; alcohol; sugar; chocolate; pasta; biscuits; cakes; other.

6. What is your idea of a healthy diet:
   ....
   ....
   ....

7. Have any of the following affected what you have eaten since becoming
pregnant?
    a. Nausea/morning sickness
    b. Constipation
    c. Food cravings

8. Which of the following foods may contain Listeria:
margarine; fruit; milk; soft cheese; bacon; pâté?

9. What are the possible effects of contracting Listeria during pregnancy?
    a. Don't know
    b. Diarrhoea
    c. Miscarriage
    d. Stillbirth
    e. Other

10. Who told you this?
    a. Doctor
    b. Nurse
    c. Midwife
    d. Someone at the hospital
    e. Friend
    f. Mother
    g. Other

11. Which of the following contains sodium?
    a. Sugar
    b. Salt
    c. Water
    d. Fibre

12. What can be the long-term effects on health of eating too many foods which
contain cholesterol?
    a. Heart disease
    b. Cancer
    c. Beneficial/good for health
    d. Don't know
    e. Other

13. What is cholesterol?
    a. Saturated fat
    b. Unsaturated fat
    c. Animal fat
    d. Vegetable oil
    e. Don't know
    f. Other

14. Which of the following foods contain cholesterol?
    butter; full-cream milk; semi-skimmed milk; skimmed milk; eggs; red meat; white meat; vegetables; bread; fish; fruit; polyunsaturated margarine; cream; lard; polyunsaturated oil; pasta

15. What is the difference between saturated and unsaturated fat:
    a. Saturated fat is animal fat
    b. Unsaturated fat is animal fat
    c. Saturated fat is vegetable fat
    d. Unsaturated fat is vegetable fat
    e. Saturated fat is unhealthy
    f. Saturated fat is healthy
    g. Unsaturated fat is unhealthy
    h. Unsaturated fat is healthy
    i. Don't know
    j. Other

16. What foods do you consider to be unhealthy?
    chocolate; eggs; fried foods fresh vegetables; sweets; crisps; red meat; white meat; alcohol; tinned vegetables; pasta; tinned beans; shop pies; bread; fatty foods; other

17. Why do you consider these foods to be unhealthy?
    ....
    ....
    ....

18. Do you think frozen/tinned foods are more healthy than fresh?

19. Do you take any supplements/pills? If so, what?
    a. Iron
    b. Vitamins
    c. Folic acid
    d. Other
    e. Do not take any

20. Who has advised you to do so?

Professional:	Lay:
Doctor	Mother
Nurse	Friend
Midwife	Partner
Other	Other

21. Who has given you advice about diet since becoming pregnant?

Professional:	Lay:
Doctor	Mother
Nurse	Friend
Midwife	Partner
Other	Other

22. What advice have you been given?
....
....
....

23. Were you satisfied with the advice?
Unsatisfied 1 2 3 4 5 6 7 Satisfied

24. If not, why not:
....
....
....

25. What is your partner's occupation?
....
....

26. What is your gross annual income (that is before deductions)?
....

27. How much do you think you spend on food:
£ weekly
£ monthly?

28. Do you smoke:
Yes
No
If so, how many per day/week?

29. Does anyone else in your household smoke?
....

30. Do you drink alcohol?
Yes
No

31. If so, what do you drink?

....

....

32. How much per

night

week

month

33. Who do you consider to be important to you now that you are pregnant:

Professional:	Lay:
Doctor	Mother
Nurse	Friend
Midwife	Partner
Other	Other

34. What weight were you before you became pregnant?

....

....

35. What height are you?

....

....

Do you have any questions about the interview?
Thank you for your time.

Appendix III

Questionnaire for use at third trimester

Coded personal details
Occupation
Due date

1. Would you say that your eating habits have changed during your pregnancy?
   ....
   ....

2. If so, in what way?
   ....
   ....

3. Have you had any domestic problems that have affected what you eat?
   ....
   ....

4. If so, what are they?
   ....
   ....

5. Are they ongoing problems?
   ....
   ....

6. Have they been resolved?
   ....
   ....

7. Have you had any financial problems which have affected what you eat?
   ....
   ....

8. If so, what are they?
   ....
   ....

9. Are they ongoing problems?
   ....
   ....

10. Have they been resolved?

....

....

11. Have you had any physical problems that have affected what you eat?

....

....

12. If so, what are they?

....

....

13. Are they ongoing problems?

....

....

14. Have they been resolved?

....

....

15. Where are you going to have your baby?

....

....

16. What is the reason for this choice?

....

....

17. What visits have you had to the hospital since becoming pregnant?

....

....

18. What advice have you received from the hospital regarding diet?

....

....

19. What advice has your doctor/nurse given you regarding diet?

....

....

20. Would you say the dietary information you have received was helpful?

....

....

21. What particular dietary advice have you acted upon?

....

....

22. Why have you done so?

....

....

23. Is there any other information regarding food and diet during pregnancy which
you feel might be helpful to me?

....

....

24. Have your personal circumstances changed in any way since we last met?
(for example, job, moving house, financial, health and so on)

....

....

25. If so, in what way?

....

....

26. What is your gross annual income, that is, before deductions?

....

....

27. How much do you think you spend on food:
£ weekly
£ monthly?

28. Are you intending to breastfeed or bottlefeed?

....

....

29. Was this what you originally intended?

....

....

30. If not, what made you change your mind?

....

....

31. What is the reason for your choice?

....

....

32. Are you intending to continue with paid employment after the baby is born?

....

....

33. What is the reason for your choice?

....

....

34. Do you drink alcohol?

....

....

35. If so, what do you drink

....

....

36. How much per
night
week
month

37. Who would you say is important to you now that you are pregnant?

....

....

38. Please list them in order of importance

....

....

....

....

....

....

....

....

39. What weight are you now?

....

....

Thank you for your time.
Do you have any questions?

Appendix IV
Questionnaire for use at six months post partum

Coded details
Occupation

1. When and where was your baby born?
   ....
   ....

2. What do you feel about your stay at the hospital?
   ....
   ....

3. What gender is your baby?
   Male
   Female

4. What weight was he/she at birth?
   ....
   ....

5. What weight is he/she now?
   ....
   ....

6. Are you breastfeeding/bottlefeeding, or both?
   ....
   ....

7. Was this what you originally intended?
   ....
   ....

8. If you have stopped breastfeeding, when did you stop and why?
   ....
   ....

9. If you are breastfeeding have you altered your food intake because of this?
   ....
   ....

10. If so, in what way?
    ....
    ....

11. (a) What do you think a breastfeeding woman should eat?
Fresh fruit; fresh veg; carbohydrates; bread; dairy products; meat; fluids; fish; fat; chocolate; alcohol; sugar; pasta; biscuits; other.

(b) Why?
....
....

12. What advice regarding food/diet have you received since the baby was born?
....
....
....
....

13. Who has given you this advice?
Doctor; nurse; health visitor; midwife; mother; family member; friend; other

14. What leaflets, pamphlets, booklets have you been given regarding food/diet since your pregnancy began?
....
....
....
....

15. Who gave them to you?
Doctor; nurse; health visitor; midwife; other.

16. What weight are you now?
....
....

17. What weight were you before you became pregnant?
....
....

18. Would you say that your eating habits have changed since the baby was born?
Yes
No

19. If so, in what way?
....
....

20. Have you had any domestic problems that have affected what you eat?
    Yes
    No

21. If so, what were they?
    ....
    ....

22. Are they ongoing problems?
    ....
    ....

23. Have they been resolved?
    ....
    ....

24. Do you have a paid job?
    Yes
    No

25. If so, part-time or full-time?
    part-time
    full-time

26. Who takes care of the baby?
    ....
    ....

27. What food arrangements have been made for the baby while you are at work?
    ....
    ....
    ....
    ....

28. Have you had any physical problems that have affected what you eat?
    Yes
    No

29. If so, what are they?
    ....
    ....
    ....
    ....

30. Are they ongoing problems?
    Yes
    No

31. Are you taking any medication, food or nutrient supplements?
Yes
No

32. If so, what are they?
Iron
Vitamins
Other
Do not take any

33. Who has advised you to do so?

Professional:	Lay:
Doctor	Mother
Nurse	Friend
Midwife	Partner
Other	Other

34. Do you drink alcohol?
....
....

35. If so, what do you drink
....
....

36. How much per
night
week
month

37. What is your gross annual income (that is before deductions)?
....
....

38. How much do you think you spend on food:
£ weekly
£ monthly?

39. Would you say that taking part in this research has influenced what you have eaten?
Yes
No

40. If so, in what way?

....
....
....
....

Thank you very much for taking part in this research, do you have any questions?

Appendix V

Likert scale questionnaire for use during first trimester and third trimesters

In this particular questionnaire I am mainly concerned with women's views towards food/diet during pregnancy and lactation (breastfeeding). I ask questions which make use of rating scales with seven places; you are asked to encircle the number that best describes your opinion. For example, if you were asked to rate the benefits of eating apples during pregnancy on such as scale the seven places should be interpreted as follows:

not beneficial 1 2 3 4 5 6 7 highly beneficial

So, if you rated the benefits of eating apples during pregnancy as 4 you would put a circle around the number 4.

In making your ratings please remember the following points:

1. Be sure you answer all items – please do not leave any out
2. Do not put more than one circle mark on a single scale.

Do you have any questions before you start?

Intentions towards eating habits
Are you intending to change your eating habits now that you are pregnant?

a. I intend to change my eating habits now that I am pregnant
   Definitely do not 1 2 3 4 5 6 7 Definitely do

b. I would like to change my eating habits now that I am pregnant
   Definitely yes 1 2 3 4 5 6 7 Definitely not

c. I want to change my eating habits now that I am pregnant
   Strongly disagree 1 2 3 4 5 6 7 Strongly agree

d. I expect to change my eating habits now that I am pregnant
   Unlikely 1 2 3 4 5 6 7 Likely

Attitudes to eating habits

My changing my eating habits now that I am pregnant would be:

a. Harmful 1 2 3 4 5 6 7 Beneficial
b. Unpleasant 1 2 3 4 5 6 7 Pleasant
c. Unenjoyable 1 2 3 4 5 6 7 Enjoyable
d. Foolish 1 2 3 4 5 6 7 Wise

What a breastfeeding mother eats has an affect on the health of the child

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Beliefs about eating habits

Changing my eating habits now that I am pregnant would:

1. Make me healthier

   Strongly agree 1 2 3 4 5 6 7 Strongly disagree

2. Make the baby healthier

   Strongly agree 1 2 3 4 5 6 7 Strongly disagree

Health beliefs

Being healthier for me would be:

Harmful 1 2 3 4 5 6 7 Beneficial

Being healthier for the baby would be:

Harmful 1 2 3 4 5 6 7 Beneficial

Significant others

People who are important to me think I

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am pregnant

People who are important to me would:

Approve 1 2 3 4 5 6 7 Disapprove

of my changing my eating habits now that I am pregnant

I feel under social pressure to change my eating habits now that I am pregnant

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Beliefs about significant others

My partner thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am pregnant

My doctor thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am pregnant

The nurse thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am pregnant

My family thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am pregnant

Influence of others on eating habits

With regard to your eating habits now that you are pregnant how much do you want to do what your friends think you should

Not at all 1 2 3 4 5 6 7 Very much

In general, how much do you care what your partner thinks you should do

Do not care at all 1 2 3 4 5 6 7 Care very much

In general, how much do you care what your doctor thinks you should do

Do not care at all 1 2 3 4 5 6 7 Care very much

In general, how much do you care what your midwife thinks you should do

Do not care at all 1 2 3 4 5 6 7 Care very much

In general, how much do you care what your family thinks you should do

Do not care at all 1 2 3 4 5 6 7 Care very much

In general, how much do you care what your friends thinks you should do

Do not care at all 1 2 3 4 5 6 7 Care very much

Personal control

Whether I do or do not change my eating habits now that I am pregnant is entirely up to me

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

How much control do you feel you have over changing your eating habits now that you are pregnant?

No control 1 2 3 4 5 6 7 Complete control

I would like to change my eating habits now that I am pregnant but I do not really know if I can

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I am confident that I could change my eating habits if I wanted to

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

For me to change my eating habits now that I am pregnant is

Difficult 1 2 3 4 5 6 7 Easy

Changing my eating habits would take time

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Changing my eating habits would be expensive

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

People with whom I eat food would support me in changing my eating habits
Never 1 2 3 4 5 6 7 Frequently

Influential factors
Understanding what to eat or avoid eating during pregnancy is
Difficult 1 2 3 4 5 6 7 Easy

If I am anxious, upset or feeling stressed changing my diet during pregnancy would be
Difficult 1 2 3 4 5 6 7 Easy

If I am in a hurry changing my diet during pregnancy would be
Difficult 1 2 3 4 5 6 7 Easy

I am influenced by what others are eating
Strongly agree 1 2 3 4 5 6 7 Strongly disagree

Thank you for your time.

Appendix VI

Likert scale questionnaire for use at six months post partum

In this particular questionnaire I am mainly concerned with women's views towards food/diet during breastfeeding/lactation and weaning. I ask questions which make use of rating scales with seven places; you are asked to encircle the number which best describes your opinion. For example, if you were asked to rate the benefits of eating apples during breastfeeding/lactation and weaning on such a scale the seven places should be interpreted as follows:

Bad 1 2 3 4 5 6 7 Good

So if you rated the benefits of eating apples during pregnancy as 4 you would put a circle around the number 4.

Please remember to answer all questions – do not leave any out.
Do not put more than one circle on a single scale.

Do you have any questions?

Firstly, I need to know if you have been breastfeeding, and/or bottlefeeding and/or weaning your child.

1. Intentions towards eating habits
Do you intend to change your eating habits now that you are bottle/breastfeeding/weaning?

a. I intend to change my eating habits now that I am breast/bottlefeeding/weaning

Definitely do not 1 2 3 4 5 6 7 Definitely do

b. (i) I would like to change my eating habits now that I am breast/bottlefeeding/ weaning

Definitely yes 1 2 3 4 5 6 7 Definitely no

(ii) I want to change my eating habits now that I am breast/bottlefeeding/ weaning

Strongly agree 1 2 3 4 5 6 7 Strongly disagree

c. I expect to change my eating habits now that I am breast/bottlefeeding/weaning

Unlikely 1 2 3 4 5 6 7 Likely

2. Attitudes to eating habits
My changing my eating habits now that I am breast/bottlefeeding/weaning would be:

(a) Bad 1 2 3 4 5 6 7 Good
(b) Harmful 1 2 3 4 5 6 7 Beneficial
(c) Unpleasant 1 2 3 4 5 6 7 Pleasant
(d) Unenjoyable 1 2 3 4 5 6 7 Enjoyable

What a breastfeeding mother eats has an effect on the health of the child

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. Beliefs about eating habits
Changing my eating habits now that I am breast/bottlefeeding/weaning would:

(i) Make me healthier

Strongly agree 1 2 3 4 5 6 7 Strongly disagree

(ii) Make the baby healthier

Strongly agree 1 2 3 4 5 6 7 Strongly disagree

4. Health beliefs
Being healthier for me would be:

Bad 1 2 3 4 5 6 7 Good

Being healthier for the baby would be:

Bad 1 2 3 4 5 6 7 Good

5. Significant others
People who are important to me think I

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am breast/bottlefeeding/weaning

People who are important to me are indifferent to my changing my eating habits now that I am breast/bottlefeeding/weaning

Strongly agree 1 2 3 4 5 6 7 Strongly disagree

People who are important to me would:

Approve 1 2 3 4 5 6 7 Disapprove

of my changing my eating habits now that I am breast/bottlefeeding/weaning

I feel under social pressure to change my eating habits now that I am breast/bottlefeeding/weaning

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Media (magazines, newspapers, television) information has an important influence on my eating habits now that I am breast/bottlefeeding/weaning

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

6. Beliefs about significant others

My partner thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am breast/bottlefeeding/weaning

My doctor thinks I:

Should 1 2 3 4 5 6 7 Should not

The nurse thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am breast/bottlefeeding/weaning

or

The midwife/health visitor thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am breast/bottlefeeding/weaning

My family thinks I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am breast/bottlefeeding/weaning

My friends think I:

Should 1 2 3 4 5 6 7 Should not

change my eating habits now that I am breast/bottlefeeding/weaning

7. Influence of others on eating habits

With regard to your eating habits now that you are breast/bottlefeeding/weaning how much do you care what your partner thinks you should do?

Do not care at all 1 2 3 4 5 6 7 Care very much

With regard to your eating habits now that you are breast/bottlefeeding/weaning how much do you care what your doctor thinks you should do?

Do not care at all 1 2 3 4 5 6 7 Care very much

With regard to your eating habits now that you are breast/bottlefeeding/weaning how much do you care what the nurse thinks you should do?

Do not care at all 1 2 3 4 5 6 7 Care very much

With regard to your eating habits now that you are breast/bottlefeeding/weaning how much do you care what the midwife, health visitor thinks you should do?

Do not care at all 1 2 3 4 5 6 7 Care very much

With regard to your eating habits now that you are breast/bottlefeeding/weaning how much do you care what your family thinks you should do?

Do not care at all 1 2 3 4 5 6 7 Care very much

With regard to your eating habits now that you are breast/bottlefeeding/weaning how much do you care what your friends think you should do?

Do not care at all 1 2 3 4 5 6 7 Care very much

8. Personal control

Whether I do or do not change my eating habits now that I am breast/bottlefeeding/weaning is entirely up to me

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

How much control do you feel you have over changing your eating habits now that you are breast/bottlefeeding/weaning?

No control 1 2 3 4 5 6 7 Complete control

I would like to change my eating habits now that I am breast/bottlefeeding/weaning but I do not really know if I can

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I am confident that I could change my eating habits if I wanted to

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

For me to change my eating habits now that I am breast/bottlefeeding/weaning is

Difficult 1 2 3 4 5 6 7 Easy

Changing my eating habits would take time

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

People with whom I eat food would support me in changing my eating habits

Never 1 2 3 4 5 6 7 Frequently

9. Influential Factors

Understanding what to eat or avoid during breast/bottlefeeding/weaning is

Difficult 1 2 3 4 5 6 7 Easy

If I am anxious or upset changing my eating habits during breast/bottlefeeding/weaning would be

Difficult 1 2 3 4 5 6 7 Easy

If I am in a hurry changing my eating habits during breast/bottlefeeding/weaning would be

Difficult 1 2 3 4 5 6 7 Easy

I am influenced by what others are eating

Strongly agree 1 2 3 4 5 6 7 Strongly disagree

Are there any comments you would like to make about eating during breast/bottlefeeding/weaning?

Thank you for your time.

Appendix VII

Pink patient referral form

DIETARY RESEARCH

Patient's name...

This prima has been informed of the dietary research being carried out at this surgery and has agreed to her telephone number being passed to Mrs Olga Tuffery. Mrs Tuffery will then contact the patient direct to explain the research in detail and establish if the patient is interested in participating in the study.

....

Medical practitioner

Receptionist,
Please provide telephone number and patient details for Mrs Tuffery as necessary.

....
....
....
....

Appendix VIII

Patient information sheet

I am studying part-time for a Master of Philosophy degree by research through the University of West of England.

My area of interest is health education, in particular, the food choices people make.

I wish to research the food choices of women during and after pregnancy. The results of such research may highlight areas for improvement in health education with regard to food. (Name of doctor(s) here) have kindly agreed to my carrying out part of the research at (name of surgery here).

I am not a medical practitioner and I am not carrying out this research on behalf of any organisation.

I would like to interview a number of women who are pregnant for the first time to discuss food choices, cooking and shopping. For example, who in the family decides what food to buy, who cooks and what meal arrangements there are within the household. Such information would help me to decide if women change their diet during pregnancy and what those changes might be.

If you are interested in taking part in this study the general practitioner you see for your booking appointment will refer you to me at the end of your consultation. I will then discuss the research with you. This will allow you the opportunity to decide if you wish to become involved in the study. At this point I would answer any queries you have and show you the patient letter and consent form which I have prepared in accordance with the requirements of the medical research ethics committee. I would also ask you to complete a food diary for one week.

If you decide not to participate you do not have to give any reason. You may decide to take part in the study initially and then wish to withdraw at a later date. Again, you do not have to give a reason. Whatever you decide will not cause any inconvenience and your decision will not affect your relationship with your general practitioner in any way.

With your permission I would like to meet you again at your home, at a convenient time and date. This meeting would entail discussion the food diary and I would be interested in your views on food and health. I will not need access to your medical records but I would be interested to know if you experience any condition/symptoms which may affect your appetite or food choices.

I would like to see you again some time during your eighth or ninth month of pregnancy as I would be interested to know how your pregnancy has progressed and if your food intake and choices have changed in any way. I would once more require completion of a food diary.

Finally, I would like to visit you when your baby is six months old when I would again ask you food related questions.

All information you give me will be entirely confidential and will not be stored on any computer. It will not be necessary for me to identify you in any way and anonymity will be maintained throughout.

Mrs Eleanor O.C. Tuffery B.Sc (Hons) PGCE
Northlands Research and Development Unit
Northlands Surgery
North Street
Calne
Wilts

Appendix IX

Letter of acknowledgement

Northlands Research and Development Unit,
Northlands Surgery,
North Street,
CALNE
Wiltshire
SN11 OHH

Contact telephone number: 01249 815185

Date:

Dear

Thank you very much for agreeing to take part in this study of the diets of women during and after their first pregnancy.

The object of this research is to highlight areas for possible improvement in health promotion with respect to dietary advice for women during their first pregnancy.

I would wish, with your permission, to interview you during the early stages of pregnancy and then again during your eighth or ninth month. A third, and final interview would take place six months after the birth.

Any information you give will be treated in the strictest confidence and it will not be necessary for me to identify you in any way.

If for any reason you decide not to continue taking part in the study please feel free to withdraw at any time. In addition, any information you may have given up to that point will not be used without your permission.

I am not a medical practitioner and cannot advise on medical matters. However, if you have any queries or problems regarding this research, please feel free to contact me on 01249 815185.

Yours sincerely,

Eleanor O.C. Tuffery (Mrs)
Post-graduate research student

Appendix X

Consent Form

Study Title: ANTENATAL AND POSTNATAL DIETS OF PRIMAGRAVIDAE

Please complete the following questions:

	Please cross out as necessary
Have you read the Patient Information Sheet?	**Yes/No**
Have you had an opportunity to ask questions and discuss this study?	**Yes/No**
Have you received satisfactory answers to all your questions?	**Yes/No**
Have you received enough information about the study?	**Yes/No**

Who have you spoken to?...

Do you understand that you are free to withdraw from the study:

- **At any time**
- **Without having to give a reason for withdrawing**
- **And without affecting your future medical care** **Yes/No**

Do you agree to take part in this study? **Yes/No**

Signed................................. **Date..................**

Name in block letters...

Signed (researcher).......................... **Date..................**

Appendix XI

Diet diary

Please write down what you eat everyday. Thank you.

FOOD DIARY

Thank you for agreeing to complete this food diary. It is important that you note down everything you eat with approximate quantities. Please state if you take milk and sugar in tea or coffee and what toppings you put on bread. An example of one day's complete food intake is enclosed for your information.

....

MONDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

....

TUESDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

WEDNESDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

....

THURSDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

FRIDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

....

SATURDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

SUNDAY

Breakfast

Mid morning

Lunch

Afternoon

Evening meal

Bedtime/evening snacks

Any other snacks, food or drinks (including alcohol) over this 24 hours

Ref: BA 17/96

31 May 1996

Mrs Olga Tuffery
Post Graduate Research Student
Northlands Research & Development Unit
Northlands Surgery
North St
Calne

Dear Mrs Tuffery

BA 17/96 ***(This number must be quoted on all correspondence)***

A Psychological/Sociological Study of the Diets During and After First Pregnancy of Female Patients at a North Wilts Group Medical Practice.

This application to include the following documents was reviewed at the Bath Research Ethics meeting on the 23 May 1996.

a) Protocol
b) Consent Form/Patient lettter

Thsi Study was approved in principle, but may not proceed until a Patient Information Sheet is received and approved.

Yours sincerely

Doreen Howlett

Doreen Howlett
Co-chair

Wiltshire
Health Authority

Southgate House
Pans Lane
Devizes
SN10 5EQ

Telephone
(01380) 728899

Fax
248

Direct Line

DX 12153
Devizes

BATH LOCAL RESEARCH ETHICS COMMITTEE

R·U·H
Royal United Hospital Bath NHS Trust

30th November 1996

Mrs Eleanor Tuffery,
Northlands Research & Devt Unit,
Northlands Surgery,
Calne, Wilts

Direct tel/fax 01225 825725
JPDR/H

Dear Mrs Tuffery

BA17/96 ***(please quote this number on all correspondence)***
A Psychological/Sociological Study of the Diets during and after first Pregnancy of Female Patients at a North Wilts Group Medical Practice.

At the meeting on 28th November the Bath Local Research Ethics Committee received and approved the further copy of the Patient Consent Form, modified Patient Information Sheet and Food Diary, as supplied with your letter of 15th November.

Yours sincerely

Dr JPD Reckless
Chairman

3rd Interview 1\4

Appendix XIV

SH\27

Please write down what you eat everyday. Thank you.

FOOD DIARY

Thank you for agreeing to complete this food diary. It is important that you note down everything you eat with approximate quantities. Please state if you take milk and sugar in tea or coffee and what toppings you put on bread. An example of one day's completed food intake is enclosed for your information

---

MONDAY

Breakfast bran flakes, semi skimmed milk, glass orange juice

Mid Morning –

Lunch – lettuce, tomato, cucumber, sardines in olive oil [illegible]

Afternoon –

Evening Meal lasagne, [illegible] Salad [illegible] [illegible].

Bedtime/Evening Snacks 1 glass wine

Any other snacks, food or drinks (including alcohol) over this 24 hours 5 pts water

---

TUESDAY

Breakfast - banana, ½ apple, ½ tin pineapple in juice

Mid Morning – 1 [illegible] few raisins -

Lunch – 2 pieces fruit, 2 slices brown bread [illegible] [illegible]

Afternoon –

Evening Meal – Fish pie 1 potato white 3 [illegible] - broccoli [illegible] green beans

Bedtime/Evening Snacks 1 glass wine

Any other snacks, food or drinks(including alcohol) over this 24 hours [illegible] pts water

[illegible]

WEDNESDAY

Breakfast 5 fruits (banana, kiwi, ½ tin grapefruit, ½ apple
few raisins

Mid Morning —

Lunch Salad (tuna, sweetcorn (no added sugar or salt)
lettuce, tomato, cucumber

Afternoon
yoghurt

Evening Meal - Pasta with roasted vegetables

Bedtime/Evening Snacks 2 glasses wine

Any other snacks, food or drinks (including alcohol) over this 24 hours 6 pts water

---

THURSDAY

Breakfast 1 bowl muesli unsweetened with ½ tin pineapple

Mid Morning —

Lunch - 2 slices bread, cheese spread and coleslaw
1 packet salt and vinegar crisps

Afternoon

Evening Meal - breaded fish, salad and saute potatoes

Bedtime/Evening Snacks —

Any other snacks, food or drinks (including alcohol) over this 24 hours 6 - 7 pts water

FRIDAY

Breakfast muesli, Apricot yogurt 1 glass orange juice

Mid Morning —

Lunch lettuce, tomato, celery, carrot cheese and coleslaw (cabbage mayo carrot home made

Afternoon —

Evening Meal – chicken, (curry paste, tin tomatoes onion) basmati rice

Bedtime/Evening Snacks

2 glasses wine

Any other snacks, food or drinks (including alcohol) over this 24 hours 6pts water

---

SATURDAY

Breakfast yogurt (natural) with banana

Mid Morning –

Lunch muesli and yogurt

Afternoon —

Evening Meal lamb in gravy, mashed potato, leeks a cheese sauce, green beans apricot and almond pie cream

Bedtime/Evening Snacks —

Any other snacks, food or drinks (including alcohol) over this 24 hours

2 glasses wine
1 glass port. 7-8 pts water.

SUNDAY

Breakfast Scrambled eggs x 2 2 pieces smoked bacon (grilled
2 grilled tomatoes ½ can baked beans
(no sugar salt)

Mid Morning -- 2 slices white
bread and flora
butter. glass
orange
juice
(fresh squeezed

Lunch 2 slices beef
Parsnips, potatoes, carrots, broccoli
sprouts
fruit salad

Afternoon

Evening Meal - 2 beef sandwiches
(2 slices bread beef, mustard.

Bedtime/Evening Snacks

Any other snacks, food or drinks - 3-4 pts water
3 glasses wine.

Appendix XV

~~[illegible]~~
not breastfeeding
Height 1.80
Weight 63.50kg

Sample of Food consumption data collation, prior to computer nutrient analyses.

Food														Total
Branflakes	30g													30g
Semi-skimmed milk	1/3 pint													1/3 pint
Orange Juice	200	200	200 mls											600mls
Lettuce	20g	20g	20g	20g	20g									100g
Tomato	1 unit	1	1	1	1	units								5 units
Cucumber	5	5	5	5	5	slices								slices 25
Sardines	50g													50g
Celery	Stick	Stick	Stick	Stick										4 x Stick
Lasagne	Average	(Portion)												Ave portion
Wine (White, Dry)	1 x glass	1 x glass	2 x glass	2 x glass	3 x glass	3 x glass								12 x glass
Banana	1	1	1	1	medium									4
Apple	1/2	1	1/2											2
Pineapple	1/2	1/2	tin											1 tin

Six months post partum
not breastfeeding
Height 1.80
Weight 63.50kg

														Total
Kiwi	1	1	whole											2
Raisins	10g	10g												20g
Egg Mayonnaise	50g													50g
Brown Bread	2	2	Slices											4
Potato (Fish 3, white) Fish pie	1	average	portion											1
Brocolli	60g	60g												120g
Carrots	60g													60g
Green Beans	60g													60g
Grapefruit	1/2 tin													1/2 tin
Sprouts	1 portion													1
Yoghurt	60	125	125	mls										310mls
Tuna	100g													100g
Sweetcorn	60g													60g

Six Months post partum
Not breastfeeding
Height 1.80
Weight 63.50kg

														Total
Pasta	Portion	(Average)												1
Roasted Vegetables	100g													100g
Fruit Salad	Portion	(Average)												1
Muesli	100g	100g	100g											300g
Cheese	40g	40g												80g
Coleslaw	Ptn	Ptn	(Portion)											2ptn
Crisps	1	packet												1
Saute potatoes	1	portion												1
Yogurt (Apricot)	1													1
Raw Mustard & Cress	1 portion													1
Carrot Raw	1													1
Chicken Curry	1	average	portion											1
Basmati Rice	1	average	portion											1

not breastfeeding
Height 1.80
Weight 63.50kg

														Total
Lamb (Roast)	100g													100g
Beef (Roast)	100g	100g												200g
Gravy	40g													40g
Mashed Potato	Portion (Average)													1
Roast Potatoes	2 (average)													2
Leeks	60g													60g
Cheese Sauce	Portion (Average)													1
Apricot & Almond Pie	1 slice													1
Cream	1 portion (average)													1
Port	1 glass													1
Scrambled egg	2													2
Grilled Smoked Bacon	2 smoked rashers													2
Grilled Tomatoes	2													2

not breastfeeding
Height 1·80
Weight 63·50kg

5/5

														Total
Parsnips	Portion (Average)													1
Baked Beans	½ Can													½can
White Bread	2	2	slices											4
Utterly Butterly	18g													18g

Appendix XVI

Faculty of Applied Sciences
AVERAGED DIETARY ASSESSMENT

10:23

Reg.No : SH27
Surname :
Forenames :
Sex : Female
DoB : 29 Jan
Age : 29
Assessment Date :
Number of Days : 7
Weight : 63.50 kg
Height : 1.80 m
Body Mass Index : 19.6
Occupational activity : Light
Non-occupational activity : Light
Pregnancy : First trimester

Total number of foods : 58

Total weight : 10349.0 gm
per day : 1478.4 gm

RefNo	Weight	Percent	Food or Recipe
14045	1080.0	10.4	Bananas
19175	540.0	5.2	Beef stew
17190	540.0	5.2	Fruit drink/squash, concentrated,
13384	510.0	4.9	Tomatoes, raw
17230	500.0	4.8	White wine, dry
12184	500.0	4.8	Whole milk yogurt, plain
14012	500.0	4.8	Apples, eating, average, raw
11070	418.0	4.0	Brown bread, average
11137	400.0	3.9	Muesli, Swiss style
14107	360.0	3.5	Grapefruit, canned in juice
18324	360.0	3.5	Chicken, breast, grilled with
14123	300.0	2.9	Kiwi fruit
17228	250.0	2.4	Red wine
11099	245.0	2.4	White bread, average
13129	210.0	2.0	Peas, boiled in unsalted water
17089	200.0	1.9	Chocolate, milk
11349	200.0	1.9	Pizza
13345	180.0	1.7	Spinach, boiled in unsalted water
13046	177.0	1.7	Baked beans, canned in tomato
19251	160.0	1.5	Pasta with ham and mushroom sauce
13036	155.0	1.5	Potato crisps
13233	150.0	1.4	Cucumber, raw
14035	140.0	1.4	Apricots, canned in juice
14211	120.0	1.2	Pineapple, canned in juice
12147	112.0	1.1	Cottage cheese, plain
13200	110.0	1.1	Carrots, old, raw
11288	100.0	1.0	Cheesecake
671	100.0	1.0	Old potatoes, roast in blended oil
13285	100.0	1.0	Mushrooms, common, boiled in
16217	100.0	1.0	Sardines, canned in tomato sauce
18359	100.0	1.0	Turkey, light meat, roasted
13217	90.0	0.9	Cauliflower, boiled in unsalted
17021	90.0	0.9	Margarine, soft, polyunsaturated
18034	90.0	0.9	Beef, fore-rib/rib-roast, roasted,
13221	90.0	0.9	Celery, raw
12134	80.0	0.8	Cheese, Cheddar, average
14031	75.0	0.7	Apricots, dried
13196	70.0	0.7	Cabbage, white, raw

17097	65.0	0.6	Snickers
13193	60.0	0.6	Cabbage, Savoy, boiled in salted
12205	60.0	0.6	Ice cream, dairy, flavoured
12113	60.0	0.6	Cream, fresh, single
13264	60.0	0.6	Leeks, boiled in salted water
14242	60.0	0.6	Raisins
11359	60.0	0.6	Yorkshire pudding
12256	54.0	0.5	Butter
13266	50.0	0.5	Lettuce, average, raw
14845	48.0	0.5	Sunflower seeds
14842	45.0	0.4	Pumpkin seeds
13172	45.0	0.4	Broccoli, green, boiled in
17311	40.0	0.4	Gravy instant granules, made up
17380	36.0	0.3	Yeast extract
12277	30.0	0.3	Mayonnaise
11185	26.0	0.3	Shortbread
11187	21.0	0.2	Water biscuits
14109	12.0	0.1	Grapes, average
17363	10.0	-	Mustard, powder, made up
5091	5.00	-	Garlic, raw
Total	10349.0		

Source of 239.6 gm of Carbohydrate per day (7 days)
from 1478 gm food

		Qty	%age	0 10 2
11137	Muesli, Swiss	40.6	17.0	**********************************
14045	Bananas	35.8	14.9	*****************************
11070	Brown bread,	26.5	11.0	**********************
11099	White bread,	17.3	7.2	**************
17089	Chocolate, milk	16.3	6.8	*************
13036	Potato crisps	10.9	4.6	*********
14012	Apples, eating,	8.43	3.5	*******
11349	Pizza	7.09	3.0	******
14242	Raisins	5.94	2.5	****
17097	Snickers	5.60	2.3	****
12184	Whole milk	5.57	2.3	****
14031	Apricots, dried	4.65	1.9	***
14123	Kiwi fruit	4.54	1.9	***
19175	Beef stew	3.86	1.6	***
17190	Fruit	3.86	1.6	***
14107	Grapefruit,	3.75	1.6	***
00671	Old potatoes,	3.70	1.5	***
11288	Cheesecake	3.63	1.5	***
13046	Baked beans,	3.16	1.3	**
13129	Peas, boiled in	3.00	1.3	**
19251	Pasta with ham	2.67	1.1	**
11185	Shortbread	2.37	1.0	*
11187	Water biscuits	2.27	0.9	*
13384	Tomatoes, raw	2.26	0.9	*
11359	Yorkshire	2.12	0.9	*
12205	Ice cream,	2.12	0.9	*
14211	Pineapple,	2.09	0.9	*
14035	Apricots,	1.68	0.7	*
14845	Sunflower seeds	1.28	0.5	*
13200	Carrots, old,	1.24	0.5	*
14842	Pumpkin seeds	0.98	0.4	

13196	Cabbage, white,	0.50	0.2	
17230	White wine, dry	0.43	0.2	
12113	Cream, fresh,	0.35	0.1	
12147	Cottage cheese,	0.34	0.1	
13233	Cucumber, raw	0.32	0.1	
13217	Cauliflower,	0.27	0.1	
14109	Grapes, average	0.26	0.1	
13264	Leeks, boiled	0.22	0.1	
13345	Spinach, boiled	0.21	0.1	
16217	Sardines,	0.20	0.1	
05091	Garlic, raw	0.19	0.1	
13193	Cabbage, Savoy,	0.19	0.1	
17380	Yeast extract	0.18	0.1	
17311	Gravy instant	0.17	0.1	
17363	Mustard,	0.15	0.1	
13266	Lettuce,	0.12	0.1	
13221	Celery, raw	0.12	0.0	
17228	Red wine	0.07	0.0	
13172	Broccoli,	0.07	0.0	
13285	Mushrooms,	0.06	0.0	
17021	Margarine,	0.03	0.0	

Energy Profile	kcal Total	Daily	per 100g	Percent	Popul.Avg Tot	& Food
Protein	2385	341	23	16.4	15%	15%
Carbohydrate	6290	899	61	43.4	47%	50%
Fat	5341	763	52	36.8	33%	35%
Alcohol	487	70	5	3.4	5%	0%
Total	14503	2072	140			

Source of 2072 kcal energy per day (7 days) from 1478 gm food
106.8% of 1940 kcal E.A.R. (M & W)

	kcal	%age	0 ... 50 ... 100
Protein	341	16.4	******
Total Carbohydrate	899	43.4	*****************
of sugars	470	22.7	*********
of starch	418	20.2	********
of un-id sugars	10	0.5	
Total Fat	763	36.8	**************.
of mono-unsaturated	200	9.7	***
of poly-unsaturated	131	6.3	**
of saturated	235	11.4	****
of un-id fats	196	9.5	***
Alcohol	70	3.4	*

Nutrient		Intake	per Day	R.N.I.	
Water	gm	e7114.8	1016.4	---	
Energy (kcal)	Cal	d 14514	2073	1940	*
Energy (kJ)	kJ	d 60941	8706	8120	*
Protein	gm	596.3	85.2	72.8	
Fat	gm	593.4	84.8	71.1	*
Saturated fatty acids	gm	m 183.1	26.2	21.6	*
Mono-unsaturated fatty acids	gm	m 155.7	22.2	25.9	*
Poly-unsaturated fatty acids	gm	m 101.9	14.6	12.9	*
Cholesterol	mgm	m1162	166	---	
Carbohydrate	gm	d1677.4	239.6	243.1	*
Starch	gm	m 781.1	111.6	---	
Total Sugars	gm	m 876.7	125.2	---	
Alcohol	gm	69.5	9.9	---	
Dietary fibre, Southgate method	gm	+ 216.3	30.9	---	
Dietary fibre, Englyst method	gm	m 143.5	20.5	18.0	
Sodium (Na)	mgm	e 17677	2525	1600	
Calcium (Ca)	mgm	6010	859	700	
Iron (Fe)	mgm	104.08	14.87	14.80	
Iodine (I)	ugm	m 733	105	140	
Zinc (Zn)	mgm	+ 76.19	10.88	7.00	
Total retinol equivalent	ugm	+7733	1105	700	
Retinol	ugm	m1928	275	---	
Carotene	ugm	m 31147	4450	---	
Thiamin	mgm	+ 12.00	1.71	0.78	
Riboflavin	mgm	+ 15.94	2.28	1.40	
Niacin	mgm	+ 197.06	28.15	12.80	
Vitamin B6	mgm	m 20.33	2.90	1.09	
Folate	ugm	+2452	350	300	
Vitamin B12	ugm	29.3	4.2	1.5	
Vitamin C	mgm	814	116	50	
Vitamin D	ugm	e 20.66	2.95	10.00	
Vitamin E	mgm	m 96.76	13.82	---	

Nutrient intake per day (7 days) from 1478 gm food
as a percentage of R.N.I.

```
                    %DRV 0                  100                    200
Energy (kcal)      106.9 |*******************|*                   |
Energy (kJ)        107.2 |*******************|*                   |
Protein            117.1 |*******************|***                 |
Fat                119.2 |*******************|***                 |
Saturated fats     121.4 |*******************|****                |
Mono-unsat.fats     86.0 |*****************  |                    |
Poly-unsat.fats    112.5 |*******************|**                  |
Carbohydrate        98.6 |*******************|                    |
Englyst fibre      113.9 |*******************|**                  |
Sodium (Na)        157.8 |*******************|***********         |
Calcium (Ca)       122.7 |*******************|****                |
Iron (Fe)          100.5 |*******************|                    |
Iodine (I)          74.8 |**************     |                    |
Zinc (Zn)          155.5 |*******************|***********         |
Tot.retinol.eqv    157.8 |*******************|***********         |
Thiamin            220.9 |*******************|*******************|
Riboflavin         162.6 |*******************|************        |
Niacin             219.9 |*******************|*******************|
Vitamin B6         266.1 |*******************|*******************|
```

Folate	116.8	|*******************|*** |
Vitamin B12	279.0	|******************|******************|
Vitamin C	232.6	|******************|******************|
Vitamin D	29.5	|***** | |

Key. For one or more contributory foods :-
d: nutrient computed by difference method. e: nutrient estimated.
+: present in significant, unknown amounts. m: missing value.
Dietary Reference Values marked * are Estimated Average Requirement

Bath Spa University College
Faculty of Applied Sciences
AVERAGED DIETARY ASSESSMENT

10:51

Reg.No : SH27 Assessment Date :
Surname : Number of Days : 7
Forenames :
Sex : Female Weight : 69.85 kg
DoB : 29 Jan Height : 1.80 m
Age : 29 Body Mass Index : 21.6
Occupational activity : Light
Non-occupational activity : Light
Pregnancy : Third trimester

Total number of foods : 49 Total weight : 8359.5 gm
per day : 1194.2 gm

RefNo	Weight	Percent	Food or Recipe
17230	625.0	7.5	White wine, dry
14284	600.0	7.2	Orange juice concentrate,
14171	450.0	5.4	Nectarines
11099	385.0	4.6	White bread, average
13005	320.0	3.8	New potatoes, in skins, boiled in
14045	300.0	3.6	Bananas
12188	250.0	3.0	Low fat yogurt, plain
11137	250.0	3.0	Muesli, Swiss style
14107	240.0	2.9	Grapefruit, canned in juice
14188	240.0	2.9	Peaches, canned in juice
14037	217.5	2.6	Avocado, average
13408	210.0	2.5	Chips, homemade, fried in
14012	200.0	2.4	Apples, eating, average, raw
19030	200.0	2.4	Beefburgers, chilled/frozen,
18021	200.0	2.4	Beef, fillet steak, grilled, lean
12806	200.0	2.4	Eggs, chicken, boiled
13010	180.0	2.2	Old potatoes, baked, flesh and
12277	180.0	2.2	Mayonnaise
5087	180.0	2.2	Courgettes/zucchini/squash, raw
13369	180.0	2.2	Sweetcorn, kernels, boiled in
16239	180.0	2.2	Prawns, boiled
13319	160.0	1.9	Peppers, capsicum, green, boiled
18307	160.0	1.9	Chicken, breast, casseroled, meat
12134	140.0	1.7	Cheese, Cheddar, average
14035	140.0	1.7	Apricots, canned in juice
11124	135.0	1.6	White rolls, soft
17021	135.0	1.6	Margarine, soft, polyunsaturated
13286	132.0	1.6	Mushrooms, common, fried in corn
15077	120.0	1.4	Coleslaw, with mayonnaise, retail
15301	120.0	1.4	Salad, tomato and onion
14211	120.0	1.4	Pineapple, canned in juice
14123	120.0	1.4	Kiwi fruit
18324	100.0	1.2	Chicken, breast, grilled with
15296	100.0	1.2	Salad, potato, with mayonnaise
5156	100.0	1.2	Cashew nuts
11171	90.0	1.1	Flapjacks
13346	90.0	1.1	Spinach, frozen, boiled in
19080	80.0	1.0	Pork sausages, chilled, grilled

13285	60.0	0.7	Mushrooms, common, boiled in
13185	60.0	0.7	Cabbage, boiled in unsalted water,
13191	60.0	0.7	Cabbage, red, boiled in salted
11168	60.0	0.7	Crispbread, rye
19023	60.0	0.7	Ham
13304	60.0	0.7	Onions, raw
15292	60.0	0.7	Salad, green
11119	48.0	0.6	Brown rolls, soft
13036	28.0	0.3	Potato crisps
17380	18.0	0.2	Yeast extract
17078	16.0	0.2	Marmalade
Total	8359.5		

Source of 197.2 gm of Carbohydrate per day (7 days)
from 1194 gm food

```
                             Qty   %age 0                   10                   2
14284 Orange juice           38.5  19.5 |*******************|*******************
11099 White bread,           27.1  13.8 |*******************|*******
11137 Muesli, Swiss          25.4  12.9 |*******************|*****
11124 White rolls,           10.0   5.0 |**********         |
14045 Bananas                9.94   5.0 |**********         |
13408 Chips,                 9.03   4.6 |*********          |
13010 Old potatoes,          8.15   4.1 |********           |
11171 Flapjacks              7.77   3.9 |*******            |
13005 New potatoes,          7.04   3.6 |*******            |
11168 Crispbread, rye        6.05   3.1 |******             |
14171 Nectarines             5.79   2.9 |*****              |
13369 Sweetcorn,             5.04   2.6 |*****              |
05156 Cashew nuts            3.99   2.0 |****               |
11119 Brown rolls,           3.55   1.8 |***                |
14012 Apples, eating,        3.37   1.7 |***                |
14188 Peaches, canned        3.33   1.7 |***                |
12188 Low fat yogurt,        2.68   1.4 |**                 |
14107 Grapefruit,            2.50   1.3 |**                 |
14211 Pineapple,             2.09   1.1 |**                 |
13036 Potato crisps          1.97   1.0 |**                 |
14123 Kiwi fruit             1.82   0.9 |*                  |
15296 Salad, potato,         1.74   0.9 |*                  |
14035 Apricots,              1.68   0.9 |*                  |
17078 Marmalade              1.59   0.8 |*                  |
05087                        1.16   0.6 |*                  |
19080 Pork sausages,         1.12   0.6 |*                  |
15077 Coleslaw, with         0.72   0.4 |                   |
15301 Salad, tomato          0.69   0.3 |                   |
13304 Onions, raw            0.68   0.3 |                   |
13319 Peppers,               0.59   0.3 |                   |
14037 Avocado,               0.59   0.3 |                   |
17230 White wine, dry        0.54   0.3 |                   |
13191 Cabbage, red,          0.20   0.1 |                   |
13185 Cabbage, boiled        0.19   0.1 |                   |
15292 Salad, green           0.15   0.1 |                   |
17380 Yeast extract          0.09   0.0 |                   |
19023 Ham                    0.09   0.0 |                   |
13346 Spinach,               0.06   0.0 |                   |
13286 Mushrooms,             0.06   0.0 |                   |
12277 Mayonnaise             0.05   0.0 |                   |
```

17021	Margarine	0.04	0.0	
13285	Mushrooms,	0.03	0.0	
19030	Beefburgers,	0.03	0.0	
12134	Cheese,	0.02	0.0	

Energy Profile	kcal Total	Daily	per 100g	Percent	Popul.Avg Tot	& Food
Protein	2083	298	25	15.0	15%	15%
Carbohydrate	5175	739	62	37.3	47%	50%
Fat	6205	886	74	44.8	33%	35%
Alcohol	398	57	5	2.9	5%	0%
Total	13861	1980	166			

Source of 1980 kcal energy per day (7 days) from 1194 gm food
92.5% of 2140 kcal E.A.R. (M & W)

	kcal	%age	0 ... 50 ... 100
Protein	298	15.0	******
Total Carbohydrate	739	37.3	**************
of sugars	350	17.7	*******
of starch	367	18.5	*******
of un-id sugars	23	1.1	
Total Fat	886	44.8	*****************
of mono-unsaturated	329	16.6	******
of poly-unsaturated	185	9.3	***
of saturated	192	9.7	***
of un-id fats	181	9.1	***
Alcohol	57	2.9	*

Nutrient		Intake	per Day	R.N.I.	
Water	gm	e5454.4	779.2	---	
Energy (kcal)	Cal	d 13766	1967	2140	*
Energy (kJ)	kJ	d 57445	8206	8957	*
Protein	gm	520.8	74.4	80.3	
Fat	gm	e 689.4	98.5	78.5	*
Saturated fatty acids	gm	m 149.6	21.4	23.8	*
Mono-unsaturated fatty acids	gm	m 255.7	36.5	28.5	*
Poly-unsaturated fatty acids	gm	m 143.7	20.5	14.3	*
Cholesterol	mgm	m2293	328	---	
Carbohydrate	gm	d1380.1	197.2	268.2	*
Starch	gm	m 685.0	97.9	---	
Total Sugars	gm	m 652.6	93.2	---	
Alcohol	gm	56.9	8.1	---	
Dietary fibre, Southgate method	gm	+ 125.5	17.9	---	
Dietary fibre, Englyst method	gm	m 96.0	13.7	18.0	
Sodium (Na)	mgm	e 14721	2103	1600	
Calcium (Ca)	mgm	3964	566	700	
Iron (Fe)	mgm	86.11	12.30	14.80	
Iodine (I)	ugm	m 735	105	140	
Zinc (Zn)	mgm	+ 63.75	9.11	7.00	
Total retinol equivalent	ugm	e3699	528	700	
Retinol	ugm	m1925	275	---	
Carotene	ugm	m9391	1342	---	
Thiamin	mgm	e 10.79	1.54	0.86	

```
Riboflavin          mgm   e  11.44     1.63     1.40
Niacin              mgm   e 137.08    19.58    14.12
Vitamin B6          mgm   m  17.66     2.52     1.20
Folate              ugm   +2270      324      300
Vitamin B12         ugm   e  31.8      4.5      1.5
Vitamin C           mgm    2050      293      50
Vitamin D           ugm   +  23.71     3.39    10.00
Vitamin E           mgm   m 115.53    16.50     ---
```

Nutrient intake per day (7 days) from 1194 gm food
as a percentage of R.N.I.

```
                    %DRV 0                  100                  200
Energy (kcal)       91.9 |******************  |                   |
Energy (kJ)         91.6 |******************  |                   |
Protein             92.7 |******************  |                   |
Fat                125.5 |*******************|*****              |
Saturated fats      89.9 |*****************   |                   |
Mono-unsat.fats    128.0 |*******************|*****              |
Poly-unsat.fats    143.9 |*******************|********           |
Carbohydrate        73.5 |**************      |                   |
Englyst fibre       76.2 |***************     |                   |
Sodium (Na)        131.4 |*******************|******             |
Calcium (Ca)        80.9 |****************    |                   |
Iron (Fe)           83.1 |****************    |                   |
Iodine (I)          75.0 |**************      |                   |
Zinc (Zn)          130.1 |*******************|******             |
Tot.retinol.eqv     75.5 |***************     |                   |
Thiamin            180.0 |*******************|****************   |
Riboflavin         116.7 |*******************|***                |
Niacin             138.6 |*******************|*******            |
Vitamin B6         209.6 |*******************|*******************|
Folate             108.1 |*******************|*                  |
Vitamin B12        303.0 |*******************|*******************|
Vitamin C          585.7 |*******************|*******************|
Vitamin D           33.9 |******              |                   |
```

Key. For one or more contributory foods :-
d: nutrient computed by difference method. e: nutrient estimated.
+: present in significant, unknown amounts. m: missing value.
Dietary Reference Values marked * are Estimated Average Requirement

Bath Spa University College
Faculty of Applied Sciences
AVERAGED DIETARY ASSESSMENT

11:17

Reg.No : SH27
Surname :
Forenames :
Sex : Female
DoB : 29 Jan
Age : 29

Assessment Date : 4 Mar
Number of Days : 7

Weight : 63.50 kg
Height : 1.80 m
Body Mass Index : 19.6

Occupational activity : Light
Non-occupational activity : Light
Lactation : No

Total number of foods : 58

Total weight : 9729.5 gm
per day : 1389.9 gm

RefNo	Weight	Percent	Food or Recipe
17230	1500.0	15.4	White wine, dry
14283	600.0	6.2	Orange juice, unsweetened
13384	425.0	4.4	Tomatoes, raw
19238	420.0	4.3	Lasagne, chilled/frozen, reheated
14045	400.0	4.1	Bananas
12184	375.0	3.9	Whole milk yogurt, plain
11137	300.0	3.1	Muesli, Swiss style
12008	292.5	3.0	Semi-skimmed milk, average
655	250.0	2.6	Fish pie
18005	200.0	2.1	Beef, average, fat, cooked
14012	200.0	2.1	Apples, eating, average, raw
17384	200.0	2.1	Pasta based meal
5216	200.0	2.1	Chicken curry, without bone
11043	180.0	1.9	White rice, easy cook, boiled
13044	177.0	1.8	Baked beans, canned in tomato
13015	175.0	1.8	Old potatoes, mashed with
671	170.0	1.7	Old potatoes, roast in blended oil
13407	165.0	1.7	Chips, homemade, fried in blended
14211	160.0	1.6	Pineapple, canned in juice
13265	160.0	1.6	Leeks, boiled in unsalted water
11070	152.0	1.6	Brown bread, average
14099	140.0	1.4	Fruit salad, homemade
11099	140.0	1.4	White bread, average
17234	125.0	1.3	Port
17393	125.0	1.3	Yogurt, fruit
15077	120.0	1.2	Coleslaw, with mayonnaise, retail
14107	120.0	1.2	Grapefruit, canned in juice
12811	120.0	1.2	Eggs, chicken, scrambled, with
14123	120.0	1.2	Kiwi fruit
13233	120.0	1.2	Cucumber, raw
13386	120.0	1.2	Tomatoes, grilled
13221	120.0	1.2	Celery, raw
11308	110.0	1.1	Fruit pie, one crust
18100	100.0	1.0	Lamb, average, trimmed fat, cooked
13266	100.0	1.0	Lettuce, average, raw
15345	100.0	1.0	Vegetable stir fry mix, fried in
16027	100.0	1.0	Cod, coated in crumbs, frozen,
16229	100.0	1.0	Tuna, canned in brine, drained

13179	90.0	0.9	Brussels sprouts, boiled in
13172	90.0	0.9	Broccoli, green, boiled in
12134	80.0	0.8	Cheese, Cheddar, average
13314	65.0	0.7	Parsnip, boiled in unsalted water
12269	62.0	0.6	Cheese sauce, made with
13084	60.0	0.6	Green beans/French beans, frozen,
14242	60.0	0.6	Raisins
12277	60.0	0.6	Mayonnaise
13371	60.0	0.6	Sweetcorn, kernels, canned,
13200	60.0	0.6	Carrots, old, raw
13202	60.0	0.6	Carrots, old, boiled in unsalted
16217	50.0	0.5	Sardines, canned in tomato sauce
12806	50.0	0.5	Eggs, chicken, boiled
19003	50.0	0.5	Bacon rashers, back, grilled
17311	40.0	0.4	Gravy instant granules, made up
11128	30.0	0.3	Bran Flakes
12116	30.0	0.3	Cream, fresh, double
13036	28.0	0.3	Potato crisps
17021	18.0	0.2	Margarine, soft, polyunsaturated
17363	5.00	-	Mustard, powder, made up
Total	9729.5		

Source of 171.7 gm of Carbohydrate per day (7 days)
from 1390 gm food

		Qty	%age	0 10 2
11137	Muesli, Swiss	30.5	17.7	******************* ***************
14045	Bananas	13.3	7.7	***************
11099	White bread,	9.86	5.7	***********
11070	Brown bread,	9.62	5.6	***********
19238	Lasagne,	9.42	5.5	**********
11043	White rice,	7.95	4.6	*********
14283	Orange juice,	7.54	4.4	********
13407	Chips,	7.09	4.1	********
00671	Old potatoes,	6.29	3.7	*******
14242	Raisins	5.94	3.5	******
11308	Fruit pie, one	4.51	2.6	*****
00655	Fish pie	4.39	2.6	*****
12184	Whole milk	4.18	2.4	****
13015	Old potatoes,	3.88	2.3	****
13044	Baked beans,	3.87	2.3	****
14012	Apples, eating,	3.37	2.0	***
11128	Bran Flakes	2.99	1.7	***
14211	Pineapple,	2.79	1.6	***
14099	Fruit salad,	2.76	1.6	***
17393	Yogurt, fruit	2.46	1.4	**
17384	Pasta based	2.43	1.4	**
13371	Sweetcorn,	2.28	1.3	**
16027	Cod, coated in	2.17	1.3	**
17234	Port	2.14	1.2	**
12008	Semi-skimmed	2.09	1.2	**
13036	Potato crisps	1.97	1.1	**
13384	Tomatoes, raw	1.88	1.1	**
14123	Kiwi fruit	1.82	1.1	**
13386	Tomatoes,	1.53	0.9	*
17230	White wine, dry	1.29	0.7	*
14107	Grapefruit,	1.25	0.7	*

13314	Parsnip, boiled	1.20	0.7	*
15345	Vegetable stir	0.91	0.5	*
12269	Cheese sauce,	0.81	0.5	
15077	Coleslaw, with	0.72	0.4	
13200	Carrots, old,	0.68	0.4	
05216	Chicken curry,	0.63	0.4	
13265	Leeks, boiled	0.59	0.3	
13179	Brussels	0.45	0.3	
13202	Carrots, old,	0.42	0.2	
13084	Green	0.40	0.2	
13233	Cucumber, raw	0.26	0.1	
13266	Lettuce,	0.24	0.1	
17311	Gravy instant	0.17	0.1	
13221	Celery, raw	0.15	0.1	
13172	Broccoli,	0.14	0.1	
12116	Cream, fresh,	0.12	0.1	
12811	Eggs, chicken,	0.10	0.1	
16217	Sardines,	0.10	0.1	
17363	Mustard,	0.07	0.0	

Energy Profile	kcal Total	Daily	per 100g	Percent	Popul.Avg Tot	& Food
Protein	1561	223	16	12.8	15%	15%
Carbohydrate	4507	644	46	37.1	47%	50%
Fat	4993	713	51	41.1	33%	35%
Alcohol	1095	156	11	9.0	5%	0%
Total	12156	1737	125			

Source of 1737 kcal energy per day (7 days) from 1390 gm food
69.7% of 2490 kcal E.A.R. (M & W)

	kcal	%age	0 — 50 — 100
Protein	223	12.8	*****
Total Carbohydrate	644	37.1	**************
of sugars	291	16.7	******
of starch	349	20.1	********
of un-id sugars	4	0.2	
Total Fat	713	41.1	****************
of mono-unsaturated	237	13.7	*****
of poly-unsaturated	95	5.5	**
of saturated	230	13.2	*****
of un-id fats	151	8.7	***
Alcohol	156	9.0	***

Nutrient		Intake	per Day	R.N.I.
Water	gm	+6940.0	991.4	---
Energy (kcal)	Cal	d 12151	1736	2490 *
Energy (kJ)	kJ	d 50798	7257	10422*
Protein	gm	390.3	55.8	93.4
Fat	gm	554.8	79.3	91.3 *
Saturated fatty acids	gm	m 178.7	25.5	27.7 *
Mono-unsaturated fatty acids	gm	m 184.4	26.3	33.2 *
Poly-unsaturated fatty acids	gm	m 74.2	10.6	16.6 *
Cholesterol	mgm	m1476	211	---
Carbohydrate	gm	d1201.8	171.7	312.1 *
Starch	gm	m 652.2	93.2	---
Total Sugars	gm	m 542.6	77.5	---
Alcohol	gm	156.4	22.3	---
Dietary fibre, Southgate method	gm	+ 134.2	19.2	---
Dietary fibre, Englyst method	gm	m 99.4	14.2	18.0
Sodium (Na)	mgm	e 13658	1951	1600
Calcium (Ca)	mgm	4506	644	1250
Iron (Fe)	mgm	89.57	12.80	14.80
Iodine (I)	ugm	m 724	103	140
Zinc (Zn)	mgm	+ 45.86	6.55	9.50
Total retinol equivalent	ugm	+5398	771	950
Retinol	ugm	m1945	278	---
Carotene	ugm	m 20436	2919	---
Thiamin	mgm	+ 9.55	1.36	1.00
Riboflavin	mgm	+ 8.75	1.25	1.60
Niacin	mgm	+ 105.77	15.11	22.16
Vitamin B6	mgm	m 16.64	2.38	1.40
Folate	ugm	+1977	282	260
Vitamin B12	ugm	+ 31.5	4.5	2.0
Vitamin C	mgm	+ 863	123	70
Vitamin D	ugm	+ 16.59	2.37	10.00
Vitamin E	mgm	m 68.20	9.74	---

Nutrient intake per day (7 days) from 1390 gm food
as a percentage of R.N.I.

	%DRV	0	100	200
Energy (kcal)	69.7	*************		
Energy (kJ)	69.6	*************		
Protein	59.7	***********		
Fat	86.8	****************		
Saturated fats	92.3	*****************		
Mono-unsat.fats	79.4	***************		
Poly-unsat.fats	63.9	************		
Carbohydrate	55.0	***********		
Englyst fibre	78.9	***************		
Sodium (Na)	121.9	*******************	****	
Calcium (Ca)	51.5	**********		
Iron (Fe)	86.5	****************		
Iodine (I)	73.9	**************		
Zinc (Zn)	69.0	*************		
Tot.retinol.eqv	81.2	***************		
Thiamin	137.0	*******************	*******	
Riboflavin	78.1	***************		
Niacin	68.2	*************		
Vitamin B6	169.7	*******************	*************	

```
Folate              108.6 |********************|*                   |
Vitamin B12         225.4 |********************|********************|
Vitamin C           176.1 |********************|***************     |
Vitamin D            23.7 |****                |                    |
```

Key. For one or more contributory foods :-
d: nutrient computed by difference method. e: nutrient estimated.
[illegible] in significant unknown amounts. m: missing value