UNIVERSITY OF SOUTHAMPTON

TO WHAT EXTENT DO SOCIO-ECONOMIC STATUS, KNOWLEDGE, AND CONFIDENCE IN COOKING SKILLS ACCOUNT FOR YOUNG WOMEN'S CHOICE OF A DIET LOW IN FAT AND HIGH IN FRUIT AND VEGETABLES. WHAT OTHER FACTORS MAY INFLUENCE FOOD CHOICE IN THIS GROUP?

by

Judy Margaret Lawrence

Doctor of Philosophy

Department of Human Nutrition

Faculty of Medicine, Health and Biological Sciences

September 2002

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF MEDICINE, HEALTH AND BIOLOGICAL SCIENCES

HUMAN NUTRITION

Doctor of Philosophy

TO WHAT EXTENT DO SOCIO-ECONOMIC STATUS, KNOWLEDGE, AND CONFIDENCE IN COOKING SKILLS, ACCOUNT FOR YOUNG WOMEN'S CHOICE OF A DIET LOW IN FAT AND HIGH IN FRUIT AND VEGETABLES. WHAT OTHER FACTORS MAY INFLUENCE FOOD CHOICE IN THIS GROUP?

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There is a consensus of agreement as to which healthy eating messages are appropriate to reduce the risks of the 'diseases of affluence'. There is also broad agreement amongst sociologists and psychologists as to the influence of knowledge and attitudes on behaviour. Certain sections of the population choose to eat a diet that is low in fat and/or high in fruit and vegetables. However public health initiatives are often not successful at changing food choice in other sections of the population. It is important that we fully understand the factors that influence food choice if we are to be more effective at changing eating patterns to reduce the incidence of disease and ill health. This thesis aims to contribute to knowledge in this important area by examining the extent to which socio-economic factors, knowledge and confidence in cooking skills account for the choice of a low fat and high fruit and vegetable intake.

An analysis of data provided by a Health and Lifestyle Survey was used to give an insight into the relative contribution of socio-economic status, knowledge and confidence in ones cooking skills to low fat and high fruit and vegetable intake. National Food Survey data was also used to explore the effect of low income on food purchasing.

Cumulative % variation accounted for by the effects of variables on low fat and high fruit and vegetable consumption in young women with odds ratio & 95% confidence intervals

Variables	Low fat intake	High fruit & vegetable intake
Socio-economic factors	0.8, (1.05, 0.65-1.71)	4.5, (1.17, 0.77-1.80)
& confidence in cooking skills	1.2, (1.34, 0.92-1.95)	5.7, (1.68, 1.19-2.34)
& being normal weight	1.3, (1.12, 0.77-1.60)	8.5, (1.01, 0.72-1.41)
& never smoked	1.3, (0.93, 1.02-0.70)	8.5, (0.95, 0.68-1.33)
& 'Prices are affordable'	2.2, (1.62, 1.07-2.45)	8.8, (0.76, 0.52-1.12)

Results show that only a small amount of the variation in choice of a high fruit and vegetable intake can be accounted for by socio-economic factors such as employment, education and tenure. Confidence in cooking skills, body mass index and cigarette smoking explain a further proportion of the variance but all the factors taken together only account for 8.8% of the variation in food choice. These factors combined explain only 2.2% of the variance in low fat intake.

This thesis contributes to knowledge by examining considerations in the food choice of a specific section of the population. The thesis draws together the work of different specialists in the nutrition field and proposes that part of the lack of success of healthy eating initiatives may be explained by the suggestion that the factors which campaigns concentrate on changing account for only a small proportion of the total variation in intake. If we are to be successful in our attempts to change peoples eating habits more research will be needed to find other factors that have a greater influence on food choice.

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Acknowledgements

I would like to thank Dr Barrie Margetts, my supervisor for his patience, honesty and support.

I would like to thank my parents for their childminding skills and my father for proof reading this thesis.

Finally I would like to thank Tony for his belief in me.

Definitions and Abbreviations

Basal Metabolic Rate (BMR)
Body Mass Index (BMI)
Coronary Heart Disease (CHD)
Confidence Interval (CI)
Confidence Limits (CL)
Continuing Survey of Food Intakes by Individuals (CSFII)
Correlation Coefficient (*r*)
Cronbach's alpha (a model of internal consistency used in reliability analysis, based on the average inter-item correlation)
Data In Data Out (DIDO)
Diet Quality Index (DQI)
Dietary Instrument for Nutrition Education (DINE)
Dietary Reference Values (DRV)
Estimated Average Requirements (EAR)
European Prospective Investigation into Cancer and Nutrition (EPIC)
European Union (EU)
Food Frequency Questionnaire (FFQ)
Gross Domestic Product (GDP)
Head of Household (HOH)
Health Education Authority (HEA)
Healthy Eating Index (HEI)
Health Development Agency (HDA)
Institute of European Food Studies (IEFS)
Look After Your Heart (LAYH)
Lower Reference Nutrient Intake (LRNI)
Medical Research Council (MRC)
Ministry of Agriculture, Fisheries and Food (MAFF)
MONICA an international study conducted under the auspices of the World Health Organisation to monitor trends in and determinants of mortality from cardiovascular disease
National Advisory Committee on Nutrition Education (NACNE)
National Food Guide (NFG)
National Food Survey (NFS)

National Health and Nutrition Examination Survey (NHANES)
National Survey of Health and Development (NSHD)
Nation-wide Food Consumption Survey (NFCS)
Non-Starch Polysaccharides (NSP)
Nutrition Task Force (NTF)
Odds Ratio (OR)
Office of Populations, Censuses and Surveys (OPCS)
Para Amino Benzoic Acid (PABA)
Physical activity level (PAL)
Polyunsaturated Fatty Acid (PUFA)
Recommended Daily Amount (RDA)
Reference Nutrient Intake (RNI)
Regional Health Authorities (RHA)
Saturated Fatty Acid (SFA)
Statistical Package for Social Science (SPSS)
Second National Health and Nutrition Examination Survey (NHANES II)
Socio-economic Status (SES)
Standard Error of the Mean (SEM)
Study on Nutrition of the Elderly in Europe (SENECA)
United States Department of Agriculture (USDA)
Women, Infants, Children. (WIC)
World Health Organisation (WHO)

To what extent do socio-economic status, knowledge, and confidence in cooking skills account for young women's food choice. What other factors may influence food choice in this group?

Introduction

The aim of this thesis is to answer the question:

To what extent do socio-economic status, knowledge, and confidence in cooking skills account for young women's food choice. What other factors may influence food choice in this group?

The thesis is structured in chapters as outlined below; each chapter has a number of aims that are addressed in the chapter.

Benefits of this research

- Quantifies the influence of socio-economic factors, knowledge and confidence in cooking skills on choice of a low fat, high fruit and vegetable intake in women aged 20-34 years.
- Investigates other influences in food choice.

Chapter I Literature review

Aims

- To explain the use of fat intake and fruit and vegetable intake as markers for healthy and less healthy diets in this thesis.
- To document the association between socio-economic variables and fat and fruit and vegetable consumption
- To document the association between financial variables and fat and fruit and vegetable consumption
- To review the links between knowledge, and fat and fruit and vegetable intake
- To assess the connection between attitudes and fat and fruit and vegetable consumption
- To justify the choice of women aged 20-34 years as the population group
- To formulate the main study question

Chapter II Methods

Aims

- To describe the health and lifestyle survey
- To describe the national food survey
- To describe the statistical analysis of the data.

Chapter III Results

Aims

- To estimate the influence of socio-economic factors on fat and fruit and vegetable consumption in women aged 20-34 years.
- To quantify the link between knowledge, socio-economic factors and fat and fruit and vegetable consumption in young women.
- To assess the connection between confidence in cooking skills, socio-economic factors and low fat and high fruit and vegetable consumption in young women.
- To investigate the links between income and low fat and fruit and vegetable intake.
- To develop a model that accounts for all the known variance.

Chapter IV Discussion of results

Aims

- To examine the validity of the survey data
- To discuss the results obtained from the analysis of the survey data with respect to the literature review and the first part of the original question which was:
- To what extent do socio-economic status, knowledge and confidence in cooking skills account for young women's food choice.
- To propose other factors that may account for the large unexplained variance in fat and fruit and vegetable intake.

Chapter V Conclusions

Aim

To answer the original question which was:

- To what extent do socio-economic status, knowledge, and confidence in cooking skills account for young women's choice of a diet low in fat and high in fruit and vegetables. What other factors may influence food choice in this group.

Chapter I: Literature review

Introduction

This chapter presents a review of the literature relevant to the aim and objectives of the thesis. The aims of this chapter are:

- To explain the use of fat intake and fruit and vegetable intake as markers for healthy and less healthy diets in this thesis.
- To document the association between socio-economic variables and fat and fruit and vegetable consumption
- To document the association between financial variables and fat and fruit and vegetable consumption
- To review the links between knowledge, and fat and fruit and vegetable intake
- To assess the connection between attitudes and fat and fruit and vegetable consumption
- To justify the choice of women aged 20-34 years as the population group
- To formulate the main study question

The first aim is achieved by discussing what is meant by a healthy diet by different groups of people. The variation between government nutrient requirement data compiled by scientists, the healthy eating guidelines endorsed by health educators and the beliefs of the public are examined. The use of fat and fruit and vegetable intake as markers for healthy diets is explained.

The second section of the review looks at social class and the measurement of socio-economic variables such as education and occupation in population studies. Socio-economic variables are considered because they are known to influence health *(DHSS 1980, Whitehead 1992)*. The literature on socio-economic variables and fat intake are reviewed to assess trends. Influences of education on fat intake and different fat intakes seen in different occupational groups are reviewed. Studies that looked at gender and age are also reviewed because women of a particular age have been chosen for this study and it is important to be aware how they might be different from men or older women in terms of socio-economic status. Studies that investigate socio-economic differences in fruit and vegetable consumption and in intakes of the nutrients associated with fruit and vegetable consumption are also reviewed.

Section three examines definitions of low income and use of National Food Survey data to assess the impact of low income on consumption of fruits, vegetables and fats.
Section four looks at knowledge and its impact on the consumption of fats and fruits and vegetables.
Section five looks at the measurement of attitude and the affect of different attitudes toward fat and fruit and vegetable consumption.
The final two sections of the literature review look at the choice of women aged 20-34 years as the population group and draw together the summaries of the preceding sections to formulate the main study question.

1.1) Definitions of Healthy Eating

Aim

- To explain the use of fat intake and fruit and vegetable intake as markers for healthy and less healthy diets in this thesis.

This section of the literature review is concerned with the use of fruits and vegetables and fat as markers for a healthy diet. In order to assess whether these are suitable markers for a healthy diet it is necessary to consider what a healthy diet is and what markers for a healthy diet are available. The first part of this section looks at consumer perceptions of healthy eating. This contrasts with government recommendations for nutrient requirements. The following two sections examine other ways of measuring healthy diets and healthy eating campaigns aimed at persuading the public to eat a healthy diet. The National Food Guide and its attempt to link nutrient requirements with consumption of actual foods is considered. The final section introduces the Health Education Authority Health and Lifestyle Survey.

1.1a) Consumer perception of a healthy diet

The concept of healthy eating differs according to different individuals and groups of people. In a study to assess the concerns of lone parents buying foods, healthy eating guidelines *(Department of Health 1994)* were used *(Dowler & Calvert 1995b)* to rank foods listed in a FFQ. Ranking was in terms of whether or not the current healthy eating guideline recommended eating more or less of that food or was neutral about it. This ranking was combined with a variety frequency score to estimate food usage variety. Recommended foods eaten frequently contributed most to the healthy diet index. Go easy foods eaten frequently reduced the healthy diet index. The responses for fruits and vegetables in the FFQ were used to calculate the probability that individuals were eating at least five different fruits or vegetables per day. The responses were summed and grouped to produce a fruit/vegetable indicator. The higher the healthy diet score, a fruit/vegetable score of five and over, and the lower the percentage energy in the diet from total fat and saturated fat, the healthier the diet. Lone parents who were concerned with 'freshness' and 'variety' were found to provide the healthiest diets for their children.

The Pan-European Union Survey of Consumer Attitudes to Nutrition, Food and Health asked consumers to describe in their own words what healthy eating meant to them. Definitions varied widely across the EU, 65% of UK consumers used the term less fat, and 63% said more fruit and vegetables, 44% mentioned balance and variety and 16% said less red meat and more fish and chicken. Only 9% mentioned fresh/natural foods *(Margetts et al 1997)*. A consumer research survey conducted in early 1992 for the National Dairy Council in London asked 1700 adults how important a number of items were for healthy eating. Respondents indicated that eating more fibre (61%), eating less sugar (62%), and eating less fat (61%) were very important but only 16% felt that eating more starchy foods was very important *(Buttriss 1997)*. An anthropological investigation into healthy eating in South-East London that involved interviewing 158 people found that balance, moderation and variety were seen as the key to healthy eating. Healthy eating was seen to have a limited role in the prevention of chronic disease and significant dietary changes were seldom made on this basis *(Keane and Wiletts 1996)*.
A Norwegian study *(Johansson & Frost Andersen 1998)* of 4,708 adults showed that high fruit and vegetable intake was associated with paying close attention to a healthful diet and participating in regular physical exercise.

1.1b) **Government recommendations for nutrient requirements**

Many nations have specific recommendations for nutrient requirements. The UK recommendations are briefly considered because it would be inappropriate to discuss healthy eating without taking into account recommendations put together by distinguished scientists. It is beyond the scope of this literature review (for reasons of space) to include European and American guidelines which are broadly similar.
The current set of UK recommendations 'Dietary Reference Values for Food Energy and Nutrients for the United Kingdom' was published *(Department of Health 1991a)* in 1991. The recommendations differed in a number of ways from the 1979 UK Recommended Daily Amounts (RDA), the most obvious change being the number of nutrients considered which rose from 10 to 40. A further change was the use of a set of figures to replace the previously used RDAs, these terms are defined below *(Dietary Reference Values 1991)*;

- Reference Nutrient Intake (RNI) the amount of protein or a vitamin or mineral that is enough or more than enough for about 97% of people in a group.

- Estimated Average Requirements (EAR) are the Panel's estimate of the average requirement of a group of people for energy or protein or a vitamin or mineral. About half will usually need more than the EAR, and half less.
- Lower Reference Nutrient Intake (LRNI) the amount of protein, vitamin or mineral that is enough for only the small number of people with low needs.
- Dietary Reference Values (DRV) this is a general term introduced to cover LRNI, EAR, RNI and safe intake.

There are a number of nutrients for which no requirement could be defined such as starches, sugars and fats. The Panel commented that 'it is not clear from the data whether correlation between these dietary components and health outcomes are best seen when their intakes are expressed as absolute amounts or when related to dietary energy.' These nutrients are briefly considered below;

Energy

Energy requirements have traditionally been estimated using data from dietary surveys, measuring energy consumption over a period of time. Surveys indicate that population energy intakes are below the RDA's, this may be due to previous recommendations including a level of activity that has not been achieved. The Panel have used this data together with results from indirect measurement of free living individuals using doubly labelled water to set an EAR for energy. The Panel did not attempted to prescribe levels of energy expenditure but set DRV's for energy on the basis of current estimates of energy expenditure. Basal Metabolic Rate (BMR) was used as the basis for calculating expenditure. The total daily expenditure is the sum of the BMR, the thermic effect of the food eaten and the energy expended in physical activity.

Fat

The Panel recognised that coronary heart disease and some forms of cancer were associated with high intakes of fats, but it wanted to take account of the normal diet and the practicality of changes when setting DRV's for fat and fatty acids. The Panel proposed that dietary intake of PUFA should not exceed 10% of total food energy and that trans-fatty acid intake should not exceed 2% of food energy. The Panel calculated total fat intake from the sum of fatty acid intake and glycerol.

Carbohydrates

COMA *(Department of Health 1991a)* gave DRV's for carbohydrate not as firm recommendations but as guidelines. The Panel agreed that carbohydrate should provide the major food energy requirement for UK populations.

Fibre

The Panel proposed that non-starch polysaccharides (NSP) which can be analysed accurately, reproducibly and specifically and form the main component of fibre should form the basis for recommendations.

Sugars

In the COMA report Dietary Sugars and Human Disease *(Department of Health 1989)* sugars were classified on the basis of their availability for metabolism into intrinsic and extrinsic sugars. The panel endorsed conclusions in the Report that non-milk extrinsic sugars were a major cause of dental caries in the UK and that their consumption should be reduced. The Panel did not recommend that intake of intrinsic or milk sugars should be limited because of their useful contribution with starch to energy requirements not met by other dietary components.

Table 1.1 summarises the recommendations 'Dietary Reference Values for Food Energy and Nutrients for the United Kingdom' *((Department of Health 1991a)* that have been discussed. The recommendations are given as % of total food energy. The most recent (to the 1991 recommendations) National Food Survey (NFS) *(MAFF 1989)* data on food intake are also presented for comparison, both as an absolute intake per person per day and as a % of food energy to make comparison easier. It is important to remember that NFS data does not take into account food eaten outside the home or foods bought without the knowledge of the main diary keeper. No account has been taken of wastage of edible food. NFS data can also be misleading when taking average per person intakes because of the presence of children in some households. A review of the validity of NFS data are presented in the methods (section 2.2).

Table. 1.1: Dietary Reference Values for Food Energy and Nutrients for the United Kingdom

Nutrient	Present Intake, NFS 1989 (% of total food energy)	Recommendation (% of total food energy.)
Energy	8.10MJ/d	n/a
Saturated fatty acids	-	11
Total fat	90.2g/d (42% food energy)	35
Carbohydrate	230g/d (45% food energy)	50
NSP	12.4g/d	18g/d
Intrinsic and milk sugar and starches	136g/d (26% food energy)	39
Non-milk extrinsic sugar	95g/d (18 % food energy)	11

1.1c) **Indices used to evaluate healthy diet.**

Researchers have not always been in a position to make a thorough measurement of peoples' diets so it is not always possible to compare nutrient intakes with recommendations. A number of different indices have been developed to assess the healthiness of respondent's diets. Patterson *(et al 1994)* developed a diet quality indicator to assess the relationship between chronic diseases and eating. The Diet Quality Index (DQI) was based on a composite of eight Diets & Health recommendations from the National Academy of Sciences. The recommendations covered total fat intake, saturated fat intake, cholesterol intake, fruit and vegetable intake, and consumption of complex carbohydrates, protein, sodium and calcium. Respondents who met a given dietary goal received a score of 0, those whose consumption fell within 30% of the goal were given a score of 1 and those whose consumption differed by more than 30% were given a score of 2. The scores for all eight goals were totalled. Respondents with a score of 4 or less were said to have a relatively healthful diet, sixteen represented a poor diet. The DQI scores were compared with a variety of other commonly used criteria of diet quality for validation purposes. The relationship between the DQI and chronic diseases was not assessed. Popkin *(et al 1996)* also used the DQI to compare dietary trends among racial and socio-economic groups in the United States.

North-West Thames Regional Health Survey *(Davenport et al 1995)* used a dietary index measure constructed by selecting a limited range of 14 foods chosen to represent 'healthy' choices. Consumption of these foods was scored so that a 'healthy' eating pattern had a high score. Rice, beans, fruit, vegetables, fish, poultry, wholemeal cereals, semi-skimmed milk and bread were given high scores, fried foods, biscuits/cakes, processed meat, cheese/eggs, butter and extra cream milk were given low scores. Trent Health *(Dengler et al 1994)* chose to look at 11 types of food e.g. high fibre bread, fish or white meat, polyunsaturated fat and added sugar.

Kennedy *(et al 1996)* in conjunction with the United States Department of Agriculture (USDA) has developed an index called the Healthy Eating Index (HEI). The Index was designed to provide a measure of the overall quality of an individuals' diet. Ten dietary components were included in the index. The first five were concerned with the degree to which the diet conformed to the Food Guide Pyramid serving recommendations for the grain, vegetable, fruit, milk and meat groups. Component 6 measures total fat consumption as a percentage of total food energy, fat intakes less than or equal to 30% of total calories were assigned a score of 10 points, the score declined to zero when the proportion of fat to total calories reached 45%. Component 7 measures saturated fat as a percentage of total food energy. Component 8 measures cholesterol, 9 measures salt and 10 measures variety over a 3-day period. The maximum overall score for the 10 components of the index is 100. The index was applied to the USDA 1989 and 1990 'Continuing Survey of Food Intakes by Individuals (CSFII),' respondents completed a 1-day dietary recall followed by a 2-day food record. Data from 3,997 subjects were collected for 1989 and from 3466 for 1990. This represented a response rate of 49.9% and 40.9% respectively. The sample was weighted to make it representative of the US population, average scores were 63.8 for 1989 and 63.9 for 1990. The HEI was assessed to examine the degree to which it correlated with other measures of diet quality. For most nutrients the likelihood of falling below 75% of the RDA decreased as the mean score on the HEI increased. The authors calculated correlation coefficients for individual nutrients and the HEI. There were positive correlation coefficients for each of the nutrients although only 0.6 for zinc and vitamin B-12. Correlation coefficients of 0.40 were shown for vitamin C, vitamin B-6, folate and magnesium. Respondents who rated their diets as excellent had higher mean HEI scores than people who rated their diets as good, fair or poor. In a review of indexes of diet quality

(Kant 1996), indexes of overall diet quality based on nutrients, indexes based on foods or food groups and indexes based on a combination of foods and nutrients were considered. The author noted that few of the published indexes have been validated against biochemical, anthropometric or clinical parameters of nutritional status.

Investigators in the UK Women's Cohort Study *(Cade et al 1999)* used a healthy diet indicator (hdi) based on the WHO recommendations for the prevention of chronic disease. Eight food groups or nutrients were allocated a 0 or 1 depending on their presence in the recommended range in the women's diet as estimated from a 217-item food frequency questionnaire. The healthy diet indicator was equal to the sum of all the variables. The best diets scored 8 and the least health scored 0.

In conclusion Kennedy's healthy eating index would appear to be the most comprehensive and well tested index developed to date. It would be interesting to see if it was predictive of chronic disease in different populations. This would be the index of choice if sufficient data were available to make its calculation possible.

1.1d) **Initiatives to promote a healthy diet**

A number of organisations within the UK have been involved in healthy eating campaigns. The Health Development Agency (HDA) formally the Health Education Authority has been involved with a range of healthy eating promotions. 'Eight Guidelines for a Healthy Diet' were launched in 1990 as the first stage of a healthy eating programme. The eight guidelines were approved by COMA as representing in simple form the essence of their advice. The guidelines were:

- Enjoy your food
- Eat a variety of different foods
- Eat the right amount of food to be a healthy weight
- Eat plenty of foods rich in starch and fibre
- Do not eat too much fat
- Do not eat sugary foods too often
- Look after the vitamins and minerals in your diet
- If you drink alcohol do so with in safe limits

These guidelines did not give any indication of actual amounts of foods to be consumed or how the foods link to nutrient requirement. They were widely criticised for being too vague. The next attempt by the Government to influence the nations eating habits came as part of the Health of the Nation initiative. The Health of the Nation White Paper *(Department of Health 1992)* was a Government produced strategy for promoting health. The White Paper identified five key areas for immediate action. These were coronary heart disease and stroke, cancers, mental health, HIV/AIDS and sexual health and accidents. Targets were set for each of the five key areas for the year 2000. Specific nutritional targets were set for the year 2005:

- To reduce the average percentage of food energy derived by the population from saturated fatty acids by at least 35% to 11%
- To reduce the average percentage of food energy derived by the population from total fat by at least 12% to no more than 35%
- To reduce the proportion of men and women aged 16-64 who are obese by at least a quarter to a third respectively

In addition a further risk factor target to reduce mean systolic blood pressure in the adult population by 5 mm Hg required a nutritional contribution from reduced sodium intake as well as alcohol and obesity.

The Nutrition Task Force (NTF) was set up to develop a co-ordinated programme of action to implement the nutritional affects of the Government's health strategy that was outlined in the Health of the Nation White Paper

1.1e) **National Food guide**

The National Food Guide (NFG) was produced in response to a programme of action published by the Nutrition Task Force. The aim of the NFG was 'to illustrate, based on scientific consensus, an agreed core structure of food groupings as a means of providing public awareness of an appropriate balance of food choices for health...'*(Gatenby at al 1995)*. Foods were selected for inclusion in the guide on the basis of their being consistent with the Eight Dietary Guidelines for Healthy Eating and possessing key characteristics that made them suitable for inclusion within a relevant food group. The five food groups are outlined,

Bread, other Cereals and Potatoes

- Major source of starchy carbohydrate and non-starch polysaccharide (NSP).
- Predominantly low in fat and can be consumed without the addition of fat.

- Commonly consumed, readily available, affordable and with transcultural application.
- Key nutrients: carbohydrate, NSP, vitamin B complex, calcium and iron.

Fruit and Vegetables

- Major source of vitamins, minerals and NSP.
- Commonly consumed, readily available, affordable and with transcultural application.
- Key nutrients: range of vitamins, minerals NSP and carbohydrate.

Meat, Fish and Alternatives

- Frequently contribute to iron intake
- Major source of protein.
- Can be low in fat (particularly saturated fat).
- Commonly consumed, readily available, affordable and with transcultural application.
- Key nutrients: major source: protein, iron, B-vitamins, zinc, magnesium, and from pulses only NSP

Milk and Dairy Foods

- Frequently contribute to calcium intake.
- Lower fat alternatives available and encouraged
- Commonly consumed, readily available, affordable and with transcultural application.
- Key nutrients: major source: calcium, protein, vitamin B_{12}, vitamins A, D and E

Fatty and Sugary Foods

- Source of energy fat and sugar or combination of fat and sugar
- Key nutrients: essential fatty acids, fat-soluble vitamins, energy, fat and sugar.

Healthy eating guidelines in the UK were traditionally based on the components of food such as fat, salt and sugar. The healthy eating campaigns of the 1980's urged the public to 'eat less fat' or 'eat more fibre.' Such campaigns were based on the NACNE report (see Appendix 1, page 203) not nutrient recommendations.

The National Food Guide was the first UK guide to include a commitment to a scientific base in its specific aims. 'To promote overall health in line with current scientific consensus on dietary requirements *(Department of Health 1991)*, and be consistent with the Health of the Nation targets *(Department of Health 1992).*' The guide used a five food group system as outlined above, the relative proportions of the food groups were based on data produced for the COMA report on the Nutritional Aspects of Cardiovascular Disease *(Department of Health 1994)* (Appendix 2). The resulting proportions had to ensure that an appropriate choice of foods would provide the necessary nutrients for health. Each of the food groups was associated with a number of key nutrients; portion size data were obtained from Ministry of Agriculture, Fisheries and Food (MAFF) and Office of Population Censuses and Surveys (OPCS) *(Gregory et al 1990).* These data were used to calculate segment sizes for each of the food groups to ensure a national average diet consistent with Dietary Reference Values on a weekly basis.

Healthy eating guidelines and recommendations for nutrient intakes are closely linked in his paper 'Evolution of dietary recommendations, goals and guidelines' Truswell commented that 'Recommended Daily Amounts (RDA) are determined from basic research on animals and metabolic studies in humans, which examine the particular micronutrients presently considered to be essential…'. Nutritionists have greater confidence in their conclusions concerning micronutrients than in their observations about macronutrients. Dietary Goals, primarily examine macronutrients, are derived from basic research on animals, metabolic studies and clinical trials with humans and epidemiological investigations. In addition, and unlike the RDA, Dietary Goals depend on using food consumption patterns. Dietary goals or guidelines aim to reduce chronic degenerative disease and are usually expressed in terms of proportions of energy in the national average diet, they are targets to aim for at some time in the future. *(Truswell 1987).*

It could be argued that in the decade following this statement on RDA and dietary goals the difference between the two types of guidelines has become blurred. Traditionally RDA are written by scientists for health professionals to use whereas dietary guidelines are food based interpretations of nutrient requirements written for the general public.

1.1f) **Health and Lifestyle Survey**

During the early 1990's there was a trend for Health Authorities to commission surveys to gain more information about the health needs of their local populations. Questions about cigarette smoking and alcohol consumption were included along with sections on exercise, sexual health and healthy eating. Information from two of these surveys has already been discussed in this literature review (North-West Thames Regional Health Survey *(Davenport et al 1995),* Trent Health *(Dengler et al 1994)*).

In 1993 the Health Education Authority commissioned MORI (a private marketing company), on behalf of the Department of Health to produce a Health and Lifestyle Survey for England *(The HEA Health and Lifestyle Survey, 1998)*. (See Methods section 2.1, page 71). The resulting survey contained information on the fruit and vegetable, fibre and fat intake of a representative sample of English adults, together with demographic information and the answers to questions about the respondents cooking skills, shopping habits, knowledge of foods and their links with disease. Results from this survey have been used as the basis for the investigations in this thesis.

1.1g) **Summary**

The purpose of this section of the literature review was:

- To explain the use of fat intake as a marker for a healthy diet.
- To explain the use of fruit and vegetable intake as a marker for a healthy diet.

The main findings were

- 65% of UK consumers used the term less fat to describe a healthy diet *(Margetts et al 1997)*
- 61% of adult survey respondents said eating less fat was very important *(Buttriss 1997).*
- Health of the Nation initiative included reducing the average percentage of food energy derived by the population from total fat by at least 12% to no more than 35% *(The Health of the Nation White Paper DoH 1992)*
- 63% of UK consumers said more fruit and vegetables, when describing a healthy diet *(Margetts et al 1997)*
- Adults associated high fruit and vegetable intake with a healthful diet *(Johansson & Frost Andersen 1998)*
- A number of systems have been developed to score or rank a diet in terms of overall quality *(Patterson et al 1994, Davenport et al 1995, Kennedy et al 1996, Popkin et al 1996, Cade et al 1999)*. The most comprehensive being Kennedy's healthy eating index.
- The National Food Guide was the first UK guide to include a commitment to scientific base in its specific aims

1.1h) **Conclusion**

The literature review provided an interesting example of a potentially useful index *(Kennedy et al 1996)*, but data available from the Health and Lifestyle survey was limited to information on fruit and vegetable intake, fibre intake and fat intake. This dietary information was not extensive enough for Kennedy's HEI and therefore precluded its use. The information gained from the pan-European Union Survey of Consumer Attitudes to Nutrition Food and Health *(Margetts et al 1997)* showed that the two things most frequently sited by UK consumers when describing a healthy diet were, low fat intake and high fruit and vegetable intake. Information on both fat and fruit and vegetable intake was available from the Health and Lifestyle Survey. These two variables will be used in the thesis to differentiate between respondents who have a healthy and less healthy diet (Chapter II: Methods, page 71).

1.2) **Differences in Fat intake and Fruit and Vegetable Intake and their relationship to Socio-economic Variables**

Aim

- To document socio-economic variables and fat intake.
- To document socio-economic variables and fruit and vegetable intake.

1.2a) **Socio-economic variables**

In the UK the coding index of the Office of Populations, Censuses and Surveys (OPCS), is used to group people into occupational categories. Stevenson *(1928)* who wrote that 'the ideal method would classify individuals and whole populations, by their degree of prosperity' introduced the categories for the analysis of infant mortality data. The categories were based on the individual requirement to use intellectual or physical abilities to earn a living and consist of six groupings, non-manual classes I, II and IIIn and manual IIIm, IV and V. Class I indicates the most prosperous group and class V the least prosperous. These grouping are used when mortality data and census data are collected, they are also used for other data collection including the Health and Lifestyle Survey that much of the work in this thesis is based on.
Problems and inaccuracies arise with the classification of individuals not currently working e.g. retired people, carers, housewives or students. The unemployed are classified according to their last job, women are grouped according to their husband's occupation. It should also be noted that social class I will tend to be biased towards older people since it is difficult to gain entry into a profession at a young age. There are particular problems with this system of classification when comparisons across time are needed. In the 30 years between 1951 and 1981 there has been an increase in professional occupations with just 1% of social classes I and II in 'professional' occupations in 1951 and 16% in 1981. In terms of home ownership 6% of social class IIIn were owner occupiers in 1951 compared with 31% of social classes I and II. By 1981 these proportions were 64% and 66%. Changes in the structure of the groups over time results in changes in size, making it difficult to interpret comparisons of relative rates over time *(Carr-Hill 1990)*.

Social class is a British concept, American studies tend to refer to socio-economic status (SES), the Stanford Three Community Study (*Fortmann 1982*), used Hollingshead's two factor classification to divide study participants into socio-economic status (SES) groups. This classification is based on income and education. No significant difference in the saturated fat intake of English speaking participants was found regardless of SES.

A scale of occupational prestige has been developed for the Australian population, which has been found to have a strong association between the measure of social status and food and nutrient intake. Occupational prestige was coded according to the lay person's perceptions of the status of occupations, on a scale of 1.0 (highest) through to 7.0 (lowest). Respondents with partners who were not presently in employment were recoded to their spouse's occupational status only if it was more prestigious than their own past occupation. The occupation of housewife has no prestige score on this scale, respondents who gave housewife as their occupation were coded by their spouse's occupation. Occupational prestige was used with educational level and income level to estimate social status (*Smith & Baghurst 1992*).

The statistical analysis of the socio-economic data in this thesis has been done using the coding index of the OPCS, the concepts of socio-economic status and occupational prestige are discussed because they are used in a number of studies included in this review. It is obviously not possible to relate the results of studies using a classification of say occupational prestige to the results of a study using socio-economic status but to ignore those studies using different socio-economic classifications would have meant ignoring a large quantity of work.

Other methods of assessing socio-economic differences between study respondents include recording differences in housing. Questions may be asked about housing tenure, that is whether the respondent owns the house that he/she is living in or whether the accommodation is rented. The quality of the housing may also give clues to the socio-economic status of the occupants; quality may be assessed using the bed standard. The bedroom standard relates the number of bedrooms in a property to the number, age and sex of the occupiers. A property that meets the bed standard will be of a higher standard in relation to the occupiers than a house that is below the bed standard. The availability of a car may be related to socio-economic differences between groups.

1.2bi) **Social Class and Trends in Fat Intake**

The Scottish Heart Health Study (*Bolton-Smith et al 1991*) recruited subjects from a list of 260 general practitioners, selected at random from 22 study districts in Scotland. The sample had a 74% response rate and included approximately equal numbers of men (5123) and women (5236) aged 40-59 years. Each subject completed a questionnaire including socio-demographic information and a FFQ. The FFQ included 50 questions on the weekly frequency of consumption of all major types of foods, average daily milk intake and family weekly consumption of cheese cooking oil, butter and margarine. The Scottish Heart Health Study classified social class in accordance with the OPCS. Significant differences in nutrient intakes between social class groups were identified. Manual women had the highest percentage energy intake from fat, which appeared to be due to increased amounts of meat products and hard margarine compared to non-manual women. The P-S ratio declined from social class I to V for both men and women. The decline in women was due to a relative increase in saturated fatty acid (SFA) intake. In this study, total energy intake was inclusive of alcohol. The same trends in nutrient intake were seen when classification was by occupation, housing tenure, or level of education. Bolton-Smith's work in Scotland may not be generalizable to women in England. The author notes that the total weight of food minus drinks was remarkably similar between the Scottish subjects and mean values reported for Cambridgeshire adults *(Bingham et al 1981)*. Total energy intakes were similar for men but not for women. It is possible that absolute differences in consumption may be different between women in Scotland and England but trends between different socio-economic groups may be similar.

Bolton-Smith et al *(1990)* found higher energy intakes in manual compared with non-manual women mainly due to an 8.8% increase in fat intake, with a shift in the source of fat intake away from margarine containing polyunsaturated fatty acids, meat and sweets/puddings to meat products, other margarine and butter.

In a 36 year follow up of a national birth cohort that used a 7-day diet diary to collect dietary information on 2424 (73% of those issued, completed 4 or more days) individuals. Braddon *(et al 1988)* found that fat intakes between women in manual and non-manual social classes were similar.

A health and lifestyle survey undertaken by the North-West Thames Region during 1989-1991 used a questionnaire to ascertain the frequency of consumption of common foods. 8251 adults were interviewed (64% response rate). 56.5% of professionals consumed low fat milk products compared with only 43% of unskilled manual workers *(Davenport et al 1995)*.

The Dutch National Food Consumption Survey *(Hulsof et al 1991)* collected data on socio-economic status, education and food consumption in 2203 households. A total of 4134 adults aged 19-85 years participated. A 2-day food record was used to collect data on food consumption. The differences in fat consumption amongst women in different socio-economic groups were found to be small when expressed as a percentage of energy intakes exclusive of alcohol. Women in lower socio-economic groups had lower intakes of saturated fatty acids than other women ($P<0.01$) had. Socio-economic status was based in part on level of education.

In the Trent Health Lifestyle Survey *(Dengler 1994)* 48% of respondents in social class II or I reported that they needed more time to have a healthier diet. Only 26% of social class IV, V or unemployed respondents felt they needed more time for a healthier diet.

The Warsaw Poland MONICA population was studied in 1984, a random sample of 2,571 men and women completed a 24 hour dietary recall, this was used to compare energy and fat intake with socio-economic status. Education, income levels and character of employment were used to determine socio-economic status. Higher socio-economic status was correlated with higher energy content of the diet and higher fat content *(Pardo et al 1994)*. The differences between these trends and those seen in Western European populations may be due in part to the different structure of a society following years under a communist regimen.

A study in Finland in 1992 used a 3-day estimated food record and a self-administered questionnaire to compare the nutrient intake and food consumption of a random sample of 1,861 men and women. No socio-economic differences in energy intake, densities of fat or saturated fat intake *(Roos et al 1996)* were found. An earlier study that examined social class based food consumption patterns in Finland during 1979-1990 *(Prättälä et al 1992)* concluded that social class was a significant determinant of food consumption patterns, with women of lower social class following food consumption trends set by higher social classes ten years previously. However social class differences were reported to be diminishing. This study based its analysis of fat consumption on two questions: 'What kind of fat do you usually spread on your bread?' and 'what kind of milk do you usually drink?'

In a study looking at maternal social class and birth weight *(Wynn et al 1994)* found no social class gradient for consumption of fat or total energy. Dietary intake was assessed using a 7-day food diary, 513 mothers took part in the study. A weak correlation was found between social class and saturated fat consumption, with lower social classes consuming marginally less saturated fat than higher social classes.

A review of the role of nutrition in socio-economic differences in health, particularly coronary heart disease *(Davey Smith 1997)*, suggested that diet does not appear to contribute greatly to trends in social class differentials in terms of total fat intake or saturated fat intake. But British data indicates that trends in micronutrient and antioxidant intakes are the most likely nutritional influences on health inequalities.

A Norwegian study *(Hjartåker & Lund 1998)* looked at a random nation-wide sample of 20,000 women born between 1927 and 1951. The response rate was 51.4%. Women were sent a questionnaire that included a dietary component designed to assess the consumption of marine foods and record usual food intake. Returned questionnaires were excluded from the analysis on the basis of low energy consumption (below 2500KJ) and excessive number of blank items. The authors report that women with higher socio-economic status reported the healthiest diet with regard to fat, dietary fibre, and fruit, vegetables and potatoes. Socio-economic status appears to have been based on information about income and years of education.

In an analysis of 7-day diet diaries from the Whitehall II study Stallone *(et al 1997)* points out that the relationships between employment status and total fat, saturated and polyunsaturated fatty acid are greatly reduced or abolished when low energy reporting is taken into account. About one third of the total sample reported implausibly low energy intakes. The prevalence of low energy reporting increased markedly with lower grade of employment. Low energy reporting was accounted for by two methods, simply excluding the data *(Pryer et al 1995)* and by energy adjustment using the residual method *(Willet et al 1985)* where nutrient intake scores are adjusted for total energy intake by calculating residuals from regression models (energy intake as the independent variable and nutrient intake as the dependant variable). This method adjusts for energy intake only to the extent that it is correlated to each nutrient. Excluding low energy reporters was unsatisfactory because such a large proportion of the data set was involved. The fact that many of the low energy reporters were in the lower grades may also introduce bias into the results. It is also likely that only those low energy reporters at the lower end of the energy intake distribution were excluded, since subjects with higher energy intakes who were under reporting remained undetected. The energy adjustment method has the advantage of retaining all the data set. Neither method can eliminate bias introduced by selectively underreporting foods containing large proportions of fats and sugars. Blood cholesterol was measured in the

Whitehall II cohort and found to be similar in each grade for both sexes, suggesting that dietary fat intake did not vary substantially by grade *(Brunner et al 1993).*

In her comparison of dietary assessment methods *(Bingham 1994)* notes that there was no association between social class index and under reporting. The women who participated in the study were noted to be highly co-operative and not representative of the general population.

In conclusion higher socio-economic status is associated with lower fat consumption *(Bolton-Smith 1990, Bolton-Smith 1991, Prättälä 1992, Hjartåker & Lund 1998)* in some studies but not in others *(Braddon 1988, Wynn 1994, Hulsof 1991, Pardo 1994, Roos 1996).* It is unclear whether fat intake is associated with socio-economic status.

1.2bii) **Social class and trends in fruit and vegetable consumption**

The Scottish Heart Health Study (*Bolton-Smith et al 1991*) found reduced average intakes for green vegetables and fresh fruit in manual compared with non-manual groups in both men and women. Fresh fruit intake was 35-50% lower in Scotland than that reported by Cole-Hamilton *(et al 1986).* The national birth cohort investigated by Braddon *(et al 1988)* found that women in non-manual social classes had significantly (P<0.001) higher levels of vitamin C than women in manual social classes. It is unclear whether this difference could be explained by educational attainment.

The Danish MONICA project involved a random sample of 4,807 men and women who were asked to complete a standardised questionnaire and attend a general health examination in 1982, five years later they were invited to attend a follow up session. A multiple regression analysis showed that social group was significantly associated with increased intake of vegetables in women. Women in the higher social groupings were most likely to have increased their vegetable intake over the 5 years *(Osler 1993).*

A study in Finland in 1992 used a 3 day estimated food record and a self-administered questionnaire to compare nutrient intake and food consumption in a random sample of 1,861 men and women. It was concluded that higher socio-economic groups consumed more fruits and vegetables but fewer breads and potatoes *(Roos et. al. 1996)* than lower socio-economic groups.

The Dutch National Food Consumption Survey found that intake of vitamin C was significantly (P<0.001) higher in women *(Hulsof et al 1991)* from higher socio-economic groups than in other women. This reflected the higher intake of vegetables and fruits amongst women from high socio-economic groups. These results must be viewed in light of the fact that they are based on a 2-day food record.

The Norwegian Women and Cancer study found women with higher socio-economic status reported the healthiest diet with respect to fruit, vegetable and potato intake *(Hjartåker & Lund 1998)*. Socio-economic status appeared to be based on years of education and income. The median number of servings of fruit and vegetables was 3.5 per day. Another study of fruit and vegetable intake in Norwegians *(Johansson & Anderson 1998)* found a median frequency of 3.7 servings of fruit and vegetables a day among women. Men with higher socio-economic status were more likely to have higher intakes of fruit and vegetables but there was no difference in fruit and vegetable consumption among women of different socio-economic status.

A systematic review of socio-economic differences in food habits in Europe looked at the consumption of fruits and vegetables *(De Irala-Estévez et al 2000)* in eleven studies between 1985 and 1999 in 15 European countries. Studies were included in the meta-analysis if,

- A validated method for assessing dietary intake at the individual level was used
- The sample was nation-wide or representative of a region
- The subjects were adults
- Information about the mean and standard deviation of fruit and vegetable consumption was provided separately for men and women across levels of occupation or education

The EPIC study *(Agudo et al 1999)* was not included because it used a non-representative sample. The study took into account the year in which the survey was performed, the participation rate in each survey and whether estimates were adjusted for total energy intake. The exposure was considered to be socio-economic status (education or occupation), the outcome was the consumption of fruit and vegetables, the effect was the average differences in food consumption (g/person/day) between individuals with the highest and lowest SES levels. A possible confounder was total energy intake. Country, gender, year of the study, and method of dietary assessment were considered as potential effect modifiers. Only two of the eleven studies had been previously published in widely accessible journals. Roos 1996 study has been discussed in this review but a Spanish study by Arija et al also in 1996 was published in Spanish and has not been included in this literature review before. The number of subjects in the studies included in the systematic review ranged from 704 to 41,178. The range of response rates was between 55% and

95%. A positive association between a higher level of education or occupation and a greater consumption of both fruit and vegetables was found. The average difference in the intake of fruit was 33.6g/person/day (95%CI 14.0-34.7) between women in the highest and lowest levels of education. The average difference for vegetable consumption was 17.1g/person/day (95%CI 22.5-44.8) between women in the highest and lowest levels of education.

Intakes of vitamins A, B and C as well as iron, magnesium, potassium, and calcium have all been shown to be lower in lower socio-economic groups *(Davey Smith et al 1997)*. People in lower socio-economic groups tend to eat less fruit and vegetables, and less food which is rich in dietary fibre. As a consequence, they have lower intakes of anti-oxidant and other vitamins and some minerals, than those people in higher socio-economic groups do. *(Colhoun 1996)*.

In conclusion higher socio-economic status is associated with higher fruit and vegetable intake in women *(Braddon 1988, Hulsof 1991, Bolton-Smith et al 1991, Roos 1996, Hjartåker & Lund 1998)* in some studies but not in others *(Johansson & Anderson 1998)*. A meta-analysis of eleven studies including Roos 1996 study also found an association between higher socio-economic status and fruit and vegetable intake in women *(De Irala-Estévez et al 2000)*.

1.2ci) **Education and trends in fat consumption**

The Norwegian Women and Cancer study *(Hjartåker & Lund 1998)* found years of education to be significantly negatively related to percentage energy intake from fat.

A study of demographic factors and their relationship to the presence of cardiovascular disease risk factors (*Winkleby 1992)* suggested that education rather than income or occupation may be the single most important SES predictor of good health. Higher education may improve health by conferring economic advantages or the association with higher education and increase knowledge about health may improve health. The hypothesis found most plausible *(Winkleby 1992)* was that education might protect against disease by influencing lifestyle behaviours, problem solving abilities and values. Education may facilitate the acquisition of positive social, psychological and economic skills. Such skills include positive attitudes about health, membership of peer groups that promote the adoption or continuation of positive health behaviours and higher self-esteem and self-efficacy.

In a 36-year follow up of a national birth cohort *(Braddon et al 1988)* found that women who attained the highest educational qualifications had significantly higher energy intakes than other women ($P<0.001$). The authors suggest that this was due to a significantly higher intake of fat ($P<0.001$), protein ($P<0.001$) and alcohol ($P<0.001$).
In conclusion greater years of education is associated with lower fat intake *(Winkleby 1992, Hjartåker & Lund 1998)* in some studies but not in others *(Braddon et al 1988)*

1.2cii) **Education and trends in fruit and vegetable consumption**

Both social class and educational attainment were considered when looking at regional differences in food and alcohol consumption (*Braddon 1988*). Higher educational attainment was associated in both men and women with greater consumption of fruit and vegetables. Educational attainment was significantly ($P<0.005$) associated with increased vitamin C intake when social class was taken into account using regression analysis. Women in the North of England had lower mean intake of vitamin C than women in the South-East of England had. Differences in regional intake remained when regression analysis had been done to account for the effect of social class and educational attainment. The Norwegian Women and Cancer study *(Hjartåker & Lund 1998)* found years of education to be significantly positively related to intake of fruit, vegetables and potatoes. The Maryland Special Supplemental Nutrition Program for Women Infants and Children (WIC) 5 A day Promotion Program *(Havas et al 1998)* found having a high school education to be significantly associated with an increase of 0.39 servings of fruit and vegetables. The study population was mainly single, black, mothers below the age of thirty with a high school education so the findings are not generalizable to other populations. The Spanish cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC) included 15,635men and 25,813 women recruited between 1992 and 1996 from five regions in Spain. Subjects were healthy volunteers, mainly blood donors. Trained interviewers, using a computerised questionnaire based on a previously validated diet history method, collected information on habitual food intake over the past year. There was a clear trend of increasing consumption of vegetables with higher educational level *(Agudo et al 1999)*. The highest consumption of fruits was observed in those subjects with the highest educational level, but a clear trend was not seen. It must be remembered that the sample in this study was not representative of the general population. The

sample had a higher educational level than the general population and many respondents were blood donors who might be expected to be healthier than the general population.
An analysis of 33 studies across Europe *(Roos G. et al 2000)* found that in the majority of studies fruit and vegetable consumption was more common among those with higher education. The studies included 13 dietary surveys, 9 household budget surveys and 11 health behaviour surveys, covering 15 countries and representing northern, eastern, western and southern Europe. Fruit consumption had strong positive associations with education in studies in Norway, Finland, Estonia, Lithuania, Denmark, Germany, the Netherlands and Switzerland. Negative associations were found in 2 Spanish studies. Studies in 9 countries showed no association. The pattern for vegetable consumption was similar to that seen for fruit consumption. The authors point out that older adults are often over represented in groups with low education. A tendency for the less well educated to under report fruit and vegetable and the better educated to over report fruit and vegetable consumption may lead to smaller differences in fruit and vegetable consumption across education levels. It is suggested that the link between education and consumption in Northern and Western Europe may result from dietary campaigns that have promoted the consumption of fruits and vegetables as healthy foods. In the south and east of Europe fruits and vegetables are more traditional foods that are consumed in greater quantities than in the north. People may have greater access to cheaper fruits and vegetables in the south and west of Europe, reducing the association between level of education and fruit and vegetable intake. Care must be taken in applying the results of studies in other countries to the young women who are the subject of this thesis.
In conclusion greater number of years of education is associated with higher fruit and vegetable intake *(Braddon 1988, Hjartåker & Lund 1998, Agudo et al 1999 & Roos G. et al 2000)*.

1.2di) **Occupation and trends in fat intake**

Occupation may affect food intake because the nature of the occupation involves some knowledge about the preparation, healthiness, or growth of the food. Black *(et al 1984)* reported the results of a study in which dietitians kept weighed food records every sixth day for a year, the results from 42 dietitians showed that their mean daily sucrose intake was 35g compared with the national average intake of 100g.

In a large cross sectional study (*Baghurst 1994*), attitudinal and demographic data were compared across selected fifths of the ratio of energy consumed as fat. High fat consumption was more evident in men of low occupational status, but not women. It is possible that the husband's occupation was used to assess the socio-economic status of women. It is stated that occupational status is not related to low fat intake, but it does not state how low occupational status is measured. A higher alcohol consumption makes the percentage energy intake from fat appear lower.
Occupation was found to have a marked effect on the dietary intake of antioxidant vitamins in the Finnish Mobile Clinic Health Examination Survey population. The Survey conducted diet history interviews with one in five of those people who participated in the health examination, 10,054 diet histories were taken altogether. White-collar workers had the highest intakes of dietary carotenoids and farmers the lowest, a similar trend was seen for vitamin A intake, and also for energy adjusted vitamin E intakes *(Järvinen et al 1994)*.
In conclusion it is not known whether there is an association between women's occupation and fat intake.

1.2dii) **Occupation and trends in fruit and vegetable consumption**

Smith & Baghurst 1993 used the concept of occupational prestige to examine socio-economic trends in an Australian population. Education was grouped into four levels, as was income, which was adjusted for the number of people in the household. Respondents with a lower occupational status had higher ratios of total, mono-unsaturated and unsaturated fat to energy. People with higher status occupations had a higher ratio of sugar and alcohol to total energy intake and a higher density of fibre in the diet. Data from this study was further analysed *(Smith & Baghurst 1993)*, to investigate vitamin and mineral intake and social status. Analyses were done on dietary intake alone, excluding supplementation. High social status groups were found to consume diets containing higher densities of vitamin C, folate, zinc, iron, magnesium, potassium, beta-carotene and thiamine whilst lower social status groups consumed diets denser in retinol. Relationships between social status and nutrient density levels occurred irrespective of whether social status was measured as income, education or occupational prestige. Occupational prestige showed the strongest linear relationships with micronutrient densities. Educational status showed very similar but slightly weaker and less consistent trends. Income level was linearly associated with mineral intakes only with relation to occupational categories; professionals, para-professionals and sales persons recorded diets with higher micronutrient densities. Analysis of the contribution of various food groups to nutrient intake, in different social groups was done. It showed that wholegrain breads and cereals, and fruits and vegetables, which were consumed in greater amounts by upper status groups, contributed to a large proportion of the differences between status groups for certain micronutrients.

The Whitehall II study of British civil servants looked at a cohort of 10,314 men and women between 1985 and 1987 consumption of skimmed and semi-skimmed milk, wholemeal bread, and fresh fruit and vegetables was greatest in higher status jobs *(Marmot et al 1991)*.

The Finnish Mobile Clinic Health Examination Survey found that vitamin C intake was significantly higher ($P<0.001$) in white-collar women than women agricultural workers *(Järvinen et al 1994)*.

In conclusion high status occupation is associated with high fruit and vegetable intake, or high vitamin C intake *(Marmot et al 1991, Smith & Baghurst 1993, Järvinen et al 1994)*.

1.2ei) **Age and trends in fat intake**

Nutrient intakes may alter significantly with age; age acts as a marker for biological, historical, physiological and social processes *(Macintyre & Anderson 1996)*. The passage of time causes the individual or population to move from one biological state to another, the child becomes an adult no longer requiring extra nutrients for growth. The pregnant woman requiring extra nutrient for the developing foetus becomes middle aged. Age can mark exposure to historical events such as the ending of free school milk or social processes such as retirement, which may differ, in different societies. Food intake may alter for psychological reasons such as the death of a partner, which is more likely to occur at an older age.

A study of 1,512 adults obtained by quota sampling at a health centre, with a 71% response rate, in Scotland found that both men ($P< 0.001$) and women ($P<0.01$) were significantly less likely to eat fried foods and butter as they got older. Older women were more likely to eat chicken and fish ($P<0.001$) and use oil ($P<0.001$) rather than fat for cooking than younger women were. Older men were significantly ($P<0.01$) more likely to report using less salt on their food than other respondents were. Older women claimed to eat more fibre ($P<0.05$) than younger women *(Currie et al 1990)* ate.

The Trent Lifestyle Survey *(Dengler et al 1994)* found that respondents were more likely to consider their diet was healthy enough as they got older.
Bolton-Smith *(et al 1990)* looked at age trends in nutrient intake in manual and non-manual men and women who participated in the Scottish Heart Health Study. They found percentage energy intake from fat increased with age for both manual and non-manual groups, but it was unclear whether different intakes were a reflection of an individuals changing intake with age or a difference in dietary awareness. The study looked at men and women aged 40-59 years. The results may not be applicable to women aged 20-34.
A Norwegian Women and Cancer Study *(Hjartåker & Lund 1998)* showed that younger women preferred low fat milk to skimmed milk, whilst other women used skimmed and low fat milks in equal amounts. The oldest women preferred butter to margarine as a spread on bread more often than younger women. The average energy intake was 6267 kJ, there was a significant inverse trend in energy ($P<0.0005$) and fat ($P<0.0001$) intake by age. The differences in fat intake remained after adjusting for energy. More than 2 out of 3 women had a fat intake higher than the recommendation (30% of energy intake derived from fat).
Younger age is associated with lower fat intake *(Bolton-Smith et al 1989)* in some studies but not in others *(Currie et al 1990, Hjartåker & Lund 1998)*

1.2eii) **Age and trends in fruit and vegetable consumption**

Level of education and occupation is associated with age, as both of these factors are also associated with increased intake of fruit and vegetables it is important to take them into account when looking at the relationship between age and fruit and vegetable intake.
Older respondents interviewed for the Finnish Mobile Clinic Health Examination Survey consumed smaller amounts of vitamins A, E and C and dietary carotenoids than younger respondents *(Järvinen et al 1994)* did. The trend of reduced intake for age was significant ($P<0.001$) for men and women for all three vitamins and dietary carotenoids.
The Dutch National Food Consumption Survey found older women had higher intakes of fruits and vegetables than younger women *(Hulsof et al 1991)* had.
No clear age trend was observed for intake of fruit and vegetables in the Norwegian Women and Cancer study *(Hjartåker & Lund 1998)*. About 17% of the women reported five or more servings of fruit and vegetables a day. The median number of servings was 3.5 per day.

In conclusion younger age is associated with higher fruit and vegetable in some studies *(Järvinen et al 1994)* but not in others *(Hjartåker & Lund 1998)*. An association between older age and higher fruit and vegetable intake has also been reported *(Hulsof et al 1991)*

1.2fi) **Gender and fat consumption**

There are various aspect of gender that affect food choice and nutrient intake. Biological, social, behavioural and psychological differences between the sexes may interact in ways that differ between different communities at different times *(Macintyre & Anderson 1996)*. A difference in nutrient intake between men and women may be due to differences in the amount of food consumed. The difference may disappear if the data is presented as a percentage of energy intakes. Women may be more conscious of body size than men and choose foods with a lower fat content.
A study in Paris (*Bellise et al 1994*) classified 27% of the student and executive populations as habitual consumers of foods specifically sold as being low in fat as compared to only 16% of workers. Male consumers of these low fat foods ate significantly more chocolate, jam and honey but consumed about half as much wine. Female consumers of the low fat foods ate significantly less bread, potatoes, sugar and butter than female non-consumers did. A programme entitled Monitoring Health Behaviour amongst the Finnish Adult Population *(Prättälä at al 1992)* found that women's food choices were consistently more health orientated then men's. Age and education influenced both male and female food choices but the shift towards healthier food was greater for men than for women between 1979 and 1990. Pill *(1993)* did a secondary analysis of a national Health and Lifestyles Survey. In women social class was strongly associated with health behaviour (including some dietary behaviours), education and tenure were the factors that seemed to have the greatest effect on the relationship between social class and Health Practices Index (HPI). Household income and partners work status did not have any effect on male HPI.
Baghurst *(et al 1994)* examined the demographic and dietary profiles of high and low fat consumers in Australia. Respondents were divided into five groups according to their percentage energy intake from fat. They found that significantly more women (P<0.001) than men fell into the low fat quintile (up to 29.7% energy from fat). There was no significant age related, or occupational prestige related trends in fat consumption for women.

Data collected from French University students as part of the European Health and Behaviour study *(Monneuse et al 1997)* shows that female students reported healthier behaviour in terms of efforts to avoid fat and cholesterol than male students did. The study did not involve a food frequency questionnaire, but test-retest reliability was calculated *(Wardle 1991)*. A total of 656 questionnaires from student's aged 18-30 were analysed.
A study that looked at people who complied with the COMA 1984 dietary fat recommendations *(Pryer et al 1995)* found that women were more likely to meet all three COMA dietary fat recommendations than men were. When low energy reporters were excluded 4.7% of the 1110 women in the study met the fat recommendations compared to only 3.8% of the 1087 men, not an important difference. Higher proportions of the male complier's were in the non-manual than the manual social classes. The National Diet and Nutrition Survey of British Adults *(Macdiarmid et al 1996)* was analysed in such a way that the differences between low and high fat consumers could be compared. There was no significant difference in the ratio of men to women in the low and high fat groups.
In conclusion being female is associated with lower fat intake *(Baghurst et al 1994)* one study but not in another (*Macdiarmid et al 1996*). A third study was inconclusive *(Pryer et al 1995)*.

1.2fii) **Gender and fruit and vegetable consumption**

The Spanish cohort of the EPIC study reported that men consumed more vegetables than women did, consumption of fruits was almost the same for both sexes *(Agudo et al 1999)*.
Two nation-wide dietary surveys conducted in Norway in 1993 & 1994 *(Johansson & Andersen 1998)* showed that fruit and vegetable consumption was lower among men than women. Consumption increased with age in both genders.
Results from the Scottish Heart Health Study *(Bolton-Smith et al 1991)* showed that fresh fruit was the third major food item consumed for women. Scottish women also consumed more green vegetables than men did. Women consumed more vitamin C and carotene per 1000 kilocalories than men did.
Data collected from French University students as part of the European Health and Behaviour study *(Monneuse et al 1997)* suggested that female students ate more fruit and vegetables then male students.

Female respondents interviewed for the Finnish Mobile Clinic Health Examination Survey consumed greater amounts of vitamins C and dietary carotenoids than male respondents *(Järvinen et al 1994)* did. The association between women and vitamin C intake remained when expressed per kg body weight.

The meta-analysis *(De Irala-Estévez et al 2000)* of eleven studies that looked at socio-economic differences and fruit and vegetable consumption found that women from higher socio-economic backgrounds consumed on average 9.3g/person/day more fruit than men from higher socio-economic backgrounds did.

In conclusion being female is associated with higher fruit and vegetable intakes *(Järvinen et al 1994, Bolton-Smith et al 1991, Johansson & Andersen 1998,)*, in all the studies reviewed except the EPIC cohort in Spain *(Agudo et al 1999)*.

1.2g) **Summary**

The purpose of this section of the literature review was:

- to document the association between socio-economic variables and fat and fruit and vegetable consumption

The main findings were,

High intake of fruits and vegetables is associated with,

- Higher social class *(Braddon et al 1988, Hulsof et al 1991, Bolton-Smith et al 1991, Roos 1996 et al, Hjartåker & Lund 1998, and Marmot et al 1991)*.
- Being female *(Järvinen 1994, Bolton-Smith et al 1991, Johansson & Andersen 1998,)*.
- Greater number of years of education (*Braddon et al 1988, Hjartåker & Lund 1998, Agudo et al 1999, Roos G et al 2000)*.

Higher intake of vitamin C associated with,

- higher levels of education *(Braddon et al 1988)*
- high status occupation *(Järvinen 1994)*.

1.2h) **Conclusion**

The literature survey suggested that high fruit and vegetable intake is associated with being female *(Järvinen 1994, Bolton-Smith et al 1991, Johansson & Andersen 1998)*, this suggests that the results (Chapter III) may not be generalizable to a population that includes men. A meta-analysis of eleven studies including Roos 1996 study also found an association between higher socio-economic status and fruit and vegetable intake in women *(De Irala-Estévez et al 2000)*. The meta-analysis showed similar differences in fruit and vegetable intake amongst men of different socio-economic groups. The literature also indicated that high fruit and vegetable intake is associated with greater number of years of education *(Braddon et al 1988, Hjartåker & Lund 1998, Agudo et al 1999, Roos G et al 2000)* and higher social class *(Braddon et al 1988, Hulsof et al 1991, Bolton-Smith et al 1991, Roos 1996 et al, Hjartåker & Lund 1998, Marmot 1991)*. This raises the question that women might be better educated than men and that differences in food choice between men and women may be due to education or knowledge rather than gender or possibly difficulties in defining social class result in gender differences being confused with social class differences. These questions highlight the difficulties of comparing studies that may define social class, education and other variables differently from each other. Cultural differences across countries also make it difficult to compare studies. For example men in some countries may only eat food prepared by women thus making their food choice appear to be the same as female food choice. It will be important to separate men and women in any analysis of results in this thesis. It will be interesting to see if the results in this thesis (Chapter III) confirm associations between social class and food choice, and knowledge and food choice once gender differences have been accounted for.

The literature review showed no clear relationship between socio-economic factors and fat intake. Data from the Health and Lifestyle Survey can be used to see if there is an association between fat intake and socio-economic variables in young women.

1.3) **Differences in fat intake and fruit and vegetable intake and their relationship to income and expenditure**

Aim

- To document financial variables and fat intake.
- To document financial variables and fruit and vegetable intake.

1.3a) **Income and food expenditure**

The relationship between food expenditure and income is not linear. Food expenditure increases with income but at a slower rate the higher the income becomes. Using data collected by the National Food Survey (NFS) Slater *(1990)* was able to consider survey week expenditure on food, against weekly household income, net of tax for 4,839 households in 1989. NFS data shows great variability in food expenditure, due to household variation in the amount spent on food, that amount also varies through time and the NFS captures just one week of food purchasing experience. A widely used model for household expenditures, capable of capturing this feature is the Working-Lesser relationship

Figure1.1: Working-Lesser relationship.

$$S_i = \frac{e_i}{x} = \alpha_i + \beta_i \log(x) + \mathrm{E}_i$$

where;

S_i is the share of total expenditure on food i

e_i denotes survey week expenditure on food i

x denotes weekly net of tax household income

E_i is a random variable capturing, across household and across time, variation in expenditure not associated with household income.

The parameters α_i and β_i will vary from food to food and can be estimated from this equation. If β_i were zero then food expenditure would be proportional to income, the data strongly suggests that β_i is less than zero, at least for expenditure on all food. At high-income levels expenditure falls with further increases in income. One reason for this is the increased incidence of eating out among higher income households, which is not recorded by the NFS and therefore appears as a reduction in expenditure. The NFS found that the food group 'all fruit' had the highest income elasticity and came closest to being a luxury food. (Income elasticity of demand for food measures the percentage increase or decrease in consumption of a product resulting from a 1% increase in income.) The income elasticity's for 'potato products' and 'white bread' are negative, for the average NFS household these are foods which higher income households tend to spend less on.

Statistics collected from European countries show a positive relationship between GDP per capita and the number of calories derived from livestock products. The relationship between GDP and calories derived from cereals and roots is negative.

The cost of food influences how much is consumed; the influence of price reduces as income rises. Own price elasticity which measures the percentage fall in consumption of a product resulting from a 1% increase in its price, tend to fall as income rises. Luxury products have price elasticity's that are larger in absolute terms than necessities such as potatoes or rice. Most food products have price elasticity close to zero, implying that policies affecting prices have little affect on consumption. Cross-price elasticity relates the percentage change in consumption of one product in response to a 1% change in the price of a substitute or complement. Cross price elasticity's for close substitutes e.g. butter and margarine can be quite large. This indicated that actions, which affect relative prices, might be important influences on diets *(Geissler 1997)*.

National food survey *(MAFF 1998)* data shows that the highest income groups in adult only households spend £29.12 per person per week on household food and drink. High-income households with 2 adults and 3 children spend £16.41 per person per week, whilst similar low-income households spend £7.27.

1.3b) **Low income and food choice**

There are two major issues affecting the purchase of food in low-income households, firstly there is the problem of access to food. Low-income families are less likely to have the use of a car and must therefore rely on public transport, friends or relatives for trips to the big superstores. The other problem is the actual cost of the food. The Trent Health Lifestyle Survey *(Dengler et al 1994)* found that 67% of unemployed respondents stated they needed more money to have a healthier diet. Clearly food needs to be paid for so the availability of money must affect food choice and therefore nutrient intake.

The Independent Inquiry into Inequalities in Health *(Acheson 1998)* points out that lack of access to transport is experienced disproportionately by women, children, older people and people with low socio-economic status. Between 1980 and 1992 the number of food retail outlets decreased by 35% *(Department of Health 1996),* food retailing has been transferred from small local retailers to large out of town superstores, this represents a greater burden to poorer households without access to a car. A significantly greater proportion of social class IV and V walk or use a bus when shopping than social class I and II *(Caraher et al 1998)*. This limits access to out of town superstores with their greater range of foods and cheaper prices.

Research in the nutrition field has tended to use occupational social class rather than geographical location, depravation indices, or income to identify poor households and, therefore may not measure differences in food choice attributable to income or deprivation *(Dowler & Calvert 1995)*

The cost of an actual diet that met the COMA *(Department of Health 1991)* reference nutrient intakes for an adult woman was reported to be £14.81 from a southern Derbyshire supermarket in 1992. This rose to £14.90 by 1994, the same diet from a small shop cost £19.01 in 1994 *(Barratt 1997)*. A study that examined the cost of meeting dietary goals (*Cade & Booth 1990*) showed that groups of people who were meeting UK dietary goals for healthy eating spent an average of £16.03 per person per week, whilst those who were consuming an average UK diet spent only £13.30. A more recent study using data on 15,191 respondents from the Women's Cohort Study *(Cade et al 1999)* used a healthy diet indicator (hei) based on WHO recommendations for the prevention of chronic disease to compare healthy and less healthy diets. Cost of the diets were calculated for the whole sample by multiplying the amount of food consumed from the FFQ for an individual with average national prices taken from the 1995 National Food Survey and from the 1997 Tesco supermarket home shopping catalogue. Indirect costs were assessed by telephone interviews with 104 women (response rate 73% of least healthy diet and 91% of most healthy diet), focusing on time spent shopping and preparing foods. The greatest difference in costs, £1.69 per day was seen between the least healthy diet group (hei 0) and hei group7. The difference in cost between the least healthy and most healthy diet (hei 80 was £1.48 per day (95%CI £1.24-£1.71). The least healthy diet group spent more money on meat, fish and eggs whilst the healthiest group spent £1.87 per day on fruits and vegetables, this was three times as much as the least healthy group spent on fruits and vegetables. Ordinal logistic regression showed being a vegetarian, spending more money, having a higher energy consumption, a lower BMI and being older were all independent predictors of a better diet score. There was a tendency for spending more money on food to be associated with a much better diet if the healthy diet indicator was low. If the diet was fairly healthy already then spending more money was associated with a lesser improvement. The Women's Cohort Study sample is not a representative sample of British women. The women are a group who are interested in their diet, they may be more likely to spend extra money on improving their diet than other women are likely to be. Women with the healthiest diets ate about 4.2MJ (1000kcal) more per day than other women, this would have made the diet more expensive.

A lower level of expenditure was reported by the National Food Survey, in 1994 the highest average weekly expenditure per person was £18.70 for single adult households in the highest income group. The lowest weekly expenditure was £8.19 per person for households with two adults and three children in the lowest income groups. NFS data shows that nutritional variations between income groups are smaller than the variations in dietary patterns, because people tend to substitute foods of a broadly similar nutritional value for cheaper foods. For example low-income households eat more meat than high-income households but spend less money on purchasing the meat. Amongst the households with earners, the higher the income the less energy derived from household food and the more energy from alcohol, soft drinks and confectionery. Households without an earner in the lowest income group consumed more milk, eggs, fats and oils and sugar and preserves than the highest income groups with one or more earners. They also consumed slightly more vegetables but only about half the quantity of fruit. Higher income groups tended to consume greater quantities of coffee whilst low-income groups drank more tea.

1.3c) **Income and fat consumption**

National Food Survey *(MAFF 1998)* data from the UK looks at average consumption and expenditure for households in different income groups. Individuals in households with one or more earners where the gross weekly income of the head of household is greater than £160 per week consume between 70g and 74g of fat per day from household foods. This is 38-39% of food energy from fat. Households with a gross weekly income of under £160 have a fat intake of 68g per day, or 38% of food energy from fat. Pence per person spent on liquid milk and cream was also lowest in these households. Food eaten out is estimated to provide an additional 17g of fat and 1.6MJ of energy in the highest income households and 9g of fat and 0.8MJ per person per day in households with a gross weekly income of under £160. This additional fat intake provides 40% and 39.3% of total energy as fat respectively.

1.3d) **Income and Fruit and Vegetable intake**

In the USA a National Cancer Institute (NCI) survey found that median fruit and vegetables consumption was 3.1 servings for the lowest income group in comparison to 3.7 servings for the highest income group *(Subar et al 1992)*.
National Food Survey *(MAFF1998)* data showed that expenditure on total potatoes was generally higher in low-income groups and fell with increased numbers of children in the household. Average expenditure (per person per week) on processed vegetables is higher in low-income households than high-income households, but did not tend to vary with household composition. Expenditure on fresh vegetables (per person per week) was £8.99 in the highest income households compared with £5.63 in low-income households (gross weekly income of less than £160). Consumption of vegetables and fresh fruit was lowest in low-income households (gross weekly income of less than £160). The NFS showed lower intakes of many nutrients expressed per person per day for the low-income household (one or more earner, gross weekly income of less than £160) compared with the high-income household (one or more earner, gross weekly income of less than £640) households. A survey of nutrition and diet in lone-parent families in London *(Dowler & Calvert 1995b)* looked at food consumption in 133 households. Those families high on the fruit and vegetable index also had high intakes of vitamin C and folate, suggesting that those who said they ate plenty of fruit and vegetables probably did so. Parents eating at least five portion of fruit and vegetables a day were more likely to be from non-manual socio-

economic groups, to have tertiary educational qualifications and not be in receipt of income support. The poorest by the poverty index were the least likely to eat more than five portions of fruit and vegetables a day. Those families in the lowest quartiles of household income and who spent the least per head on food had some of the lowest nutrient intakes. The material poverty index was the most important factor in differentiating parents' folate intake, being able to afford what respondents described as 'fresh' foods differentiated parents' folate intakes very powerfully. Shopping exclusively at discounted food stores was associated with a lower folate intake in parents, those who never used the major chain supermarkets had much lower intakes than those who did. The main sources of vitamin C for survey participants were fruits, vegetables, crisps and Ribena (fortified), children's vitamin C intakes were lower for each increase in the poverty index but all the group means were higher than 100% of reference intake. Shopping exclusively at discount stores was associated with lower vitamin C intakes in parents, whilst those children whose parents looked for 'fresh foods had higher vitamin C levels. The most important factors associated with increasing fruit and vegetable variety score in parents' diets were not being poor, being black, looking for 'freshness' when buying food, aiming for variety in the families diet and not shopping for food that is just 'cheap'. Also important was shopping regularly in supermarkets rather than only in discount stores, looking for 'healthy' food when shopping and having tertiary educational qualifications. Researchers working on the Women's Cohort Study found that women with the healthiest diets spent 98pence per day on fruit and 89pence per day on vegetables. They compared this with NFS data showing a national average of 17 pence per day on fruit and 31 pence per day on vegetables excluding potatoes *(Cade et al 1999)*.

Low income is associated with lower fruit and vegetable intakes *(Subar et al 1992, Dowler & Calvert 1995b)*.

1.3e) **Income/expenditure and age.**

National Food Survey *(MAFF 1998)* data showed that expenditure on household food and drink varied from £12.33 per person per week in households where the main diary keeper was under 25 years to £20.92 where he or she was aged 55-64 years. Consumption of most food items but particularly milk and cream, fish, eggs, fresh potatoes, fresh vegetables, fruit and fruit products and cereals all rose steadily with the age of the main diary keeper. Data from the Women's Cohort Study *(Cade et al 1999)* showed that being older was an independent predictor of having a better diet. Women in the study were aged between 35 and 69 years at recruitment.

1.3f)) **Low income and attitudes towards food.**

Cost and convenience were not shown to be important in two studies using the same attitude questionnaire *(Towler 1992, Shepherd 1992)*. But a later study *(Richardson et al 1993)* that looked at 13 separate foods found value for money to be a significant consideration in all but four of the foods.

A study done in Australia *(Santich 1994)* using semi-structured interviews with women from low income and socially disadvantaged backgrounds asked the question, 'What would you buy if you had more money, that you don't buy now?' Thirteen of the forty-five women interviewed stated that it would make no difference or that they would buy more of the same, whilst nine said they would buy dearer, better quality meat, another four said that they would buy more meat. The author stated that 'although it was often implied during the course of the interviews that low income and a fixed budget constituted barriers to a 'healthy' diet, only three women suggested that, with more money they would be able to buy 'healthier' foods. That is not to say that budgetary constraints are not a barrier to a healthy diet, but that other needs and desires may be given priority when such restraints are removed.'

A study investigating the relationship between income and attitudes and beliefs about eating a healthier diet used a postal questionnaire to 400 adults from five different income groups in England and Scotland. A significantly greater percentage of total income was spent on food in the lowest income group, (43% of an average income of £141), than in the highest income group (17% of an average income of £621 per week). All income groups viewed healthy eating as both enjoyable and beneficial. People on a lower income reported greater difficulty in eating a healthier diet and also greater social pressure to change. Knowledge of nutrition did not vary greatly between people at different levels of income *(Shepherd 1996)*.

The Institute of European Food Studies (IEFS) Pan-European study found that 'Quality/freshness,' 'price,' and 'trying to eat healthy' were most frequently selected by subjects aged 55 years and over when asked to select the three most important influences on food choice from a list of 14. Women were more likely to select 'price' than men. The greatest influence on food choice was 'price' for 8% of the total sample. 'Price' was amongst the top five influences on food choice in all 15 member states *(Lennernas et al*

1997) although it's influence varied greatly amongst the member states, it was second when the combined European Union (EU) sample was considered. A comparison of price level index (defined as the ratio between purchasing power parity and exchange rates) and the ratings for 'price' from the survey have a correlation coefficient of 0.51. The author suggested that high price level in Finland, Sweden, France and Austria might be a contributing reason to the high percentage of consumers considering 'price' as an important influence of food choice. When subjects in the same study were asked about barriers to healthy eating 15% of respondents reported cost of food. There was a wide variation between countries, with 24% of respondents in Luxembourg and 23% of UK respondents reporting cost to be a barrier and only 7% of Italians and 9% of Germans. More respondents with secondary education (16%), than those with primary education (13%), reported cost to be a barrier too healthy eating *(Lappalainen et al 1997)*.

Women were more concerned about feeding their children healthy food than about what they ate *(Treiman et al 1996)*. This attitude is also seen in the Hispanic Health and Nutrition Examination Survey (HHANES) where 1,0446 low-income Hispanic-American women and 1,063 children took part in a 24-hr recall. There was a tendency for women to consume less fruit than their children did, bananas for example were consumed by 17.6% of children but only by 7.7% of women, the same relative level of fruit consumption by women and children was true of all the fruits. The authors suggest that there was a tendency for women to provide more for their children than they eat for themselves *(Block et al 1995)*. Several common barriers to eating five portions of fruits and vegetables daily emerged from the study with WIC participants, these included lack of availability, time and effort to prepare and eat fruits and vegetables and not liking fruits or vegetables or preferring other foods *(Treiman et al 1996)*. Cost was seen as the primary barrier to buying new kinds of fruits and vegetables, financial constraints were also thought by the authors to underlie concerns about waste and spoilage of produce.

It is very hard to draw an association between people on low incomes and specific attitudes towards foods that they have because of their level of income. The studies were diverse in the attitudes that they looked at. There is an implication that people would eat healthier diets if they had more money but no concrete evidence to say that a specific rise in income correlated to an increase in consumption of a specific food or nutrient.

1.3g) **Summary**

The purpose of this section of the literature review was:

- To document the association between financial variables and fat and fruit and vegetable consumption

The main findings are,

- High-income households with 2 adults and 3 children spend £16.41 per person per week, whilst similar low-income households spend £7.27 *(MAFF 1998)*
- Groups of people who were meeting UK dietary goals spent an average £3.27 more per week than people consuming the average UK diet did (*Cade & Booth 1990*).
- Low income is associated with lower fruit and vegetable intakes *(Subar et al 1992, Dowler & Calvert 1995b, MAFF 1998)*
- Being older is an independent predictor of having a better diet *(Cade et al 1999)*.

1.3h) **Conclusion**

The association between low fruit and vegetable intakes and low income *(Subar et al 1992, Dowler & Calvert 1995b)* will be hard to examine directly because of the lack of data on income levels. It may be possible to look at other indices of wealth such as car ownership and bed standard to see if results from the survey suggest a relationship between fruit and vegetable intake and income.

It would be interesting to gain more information on income and food intake. Data from the National Food Survey could be used to answer the following questions;

- What is the nutrient profile of low-income diet?
- What happens to the nutrient level if fat is reduced, fruit and vegetables increased and expenditure remains constant?

These questions will be answered in Chapter III, Results.

1.4) **Knowledge and fat and fruit and vegetable intake**

Aim

- to review the links between knowledge and fat intake
- to review the links between knowledge and fruit and vegetable intake

There has been a wide spread assumption that increased knowledge about food leads to healthier food choice. A self-completed postal questionnaire study of 200 health professionals found that 22% of respondents cited lack of knowledge as one of the three most common barriers to people changing their diet *(Buttriss 1997)*. A consumer survey put lack of knowledge as the biggest obstacle to eating a healthy diet *(Buttriss 1997)*. The survey involved face to face interviews with 1700 nationally representative members of the public. The interviews were based on six qualitative group discussions held around the country to aid in the design of the questionnaire.

The IEFS pan-EU survey found that 'not knowing enough about healthy eating' was not selected very often as being a barrier to healthy eating. It was selected by 15% of Austrians and Swedes but by only 4% of Italians and 5% of people in Finland and The Netherlands. This barrier was not related to education level in the overall EU population but in Austria, Greece, Ireland and the Netherlands respondents with only primary education perceived it as a barrier more frequently than respondents with a higher educational background did. In Austria, Finland, Germany, Greece and the United Kingdom younger respondents perceived this to be a barrier more frequently than older people *(Lappalainen et al 1997)* did. There is some evidence to suggest that increased knowledge may be related to increased likelihood of making changes. Bolton-Smith *(et al 1990a)* found that women with medically diagnosed coronary heart disease were significantly more likely than other women to know that loosing weight would reduce CHD ($P<0.001$) risk, they were also significantly more likely to be trying to loose weight ($P<0.005$) than other women were.

This section of the literature review looks at the relationship between knowledge and fat intake and knowledge and fruit and vegetable intake.

1.4a) **Knowledge and the fat content of foods**

A number of studies have attempted to answer questions about the role that knowledge plays in predicting behaviour. A study that looked at the influence of printed nutritional information on subsequent change in behaviour, gave thirty women, between the ages of 20 and 50 a pack of materials designed to encourage moderation of fat intake. The women's responses to the materials were videotaped. They were allowed to take the pack home for a month and then interviewed to see if any dietary changes had been made *(Shepherd & Sims 1990)*. A behaviour change score was developed for each participant. Two independent judges using audio tapes of the exit interviews did this. All the participants reported that they were interested in nutrition and 88% rated their perceived nutrition knowledge as good or very good. The authors concluded that women's responses to the nutrition pack were related to subsequent behaviour change to reduce fat intake. The study did not measure change in food consumption.

A study that looked at nutrition knowledge, attitude and fat consumption distributed questionnaires at a Food Exhibition in London in 1985. Two hundred and ten returned questionnaires were analysed. The nutrition knowledge questions were pre-tested in a pilot study. The food frequency questions were a modification of a previously used questionnaire. Subjects with high nutrition knowledge scores did not report lower consumption of, or have more negative attitudes towards high fat foods *(Shepherd & Stockley 1987)*. The authors stated that the nutrition knowledge questionnaire may have been too short and was not validated. A nutrition knowledge questionnaire was subsequently developed and tested for its ability to differentiate between groups likely to be high and low in nutrition knowledge. The mean scores and ranges for nutrition knowledge were comparable with scores previously found for individuals not trained in nutrition *(Towler & Shepherd 1990)*. The questionnaire included four sections on nutrient density, a section on fat and a set of multiple choice questions *(Shepherd & Towler 1992)* to investigate the relationship between nutrition knowledge and the consumption of foods that contributed large amounts of fat to the diet. Five hundred and thirty eight subjects were recruited from a large insurance company. The nutrition questionnaire was completed together with a socio-demographic section and a questionnaire designed to measure attitudes towards food the consumption of foods that contribute highly towards fat intake. A random group of men was selected to participate in a 3 day weighed intake to measure food intake. The correlation between the scores for total nutrition knowledge against the sum of belief-evaluations, attitude, intention and behaviour were generally negative. Those subjects with the greatest nutrition knowledge had the most negative attitudes towards consuming the high fat foods. Significant correlation's tended to be for the meat and meat product sections of the questionnaire. Women tended to have more negative attitudes towards consuming meat, meat products, dairy products and fried foods than men did. Women had correspondingly higher knowledge than men did. The study confirmed that nutrition knowledge is related to consumption of these specific types of foods but only to a limited degree.

During February and March 1986 the Cardiff Health Survey was carried out to investigate health attitudes, knowledge, practises and beliefs. A random sample of 5145 individuals drawn from the electoral register were approached, by medical students with self completion questionnaires. A response rate of 71% resulted in 4266 completed questionnaires. Results showed an association between reported change in eating habits and nutrition knowledge. The questionnaire does not seem to have been validated or checked for test-retest reliability. Food intakes were not assessed, participants were asked if they ate more, less or the same amount of sugar, meat, fish, salt or fat as they did a year ago *(Charney & Lewis 1987)*.

A study that aimed to determine whether changed eating habits in pregnancy *(Anderson 1993)* were attributable to differences in knowledge or differences in attitude found little difference in nutrition knowledge between the two groups. Dietary change in the pregnant women could not be attributed to an increased level of knowledge.

A questionnaire to assess nutrition knowledge *(Mela 1993)* in 293 UK consumers, made no attempt to examine knowledge in terms of behaviour except the reading of nutrition labels on foods. Perceived nutrition knowledge, likelihood of reading nutrition labels, and perceived understanding of label information were all significantly correlated with each other.

In the Netherlands three generations of women were asked about nutrition knowledge, attitudes and fat intake. The objective of the study was to assess family resemblance in three generations of maternally related family members. A nutrition knowledge instrument based on Dutch Dietary Guidelines was developed; the study used only 22 questions related to fat and cholesterol. Nutrition knowledge was measured by summing the correct answers. Reliability was assessed in a study among 419 men and women between 19 and 75 years of age by means of internal consistency (Cronbach's alpha) and test-retest reliability. Comparing nutrition knowledge scores of lay people with nutrition knowledge scores of

MSc students in human nutrition assessed discriminate validity. A letter was sent to 2052 women, aged between 20 and 30 and living in low-income areas; the women were asked if their mother and grandmother were still alive and living in the Netherlands. All three women had to speak Dutch and should not be living together. Intake of fats, cholesterol and energy was assessed by means of a food frequency questionnaire consisting of 104 items. The questionnaire was tested for validity in the elderly and in men and women aged 30-50. It was also tested for test-retest reliability. Results showed that the correlation between nutrition knowledge score and fat intake, as a percentage of energy, was not significant *(Stafleu et al 1996)*. The authors note that fat intake is not behaviour but an outcome of several behaviours. If nutrition knowledge is a predictor of behaviour then the knowledge measured should be the knowledge required to perform the behaviour. This was the only study that attempted to measure participant's fat intake and considered the validity and test-retest reliability of its instruments.

A study that looked at male patients with coronary heart disease classified men into two groups, high fat consumers and low fat consumers. No difference was found between the two groups in terms of knowledge *(Koikkalainen et al 1999)*.

The 'Green Keyhole' nutrition campaign in Sweden *(Larsson & Lissner 1996)* involved the introduction of a 'Green Keyhole' symbol on foods to help consumers identify low fat and high fibre foods. A study was done to examine whether knowledge was associated with reported intakes of dietary fat and fibre. No significant differences were seen in total fat intake or in percentage energy from fat between the women who understood and women who did not understand the meaning of the Keyhole symbol. Women with better knowledge were reported to have a higher dietary P:S ratio than other women. The study used 669 randomly selected women, who answered a questionnaire to test their knowledge of the keyhole symbol.

The mean age of the women with adequate knowledge of the Keyhole system was 61±11 years, 62% of the selected women adequately understood the symbol. There was no significant difference between the women with more or less education in terms of understanding the Green Keyhole. A further study published in 1999 *(Larsson et al 1999)* suggested that 53% of women understood the meaning of the symbol and that subjects who understood the symbol were significantly younger ($P<0.0001$) and thinner ($P<0.0105$) than other women without knowledge were.

Smith (*et al 1995*) found nutrition knowledge to be strongly predicative of behaviour change. The aim of the study was to examine whether socio-economic status and selected aspects of knowledge, beliefs and attitudes were related to dietary behaviour change in volunteers for a nutrition education program. Recruitment letters inviting participants to a study of dietary change offering free cholesterol testing and dietary advice were sent to randomly selected adults on the electoral rolls of Adelaide suburbs. There was a 24% response rate. Participants were randomly assigned to intervention and non-intervention groups. Both groups completed a dietary assessment from a quantitative food frequency questionnaire, used extensively in Australian dietary surveys, and questionnaires to measure knowledge, attitudes and beliefs at base line and week 13 of the study. The intervention group had dietary feed back based on their usual food intake using verbal, written and pictorial information from the nutrition education instrument. Participants were asked to set their own dietary behaviour goals and to monitor their adherence to these during three separate 7-day periods over the three-month intervention. There were 487 participants in the study, of the 249 in the intervention group, 223 returned for follow up. Initial food guide based knowledge score; change in food guide based knowledge score and change in applied knowledge score were found to be independently predictive of dietary change. Study participants differed from the general population in three ways, they were more likely to be from a higher socio-economic group, they had stronger beliefs in the need for a healthy diet and they had healthier dietary intakes. Dietary changes made by study participants are not recorded. In conclusion increased knowledge is associated with lower fat intake *(Shepherd & Sims 1990, Shepherd & Towler 1992)* in some studies but not in *(Larsson & Lissner 1996, Stafleu et al 1996, Koikkalainen et al 1999)* others.

1.4b) **Knowledge and fruit and vegetable intake**

The Maryland WIC 5 A Day Promotion *(Havas et al 1998)* aimed to increase fruit and vegetable consumption by women involved in WIC, baseline surveys of control and intervention participants contained 7 knowledge items. These items could not be used on a scale due to low internal reliability. A single knowledge question was used in the analysis, the question asked 'How many servings of fruits and vegetables do you think a person should eat each day on average?' A response of 5 or greater was classified as correct. A statistically significant higher consumption of fruits and vegetables was associated with correctly answering this question.

A qualitative study in Scotland *(Piacentini et al 1995)* that used focus group discussions with consumers in high and low socio-economic groups found lack of knowledge of fruit and vegetable preparation and use was a constraining factor in the consumption of fruits and vegetables.

A study that looked at fruit and vegetable consumption in 92 children and their mothers, in urban primary health care practices *(Gibson et al 1998)*, found that mother's nutritional knowledge was an independent predictor of the child's fruit and vegetable intake. The women's diets were assessed by food frequency questionnaire whilst the children's diets were assessed by 3-day diaries.

A postal survey that sent a validated nutrition knowledge questionnaire, to 1040 adults selected at random from General Practitioners' lists in England and Wales, found that respondents in the highest fifth for knowledge were almost 25 times more likely to meet current recommendations for fruit, vegetable and fat intake as those in the lowest fifth *(Wardle et al 2000)* after controlling for demographic variations.

Increased knowledge is associated with higher fruit and vegetable intake *(Piacentini et al 1995, Havas et al 1998, Wardle et al 2000)*.

1.4c) **Summary**

The purpose of this section of the literature review was:

- To review the links between knowledge and fat intake.
- To review the links between knowledge and fruit and vegetable intake.

The main finding is that:

Increased knowledge is associated with;

- Increased likelihood of consuming high fruit and vegetable intake *(Piacentini et al 1995, Havas et al 1998, Wardle et al 2000*)

1.4d) **Conclusion**

The literature review found two studies linking increased knowledge with lower fat intake and three studies that did not show a link. Two studies showed a link between fruit and vegetable intake and knowledge *(Piacentini et al 1995, Havas et al 1998*). The results of the study done by Havas are not applicable to our study population because it was done on WIC participants, who are a very particular group of young women. The lack of conclusive evidence about the relationship between knowledge and food choice suggests that it would be useful to look at the data in the Health and Lifestyle Survey. It may be possible to identify an association between knowledge and low fat intake or high intake of fruits and vegetables using data collected from the survey.

1.5) **Attitudes and fat and fruit and vegetable intake**

Aim:

- to assess the connection between attitudes and fat consumption
- to assess the connection between attitudes and fruit and vegetable intake.

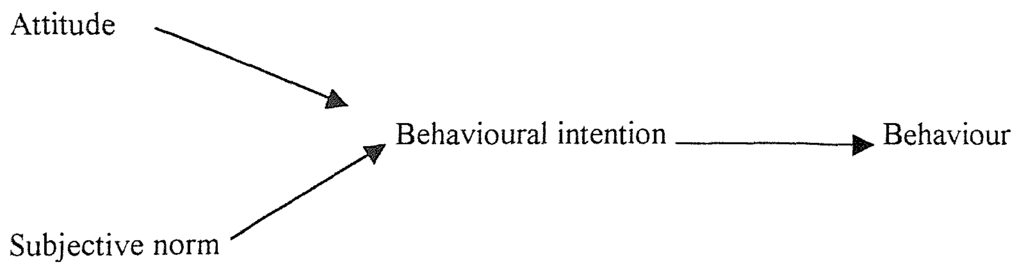
This section reviews the literature on attitudes towards the choice of high and low fat foods and fruits and vegetables. A number of papers on attitudes and food choice are based on the work of Ajzen and Fishbein so a summary of their work has been included. Another prominent theory of behaviour change is the Transtheoretical or Stages of Change model described by Prochaska & DiClemente *(1994)*. This model is not discussed here as it was felt to be more appropriate to assessing readiness to change behaviour than predicting behaviour. Attitudes cannot be viewed in isolation from socio-economic variables so papers that examine the links between attitudes and socio-economic factors have been included.

1.5a) **Review of the Theory of Reasoned Action and the Theory of Planned Behaviour**

Ajzen and Fishbein developed the 'Theory of Reasoned Action', which states that when appropriately measured attitudes and subjective norms were sufficient to predict intentions. It may be helpful to look at some of the terms used

- Attitude - this was defined *(Fishbein & Ajzen 1975)* as learned predisposition's to respond in a consistently favourable or unfavourable way towards a given object, person or event.
- Behavioural intentions - these are assessed by the subject's indication of his intention or his willingness to engage in various behaviours with respect to or in the presence of a given person or object.
- Subjective norms - these are the individuals own perceptions of social pressures. They are predicted by the sum of the product of an individual's beliefs concerning whether significant others think the individual should perform the behaviour and the motivation to comply with the wishes of these significant others.

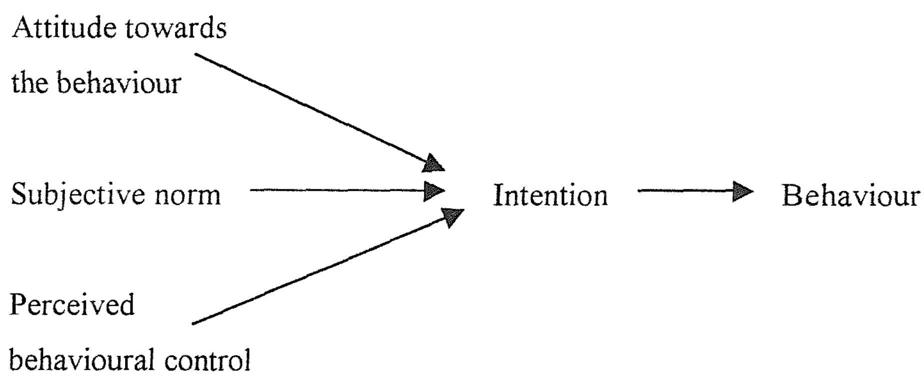
Figure 1.2: The Theory of Reasoned Action



The Theory of Reasoned Action was refined and became known as the Theory of Planned Behaviour *(Ajzen 1991)*. It stated that behavioural intention is predicted by:

- The attitude towards the behaviour
- Subjective norm
- Perceived behaviour control

Figure 1.3: The Theory of Planned Behaviour



Behaviour intention predicts actual behaviour and can be assessed by questionnaire. Attitudes to the behaviour are predicted by the sum of the products of the individual beliefs about the outcomes of the behaviour and the values attached to the outcomes.

Attitude = $\sum$ belief $\times$ outcome

Subjective norms are predicted by the sum of the product of an individual's beliefs concerning whether significant others think the individual should perform the behaviour and the motivation to comply with the wishes of these significant others.

The Theory of Planned Behaviour describes three rather than two distinct determinants of intention.

Ajzen himself *(1991)* indicated that the model might need further modification. 'The theory of planned behaviour is, in principal, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behaviour after the theories current variables have been taken into account.'

1.5b) **Attitudes and fat intake**

The theory of planned behaviour has been used as the basis for many studies of nutrition related behaviours. A study looking at the consumption of fats and oils *(Saba et al 1998)* found behavioural intention to be predictive of actual consumption of olive oil, seed oil and butter. Habit was shown to be more important than attitude in influencing behavioural intention

Attitudes have been shown to be good predictors of the frequency of consumption of individual fatty foods and also of total fat intake *(Shepherd & Stockley 1985)*. The measure of attitude towards a food was found to be a better predictor of intake than the subjective norm, which relates to how the individual thinks others think he or she should behave. This was shown again in a later study *(Shepherd & Stockley 1987)*. People were more inclined to eat what they wanted to eat, than what they felt other people wanted them to eat, or they did not want to admit the extent to which other people's opinions influence them. Both these studies looked at self-reported behaviour, not actual behaviour, although the FFQ was validated against 7-day weighed food intake measurements, on a separate group of thirty subjects. Another study used a modified version of this FFQ to examine the relationship between nutrition knowledge, attitudes and consumption of fatty foods *(Shepherd & Stockley 1986)*. Knowledge was not related to either attitude or the frequency of consumption of a food (behavioural intention). Attitude was confirmed as a good predictor of consumption.

A study designed to measure attitudes towards the consumption of foods high in fat *(Towler & Shepherd 1992)*, found correlation coefficients measuring the correlation between attitudes and intention and intention and behaviour to be between 0.37 and 0.68 for meat, meat products and fried foods, but lower for diary products. The authors suggest that the attitude measure showed good prediction of the reported consumption of the foods that contribute the majority of fat in the diet. This study looked at self-reported behaviour not actual behaviour.

Lloyd *(et al 1993)* used a FFQ to assess people's attitudes and beliefs regarding nine dietary changes. The results were used to divide 390 respondents into thirds for percentage energy intake from fat. No significant differences in attitude towards reducing fat content of the diet in the future, was found between the three groups. Attitudes towards making changes were positive, except for increasing fruit and vegetables and changing to reduced fat milks. The medium fat group had the least favourable attitude towards making these changes. Respondents were also classified into thirds based on their perceived fat intake *(Paisley et al 1995)*. Statistically significant ($P<0.05$) differences were seen for attitude and perceived control scores between the perceived high fat and the perceived low fat group for all nine dietary changes, and for the sum of the nine changes. The perceived high fat group had less positive attitudes and believed that all the changes would be more difficult to make than did the perceived low fat group. Subjective norm ratings were significantly lower for the perceived high fat group than the perceived low fat group for three dietary changes. For the total sample attitude, subjective norm and perceived control were all significantly correlated with intention to reduce fat intake but subjective norm was a more important predictor of intention than attitude. When fat intake was correctly perceived as high or low, attitude scores were higher than when fat intake was incorrectly perceived. Subjects who accurately perceived their fat intake scores to be low had the most favourable attitudes towards reducing their fat intake, while high fat intake subjects who felt that their fat intake was neither high nor low had the least favourable attitude.

Seventy volunteers, recruited by newspaper advertisements requesting participants for a food marketing study *(Lloyd 1995)* were divided into control and experimental groups and asked to reduce the fat content of their diet over a twenty week period. All subjects completed a questionnaire eliciting beliefs and attitudes towards nine dietary changes aimed at reducing fat intake, at the beginning and end of the study. The experimental group believed a reduction in taste to be a potential problem for five of the changes, subjects also believed that buying reduced fat products and more fruit and vegetables would be more expensive. In general perceived barriers were reflected in practice. Taste was the most important factor distinguishing between persons who liked and persons who disliked the changes. At the end of the study period, approximately two thirds of all subjects believed they were eating the right amount of fat. All subjects completed four day weighed diet records as baseline and five more times during the study. These were used to split the experimental group into two equal groups classified as more successful and less successful fat reducers. The weighed records indicated a 25% reduction in total fat intake in the first two weeks of the study among subjects in the experimental group. The more successful group significantly and constantly reduced their percentage of energy from fat, the less successful group made little change. The less successful group believed the changes would make their diet worse, but there was no difference between the two groups in beliefs about taste, cost and convenience. The only difference reported in problems encountered by the two groups was for reducing intake of cakes and biscuits where the less successful group reported a lack of family support. Analysis indicated family support was an important discriminator for reducing intake of cakes and biscuits, red meat, other meats and total fat and for increasing intakes of fruit and vegetables. For these changes the more successful group had more family support than the less successful group.

Researchers in Holland, working with 419 subjects from low income areas *(Stafleu 1994)* found that their attitude scale explained 25% of the variance in percentage of energy from fat in the diet as assessed by a semi-quantitative FFQ. On average subjects had more positive attitudes towards low fat foods than high fat foods. The attitude scale was based on questions about ten foods covering 37% of the total fat intake as indicated by the Dutch National Food Consumption Survey.

A study that aimed to investigate the relationship between beliefs and attitude *(Shepherd 1988)*, used a questionnaire completed by 103 subjects, questions concentrated on beliefs about low fat milks. Thirteen beliefs were broken down into four categories; sensory attributes, nutrition, function properties and price. The relationship between the different types of beliefs and the attitude score was tested using multiple regression. The nutritional beliefs were more closely related to attitude than the sensory/functional beliefs. Taste was shown to be the belief that correlated most highly with attitude when Towler *(1992)* studied six salient beliefs for each of four food groups. Three of the beliefs were the same for each of the four food groups, these were related to foods being seen as healthy, high in fat, and tasting good. The remaining three beliefs depended on what the pre-interviews had shown to be relevant for that particular food group. Foods' being seen as being healthy was the belief that correlated second highest with attitude. This finding was seen again *(Richardson 1993)*, when taste was found to be a significant determinant in the consumption of all 13 foods studied. Health was found to be significant for 12 of the foods, the exception being pulses.

A questionnaire on attitudes and beliefs regarding low fat diets was mailed to 2,000 consumers throughout the UK *(Lloyd 1993)*. Thirteen belief items were included covering, nutrition and sensory qualities, price, ease of preparation and perceived health benefits. Corresponding evaluation questions measured the importance of each belief to the subjects. Each belief item (b) was multiplied by its corresponding evaluation (e) score and the products summed over beliefs for each specific dietary change (⊘ b.e). For the total sample ⊘ b.e for all dietary changes was highly correlated with attitude. The majority of people in this study believed that their diet was healthy, all three fat intake groups considered themselves to consume on average a relatively low fat diet. Although the low fat group were significantly more likely to classify themselves in this group.

Subjects stopped in a Supermarket *(Wise 1995)* were asked to fill in a questionnaire of 14 statements designed to measure beliefs about fat and consumption of fat spreads. Subjects were also asked to identify, from a choice of ten, the slice of bread spread with fat most similar to the amount they would use at home. There was a significant relationship between the belief and the weight of spread for eight of the statements. Subjects with positive beliefs about the taste used a larger portion of spread than other subjects did. The belief that it would be unpleasant or unacceptable to reduce the amount of spread was not associated with portion weight.

Towler's 1992 study found good correlation between peoples attitudes and intentions and between intention and behaviour towards meat, meat products and fried foods, less good but none the less significant correlation's between attitudes and intentions and between intentions and behaviour were shown for dairy products. This may be because dairy products are not clearly defined in the public view as a 'good' or 'bad' foods in the same way that meat products and fried foods have been labelled 'bad' and 'unhealthy'. A study that looked at dairy products and considered perceived obligation for the families health *(Raats 1993)* in addition to attitudes, found that perceived obligation to one's family's health was an important independent predictor of behavioural intention for the use of semi-skimmed and whole milk. It was also an independent predictor of attitude towards use of each type of milk.

In contrast to the generally positive attitudes found by Lloyd in the 1993 study of 2,000 consumers, intention scores did not differ significantly from the neutral mid-point, except for increasing fruit and vegetable intake and for reducing red meat. The high fat intake group showed significantly higher scores for their intention to reduce their intake of full fat milk, fried foods and full fat products, than did the low or medium fat groups.

In conclusion negative attitudes towards high fat foods are associated with lower fat intake *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler 1992, Stafleu et al 1994, Dittus 1995, Paisley et al 1995, Wise & McPherson 1995)*.

1.5c) **Attitudes and fruit and vegetable intake**

A study based on analysis of data obtained from 3,122 participants of the Maryland Special Supplemental Nutrition Program for Women, Infants and Children (WIC) 5 A day Promotion Program *(Havas et al 1998)* found that those women with positive attitudes towards the consumption of fruits and vegetables consumed 0.73 servings more than other women. The survey was a self administered written questionnaire. It consisted of 12 socio-economic items, 5 attitude questions, and 7 knowledge items. There were also a number of questions on social support and self-efficacy and a 7-item food frequency questionnaire. Internal reliability of the scales was assessed using Cronbach's alpha. The knowledge scale was disregarded because of low internal reliability. The majority of respondents were black, single high school graduates below the age of thirty. The authors note that the food frequency questionnaire was an imprecise measure of fruit and vegetable intake. The survey contained five attitude questions about fruits and vegetables, e.g. 'having my family eat five or more portions of fruits and vegetables is very important to me' which respondents were asked to score on a five point scale. Values were then summed to create an attitudes score, higher scores reflecting positive attitudes were significantly associated with higher consumption of fruits and vegetables *(Havas et al 1998)*. WIC participants must have a family income of 185% or less of the USA poverty level and must have some nutritional risk condition *(Treiman et al 1996)*. A study using focus group discussions was conducted with 32 WIC participants with the aim of finding out more about attitudes and behaviours related to fruit and vegetable consumption. Information that arose from the focus group discussion was used to formulate questions for 207 women who were then interviewed individually. Participants were generally found to have positive perceptions about fruit, the major disadvantages mentioned were that fruit is expensive and hard to select and store. Participants generally considered vegetables to be 'good for you'. The major disadvantage mentioned was that vegetables spoilt quickly.

A mail survey conducted in 1990 to examine attitudes towards nutrition and reported fruit and vegetable intake among randomly sampled Washington State residents indicated that 16% of the variance in fruit and vegetable intake was accounted for by attitude variables

(Dittus et al 1995). Principles of the Health Belief Model were used to develop a questionnaire that included attitude variables to address a readiness to consume fruits and vegetables. The questionnaire was not validated. Actual consumption of fruit and vegetables was determined using a food frequency questionnaire. Demographic questions were also included in the questionnaire. The questionnaire was mailed to 2000 residents. There was a 60% response rate. The majority of survey respondents were female (59%). The respondents were also more likely to have high incomes and a good education than the general population. Attitude statements had a 5 point Likert scale ranging from 'strongly agree to strongly disagree'. Cronbach's alpha values were determined to assess reliability of the final scores. Respondents showed a high level of nutrition concern regardless of income or education level.
The Norwegian Women and Cancer study *(Hjartåker & Lund 1998)* found that women who emphasised diet's importance to health were 2.5 times more likely to follow the recommendation for consumption of 5 portions of fruit and vegetables per day than women who put only some or no emphasis on their diet. Authors acknowledge that lack of information on orange juice consumption reduces the ability to make accurate calculations of the 'five a day index', although this would tend to make estimates an underestimation rather than an over estimation.
In conclusion positive attitudes are associated with higher fruit and vegetable intake *(Dittus et al 1995, Hjartåker & Lund 1998, Havas et al 1998*

1.5d) **Attitudes and socio-economic variables**

Higher social class subjects *(Shepherd 1987)* tended to show more negative responses to high fat foods, but the only significant result was for the subjective norm. *(Towler 1992)* found that higher social classes demonstrated more negative attitudes towards, and lower consumption of, high fat foods with the exception of dairy products. No significant effects of social class were found for attitudes and beliefs towards eating certain items of food *(Dennison 1995)* in school children. Intentions to eat chips were found to be lower in the higher socio-economic classes, differences were also found in the degree to which children from different socio-economic groups identified themselves as healthy eaters. The mean scores for those in socio-economic group 1 were significantly higher than the scores in the three remaining groups were.

A questionnaire sent to males aged 46 years, living in Rome *(Seccareccia 1991)* included sections on socio-economic status, knowledge of coronary heart disease, dietary habits and behaviour in relation to the prevention of coronary heart disease. The study had a low response rate (27.8%) that was biased towards the higher social classes. It showed trends that indicate that the higher social classes have attitudes towards leisure time physical activity, smoking, alcohol consumption and perhaps blood pressure and serum cholesterol control that are more favourable with respect to the prevention of CHD than the lower social classes have. In a paper entitled; 'The diffusion model and the social-hierarchical process of change' *(Lindbladh et al 1997)* it is suggested that the disposition to keep up with new trends is a normal part of the lives of those people who have access to the material and cultural means which are required to benefit from those new trends. In other words higher socio-economic groups are the first to adopt new i.e. healthy patterns of behaviour. Prättälä *(1992)* said that men and women of lower social classes followed the trends in dietary habits set by the upper social classes with a time lag of about ten years. In a later study *(Roos et al 1996)* commented that the diets of the higher socio-economic groups were not healthier than those of the lower socio-economic groups but included more of the modern recommended foods such as fruits and vegetables than the traditional recommended foods such as bread and potatoes.

In conclusion higher socio-economic groups were associated with positive attitudes towards higher fruit and vegetable intake *(Roos et al 1996)* in one study but there was not much evidence to confirm this association from other studies. Higher socio-economic groups are associated with negative attitudes towards high fat intake *(Towler 1992)* but only in one study.

1.5e) **Attitudes and gender**

In a study population of 592 adults from Northern Ireland *(Barker 1995)* found a correlation between the fat-phobic attitudes of the women studied and their reduced intake of chips, butter and sausages. Men did not show a similar correlation.

Other studies also found women had more negative attitudes towards high fat foods *(Shepherd 1985) (Towler 1992)*, than men. Women were also shown to have more positive attitudes and beliefs towards low fat milk consumption *(Shepherd 1988)* than men. In this study the scores for behavioural intention approached statistical significance. The scores for self reported behaviour did not differ between men and women at all.

A study that included a nutrition knowledge questionnaire *(Shepherd & Towler 1992)* showed women to generally have a more negative predisposition than men towards the consumption of meat, meat products, and dairy products and fried foods. Women were also shown to have greater nutrition knowledge than men, a questionnaire eliciting estimates of fat content as a percentage of energy for 24 common foods, showed women to have a significantly lower median overall estimation error than men *(Mela 1993)*. This questionnaire also showed women to be more restrained eaters than men.
Women were also found to have more negative attitudes to high fat foods than men had in a Dutch study *(Stafleu et al 1994)* but no difference between genders for percentage energy from fat in the diet was found.
The weight of fat spread on bread identified as being closest to that used at home *(Wise 1995)* was found to be different for men and women. A number of other beliefs were also found to be significantly different between genders, more females than males thought that the amount of spread they put on bread was important for health. Prediction of the portion weight from the scores given for the 14 statements were significantly more accurate for females (P>0.001). Women also showed more positive beliefs than men did.
Women were found to have a significantly more favourable attitude than men towards making changes to reduce the fat content of their diet *(Lloyd et al 1993)*, except for changing to low fat milks. Women were also said to be significantly more likely to report the intention to reduce the proportion of fried foods and red meat in their diets than men were but the results were not presented.
A study of adolescent food choice *(Dennison & Shepherd 1995)* found that girls tended to see themselves as more concerned about healthy eating than boys. Girls had significantly more positive attitudes towards fruit than boys had, girls also saw fruit as tasting better and being better for health, they saw chips, chocolate and sweets as being less good for health and as more fattening and fatty than did the boys. The same study also found gender differences in the reported levels of perceived social pressure to eat certain items of food. Girls perceived less pressure to eat sweets, chocolate and chips and greater pressure to eat fruit than boys did.
The IEFS Pan-EU study found that women selected 'quality/freshness', 'price', 'trying to eat healthy' and 'family preferences' when asked to select the three most important influences on food choice. Men selected 'taste' most often. Men were also more likely to select 'habit', 'cultural, ethnic or religious background', 'availability' and 'someone else chooses', than women. Women were more likely to select 'slimming', 'vegetarian or other

diet', 'prescribed diet', or 'content of additives or colours or preservatives' than men *(Lennernas et al 1997)*. In the same study men (27%) were found to perceive irregular working hours as a barrier to healthy eating more frequently than women (22%) did. This was most significant in Belgium, Germany and Greece ($P<0.001$ *Lappalainen 1997)*.
The European Health and Behaviour Survey *(Wardle & Steptoe 1991)* assessed attitudes with a series of 10-point scales for 25 items including avoiding animal fat. Women believed that avoiding eating animal fat was more important for health than men.
In conclusion being female is associated with more positive attitudes towards low fat intake *(Shepherd & Stockley 1985, Shepherd 1988, Wardle & Steptoe 1991, Towler 1992, Lloyd 1993, Stafleu et al 1994, Barker et al 1995, Wise & McPherson 1995*) and with having more positive attitudes towards fruit (*Dennison & Shepherd 1995*) than men have.

1.5f) **Summary**

The purpose of this section of the literature review was:

- To assess the connection between attitudes and fat consumption
- To assess the connection between attitudes and fruit and vegetable intake.

The main findings are,

- Negative attitudes towards high fat foods are associated with lower fat intake *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler 1992, Stafleu et al 1994, Dittus et al 1995, Paisley et al 1995, Wise & McPherson 1995*).
- Positive attitudes are associated with increased fruit and vegetable consumption *(Dittus et al 1995, Hjartåker & Lund 1998, Havas et al 1998)*

Being female is associated with positive attitudes towards,

- Low fat intake *(Shepherd & Stockley 1985, Wardle & Steptoe 1991, Towler 1992, Lloyd et al 1993, Stafleu et al 1994, Barker et al 1995, Wise & McPherson 1995*)
- Consumption of low fat milk (*Shepherd 1988)*
- Fruit (*Dennison & Shepherd 1995*)

Being female is associated with negative attitudes towards;

- Consumption of meat, meat products and dairy foods *(Shepherd & Towler 1992).*

1.5g) **Conclusion**

There is a lot of evidence to suggest that negative attitudes towards high fat foods are associated with a lower fat intake *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler 1992, Stafleu et al 1994, Dittus et al 1995, Paisley 1995, Wise & McPherson 1995)*. There was very little work on the influence of attitudes on the consumption of fruit and vegetables, but positive attitudes were associated with increased fruit and vegetable consumption *(Dittus et al 1995, Hjartåker & Lund 1998, Havas et al 1998)*. Being female is associated with more positive attitudes towards low fat intake *(Shepherd 1985, Shepherd 1988, Wardle & Steptoe 1991, Towler 1992, Lloyd 1993, Stafleu 1994, Barker 1995, Wise 1995)* and with having more positive attitudes towards fruit (*Dennison 1995*) than men have.

1.6) **The choice of women aged 20-34 years as the study population**

Aim:

- To explain the choice of women aged 20-34 as the study population

In any research it is important to avoid introducing bias and confounding factors (Chapter IV, 4.1c & 4.1d) into the analysis of results. Careful consideration of the study design and population can help to avoid bias and confounding to a certain extent. This section of the literature review considers the choice of study population.

1.6a) **The choice of women as a study population**

The literature survey suggested that both low fat intake *(Baghurst & Baghurst 1994, Pryer et al 1995)* and high fruit and vegetable intake are associated with being female *(Järvinen et al 1994, Bolton-Smith et al 1991, Johansson & Andersen 1998)*. Being female is also associated with more positive attitudes towards low fat intake *(Shepherd & Stockley 1985, Shepherd 1988, Wardle & Steptoe 1991, Towler & Shepherd 1992, Lloyd et al 1993, Stafleu et al 1994, Barker et al 1995, Wise & McPherson 1995*) and with having more positive attitudes towards fruit (*Dennison 1995*) than men. Women were shown to have greater nutrition knowledge than men *(Shepherd & Towler 1992, Mela 1993)* had. Education was also shown to be associated with food choice (*Braddon 1988, Hjartåker & Lund 1998, Agudo et al 1999 & Roos G. et al 2000)*. It is important to be sure that education and knowledge influence food choice in their own right and not through the influence of gender.

A confounding factor is associated with both the exposure under study, in this instance knowledge and attitude and with the outcome, fat and fruit and vegetable intake. Confounders can provide a true explanation for any association that may be found, and therefore need to be controlled for. If both men and women were included in the study sample it would be necessary to analyse the results obtained from men and women separately in order to avoid gender acting as a confounding factor. This would have the effect of approximately halving the numbers available in each group for analysis. By including only one gender in the study population resources can be maximised and greater numbers of subjects included in the analysis.

The Health and Lifestyle Survey includes a number of questions concerning attitudes towards food and cooking. A greater number of women are involved in cooking on a regular basis than men so it would make sense to include women rather than men in the study to increase the number of results available for analysis. Women also tend to be more knowledgeable about foods than men, again increasing the numbers available for analysis.

1.6b) **The choice of the age group 20-34 as a study population**

It is also important to consider age as a potential confounding factor. Previous sections of the literature review looked at age and fruit and vegetable intake (1.2eii) and age and fat consumption (1.2ei). The results of the literature review were not conclusive, younger age was associated lower fat intake *(Bolton-Smith et al 1989)* in some studies but not in others *(Currie et al 1990, Hjartåker & Lund 1998)*. Younger age was associated with higher fruit and vegetable in some studies *(Järvinen et al 1994)* but not in others *(Hjartåker & Lund 1998)*. An association between older age and higher fruit and vegetable intake has also been reported *(Hulsof et al 1991)*. The literature review did not specifically examine the relationship between age and income, although younger people might be expected to be more likely to have low incomes because they have had less time to progress in the job market. Younger people may also be more likely to have dependant children and thus have higher levels of expenditure than older people have. National Food Survey *(MAFF1998)* data showed that households with young diary keepers spent the lowest amounts of money per person per week on household food expenditure.

1.6c) **Summary**

The purpose of this section of the literature review was:

- to explain the choice of women aged 20-34 as the study population.

The key finding are;
Gender may be a confounding factor as it is associated with the exposures, attitudes *(Shepherd & Stockley 1985, Shepherd 1988, Wardle & Steptoe 1991, Towler & Shepherd 1992, Lloyd et al 1993, Stafleu et al 1994, Barker et al 1995, Wise & McPherson 1995)*, knowledge *(Shepherd & Towler 1992, Mela 1993)*, education (*Braddon 1988, Hjartåker &*

Lund 1998, Agudo et al 1999 & Roos G. et al 2000), and income. And with the outcome variables fruit and vegetable intake *(Järvinen et al 1994, Bolton-Smith et al 1991, Johansson & Andersen 1998)* and fat consumption *(Baghurst & Baghurst 1994, Pryer et al 1995)*.

- Age may be a confounding factor as some studies link age with the exposures, income and with the outcome variables fruit and vegetable intake *(Järvinen et al 1994)* and fat consumption *(Bolton-Smith et al 1989)*. The evidence is not conclusive.

1.6d) **Conclusion**

A mixed gender group would have presented problem in terms of the analysis of the results because women are known to have different attitudes towards fats and fatty foods and towards fruits and vegetables than men have. By looking at just one gender it is possible to include greater numbers of subjects in each group of variables. This would make it possible to consider socio-economic factors such as car use and housing tenure in a statistical analysis. Women have been chosen in preference to men because they were most likely to be more knowledgeable about foods resulting in greater numbers being available for analysis. Young women are also likely to be or to become mothers; it is known that the nutritional status of the mother influences the outcome of pregnancy and the future health of the offspring *(Barker 1999)*. Women are also more likely than men to be responsible for feeding children, this increases their influence on the health of future generations and makes them more interesting to study. The food choice of young women is an important public health issue and study that adds to our knowledge in this area is useful. Age is a potential confounding factor and the study population chosen from a small age band to minimise the effects of confounding. A young age has also been chosen because a greater proportion of young people was expected to be in the lower socio-economic groups. Data from MAFF suggests that young households have less money to spend on food. The age group starts at 20 years old because a proportion of women younger than this were still in full time education which would make analysis of the results more difficult. The age of 34 was chosen as an arbitrary cut off point before the women approached middle age.

Women aged 20-34 years were chosen as the study population. The choice of this group will affect whether or not the results are generalizable to other population groups.

1.7) **Formulation of the main study question**

Aim

- To relate the literature review to the formulation of the main study question

The literature review was started with an interest in finding an explanation for why healthy eating campaigns tended not to be very successful at changing eating habits. There was a general agreement that socio-economic factors, knowledge and attitudes were responsible for food choice and attempts to change habits addressed these issues by targeting specific socio-economic groups with literature (e.g. Health Education Authority Food for the Heart Campaign Manual. *HEA London 1991,* Health Education Authority Enjoy Healthy Eating Campaign Manual. *HEA London 1992,* Health Education Authority Eight Guidelines for a Healthy Diet. A Guide for Nutrition Educators. *HEA Abingdon 1997*). Why then was there the feeling that healthy eating campaigns were a waste of time? Maybe the previously mentioned factors could explain the small amount of compliance with dietary guidelines, but some other influence on food choice remained unaccounted for. This final section of the literature review draws together the previous six summary sections and explains the formulation of the main study question.

1.7a) **Healthy eating**

The literature review revealed that a number of systems have been developed to score the healthiness of diets. In an ideal situation one of these indexes would have been used to score a number of 7-day food diaries completed by study participants throughout a study period of a year. Given the limited resources available for the project and the need to include sufficient numbers of people a simpler method of distinguishing between a healthy and less healthy diet was felt to be more appropriate. All of the various diet scores included a measure of fat intake and fruit and vegetable consumption as part of their assessment of the diet *(Dowler 1995b, Patterson 1994, Davenport 1995, Kennedy 1996).*

UK consumers (63%) also mentioned more fruit and vegetables *(Margetts et al 1997)* when describing a healthy diet.

UK consumers were also familiar with the association between fat intake and health, 65% of UK respondents to the pan-European Union Survey of Consumer Attitudes to Nutrition Food and Health used the term less fat to describe a healthy diet *(Margetts et al 1997)*. This study had similar findings to a consumer research survey of 1700 adults *(Buttriss 1997)*, 61% of respondents indicated that eating less fat was very important. The consumer perception that eating less fat is associated with good health may be a reflection of a target, in the Health of the Nation initiative *(The Health of the Nation White Paper DoH 1992)*. The target to reduce the average percentage of food energy derived by the population from total fat by at least 12% to no more than 35% is similar to the reduction in fat recommended in 'Dietary Reference Values *(COMA 1991)*.

Rather than attempt to assess the quality of the whole diet the literature review led to the idea that using a measure of fat intake and fruit and vegetable intake might provide an interesting indication of the overall healthiness of the diet. This section of the literature review led to the inclusion of the phrase 'choice of a diet low fat and high fruit and vegetables' in the study question.

1.7b) **Socio-economic variables and fat and fruit and vegetable intake**

A number of studies showed an association between high fruit and vegetable intake and years of education *(Branddon 1988, Hjartåker & Lund 1998, Agudo 1999, Roos G. 2000)*, but it was not possible to say that a specific number of years of education was associated with a quantifiable rise in fruit and vegetable consumption. The literature also showed an association between higher social class and increasing consumption of fruit and vegetables *(Branddon 1988, Hulsof 1991, Marmot 1991, Bolton-Smith 1991, Roos 1996 Hjartåker & Lund 1998)*, but again the extent of that association was not accounted for. An association between fat consumption and education was found in some studies *(Winkleby* 1992, *Hjartåker & Lund 1998)*, but not in others *(Branddon et al 1988)*. A mixed picture was also seen for the association between fat consumption and social class, some studies showed an association *(Bolton-Smith 1990, Bolton-Smith 1991, Prättälä 1992, Hjartåker & Lund 1998)*, whilst others did not *(Branddonl 1988, Hulsof 1991, Pardo 1994, Wynn 1994, Bolton-Smith 1991, Roos 1996)*.

The literature available on fruit and vegetables and fat consumption and socio-economic variables is extensive but does not contain any estimation of the extent to which socio-economic variables might account for the choice of diets low in fat or high in fruits and vegetables. The review suggests that a study that attempted to quantify this relationship in some way would add to our understanding of the influences on food choice. The term socio-economic status is used in the main study question as a way of encapsulating all the various factors that can loosely be described as socio-economic or sociodemographic.

1.7c) **Differences in fat intake and fruit and vegetable intake and their relationship to income and expenditure**

The literature review showed that high income households spend more money on food than low income households *(MAFF 1998)* and that groups of people meeting the UK dietary goals were spending more money on food than people consuming the average UK diet *(Cade & Booth 1990)* did. It also showed that low income is associated with low fruit and vegetable consumption *(Suber 1992, Dowler & Calvert 1995b. MAFF 1998)*. Reviewing the literature confirmed that income and expenditure were related to food choice but did not suggest the extent of the influence. The review also showed that income and expenditure are closely related to other indicators of socio-economic status such as housing, employment and levels of education. Data available from the Health and Lifestyle survey for the main study did not include income levels. It was decided not to include income as a separate factor in the main study question but to consider it separately from other socio-economic variables.

1.7d) **Knowledge and fat and fruit and vegetable intake**

The literature review suggested that increased knowledge was associated with higher consumption of fruits and vegetables *(Piacentini et al 1995, Havas et al 1998, Wardle et al 2000)*. The evidence for a link between increased knowledge and reduced fat consumption was more mixed, two studies showed an association *(Piacentini et al 1995, Havas et al 1998)* and three studies did not show an association *(Larsson & Lissner 1996, Stafleu et al 1996, Koikkalainen et al 1999)*. The literature review suggested that there was a need for further work in both the areas of fat and fruit and vegetable intake and knowledge in order to make some assessment of the magnitude of the relationship. It was also interesting to see that although both socio-economic factors and knowledge were associated with increased fruit and vegetable consumption there was no feeling for the relationship between the socio-economic variables, knowledge and food intake. It was not known whether knowledge was more or less important than socio-economic variables in influencing food choice.

The term knowledge was included in the main study question because the literature review indicated that it did have some influence on food choice and so was worth including, but the influence had not been quantified with relation to socio-economic so further work in the area would add to our current understanding of influences on food choice.

1.7e) **Attitudes and fat and fruit and vegetable intake**

There was more evidence to suggest that negative attitudes towards high fat foods were associated with a lower fat intake *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler 1992, Stafleu et al 1994, Dittus et al 1995, Paisley 1995, Wise & McPherson 1995*), than there was to suggest that positive attitudes were associated with increased fruit and vegetable consumption *(Dittus et al 1995, Hjartåker & Lund 1998, Havas et al 1998*). There did not seem to be any perception of whether attitudes were more important than knowledge or whether socio-economic variables or income was the most important influence on food choice. The literature on attitudes was not always clear on the specific definition of what an attitude was. The Health and Lifestyle Survey data that could be used to answer the main study question had a number of questions relating to confidence in cooking skills. It was decided to use this specific term in the study question to avoid problems with defining attitudes.

1.7f) **The choice of women aged 20-34 years as the study population**

This section of the literature review showed that gender was potentially a confounding factor in the relationship between socio-economic variables, knowledge, attitudes and fruit and vegetable and fat consumption. The review also suggested that age might be a confounding factor. It therefore seemed sensible to limit the analysis to a single gender and restrict the age range of the subjects. Young women of childbearing age were chosen as their food choices have the potential to influence the next generation as well as their own health. This makes young women a particularly useful group to study.

1.7g) **Summary**

The literature review did not find any work that had attempted to bring all the factors thought to influence fat and fruit and vegetable consumption together and estimate the extent to which these factors could explain the variance in intake in a single population group. The study question is;

'To what extent do socio-economic status, knowledge and confidence in cooking skills, account for young women's choice of a diet low in fat and high in fruit and vegetables. What other factors may influence food choice in this group?'

By studying this question it is hoped that a contribution to knowledge will be made by explaining what percentage of the variation in food choice can be accounted for, and how much remains unexplained.

Knowledge gained from answering this question will be useful in helping to make public health education initiatives more successful. The next section of the thesis describes the methods employed to answer the question. Data from the Health and Lifestyle Survey *(HEA 1998)* mentioned in section 1.1f. were used to add to the information gained in the literature review and further explore the relationship between socio-economic factors, knowledge and attitudes and food choice. Comparison between studies can be difficult because of different populations and different methods used. The Methods sections outlines the issues involved in answering as much of the question as possible in a single study.

Chapter II: Methods

Introduction

Aim:

- To describe the health and lifestyle survey
- To describe the national food survey
- To describe the statistical analysis of the data.

This chapter gives details of the Health and Lifestyle Survey *(The HEA Health and Lifestyle Survey, 1998)* from which the data used in this thesis was obtained. The survey contained a wealth of information related to the health and lifestyle of 5,553 individuals. Although some of this information had been analysed and published there was a lot of data that had not been considered and could be used to answer the question posed in this thesis. The demographic information and details of the dietary questionnaire used are discussed. The indices that were used to measure knowledge and attitudes are also introduced. The Health and Lifestyle Survey did not provide useable information on income so patterns of food consumption from low-income groups in the National Food Survey were used as a basis for some data analysis. A brief introduction to the National Food Survey is provided in this section of the literature review.
The methods involved in the statistical analysis of the data are also presented.

2.1) The Health and Lifestyle Survey Sample

The data used in this analysis were obtained by MORI (a private marketing company) between May and September 1993 in England, for a Health and Lifestyle Survey commissioned by the Health Education Authority on behalf of the Department of Health. The sample was designed to be cross-sectional and nationally representative in terms of age, sex, region and socio-economic variables.
The sample was stratified by the eight Regional Health Authorities (RHA), with the Thames regions each divided into the London and non-London parts. This gave a total of 18 area categories. Within each category enumeration districts were selected at random, with probability of selection proportional to the number of adults aged 16-74 years in the enumeration district. There were 7,887 eligible subjects, of these 18% (1,419) refused to be interviewed, a further 8% (601) subjects were non contacts even after repeated calls at

the house and 314 individuals were not interviewed because they were to ill or had moved away since the original screening. Interviews were conducted with 5,553 respondents, 70% of the original 7,887 eligible subjects.
For each enumeration district sampled, 40 addresses were listed at random from the Small Users Postcode Address File. These addresses made up the primary sample for the survey. A letter was sent to each address included in the survey to explain the purpose of the survey and to inform people that a MORI interviewer would be calling at their address. Interviewers screened households and those that were identified as invalid (vacant, demolished etc.) were eliminated from the sample. Addresses were screened for multiple households and if necessary a Kish grid was used to select households and the individual within the household for interview. The Kish grid is a method used for selecting the unit to investigate where there is more than one eligible address or household that should be interviewed. The interviewer lists all eligible persons or all eligible households at the address; a number is then allocated to each person or household at this address. Eligible persons are listed in descending order of age, males followed by females. The persons are then numbered serially and the interviewer makes a selection by referring to the two lines of figures printed on the questionnaire. Interviews were done with 4,000 16-54 year olds and 1,000 55-74 year olds (every second 55-74 year old who was identified at the screening stage was excluded). The survey covered the 16-74 age group, but the HEA wished to under-sample the 55-75 year olds as health promotion activities are primarily targeted at those in the 16-54 year age band. The HEA also asked that the sample of 16-24 year olds was boosted for a separate analysis of the sexual health data, the booster sample of 550 16-24 year olds was obtained by random selection of a further 25 addresses from the Post Code Address File. Interviewers screened the addresses during the main stage of fieldwork to identify any 16-24 year olds; interviews were then conducted with the young people.

2.1a) **Survey Data**

The survey data was weighted in two ways: by household size - each respondent received a weight proportional to the number of adults in the household, to correct the fact that MORI only interviewed one adult per household, thereby lessening the chances of selection for adults in larger households. Data was also weighted by age within sex within RHA, using Census estimates. Certain questions relating to health status had been used in the 1992 survey; other questions were formulated by the HEA who consulted on certain questions such as those relating to psychosocial health. Both questionnaires (main and self-completion) were piloted in 10 sampling points, 50 pilot interviews were conducted overall, and interviewers were briefed and debriefed and the questions revised as a result. All respondents completed a face to face interview, which took about 45 minutes to complete.

The sample used in this thesis consisted of all the women aged 20-34 years from the MORI survey. Data were available on fruit and vegetable consumption for 875 women and for 819 women on fat consumption. This discrepancy was probably due to the difficulties in involved in collecting complete data from food frequency questionnaires. Collecting information on fat intake involved answering more questions than those needed to establish fruit and vegetable intake. It is of concern that 3% of the women who were included in the analysis for fruit and vegetable intake could not be included in the analysis for fat consumption. Numbers of women in each individual table of results varies due to lack of completeness of data.

2.1b) **Demographics characteristics of the survey sample**

The occupation of the Head of Household (HOH) was used to determine the social grade of the household. The HOH is almost always male; this method of classification tends to be based on traditional ideas of seniority and status rather than income or lifestyle. Even if the wife were earning more than her husband, she would not be the HOH. The HOH is the person who owns or rents the property or who has the property rent-free. If that person is a wife the husband is regarded as the HOH, provided that he is normally resident at that address. This applies to couples who are living together as if married. In the case of joint responsibility then to establish the HOH, husband takes preference over wife, male takes preference over female. If the people are of the same sex than the older person is HOH. If a resident husband is temporarily absent, he still remains HOH. If a person lives alone they are both HOH and housewife; each household can have only one HOH.

The housewife is the person who is mainly responsible for catering and domestic duties even if he/she works full time as well. In cases of equal responsibilities then female takes preference over male, if all are of the same sex then the eldest takes precedence over the others.

Where respondents were not head of the household, and where they also had a partner, they were asked to provide demographic details about their partner.

Living in crowded conditions was defined as the number of bedrooms matched to the household residents in terms of age, gender and relationship. This is known as the bedroom standard. If the standard is below the minimum (e.g. If more than two children of either gender below the age of ten years of age share a room, or two adolescents aged 10-20 years of the same gender share a room), living conditions were defined as overcrowded.

The level of educational attainment was divided into three categories; 'A' level and above (University entrance), up to 'O' level (GCSE, high school graduation at 16 years) or trades (plumbers, electricians etc.) and no formal qualification. Full time education meant that the respondent was at college full-time not part-time.

2.1c) **Dietary Instrument for Nutrition Education**

Estimates of fat and fibre consumption were obtained using the Dietary Instrument for Nutrition Education (DINE) developed by members of the General Practice Research Group at Oxford University. DINE was developed for use in nurse administered health checks in general practice and work site programmes *(Roe et al 1994)*. One of its objectives was to give a brief initial assessment of individual intake of total fat and dietary fibre. The main part of the instrument consists of a food frequency questionnaire of 19 groups of foods, which account for about 70% of the fat and fibre in the typical UK diet, according to the National Food Survey. Groups of foods with a similar nutrient content and use are combined; each group of food is then assigned a score proportional to the fat or fibre content of a standard portion. The scores are then weighted according to frequency of consumption using four categories which range from 'less than once a week' to 'six times a week or more'; more frequently eaten foods are categorised on a daily basis. Types of spreading, frying and baking fats were evaluated by further questioning. The interviewer then summed the individual scores to give total scores for fat, fibre and unsaturated fat, which were categorised as low, medium or high intake. The DINE method did not estimate energy intake so dietary fat intake was classified in terms of total fat intake not fat as a percentage of energy. The low and high fat consumption categories were calculated on the basis of the Dietary Reference Values (DRV's) for fat intake of 33% of total energy intake *(Department of Health 1991a)*.

Energy intake was taken as the Estimated Average Requirement (EAR) from the same report. This is 8.1MJ/ day for women aged 19-50 years. Low fat consumption for women was taken as less than or equal to 71g daily and high fat consumption was taken to be greater than or equal to 72g daily. The validation of the DINE questionnaire is discussed in chapter 4 (section 4.1aii, page 152 & section 4.1aiii, page 157).
The DINE questionnaire also asked respondents about their fruit consumption and their vegetable consumption. The answer's to these questions were coded so that people were grouped as having a high intake if they consumed both fruit and vegetables daily. If they consumed fruit or vegetables daily but not both, they were coded as having a low intake.

2.1d) **Use of questions as indices of knowledge**

The Heath and Lifestyle Survey used nine different sets of questions to investigate respondents' knowledge. Each set of questions could have as many as thirteen answers, giving a total of ninety-eight possible questions. It was impractical to analyse the results from so many questions within the time constraints posed by the thesis. Four of these sets of questions were concerned with either fat or some aspect of fruit and vegetables and were therefore felt to be the most appropriate to the aim of quantifying the link between knowledge, socio-economic factors and low fat and high fruit and vegetable consumption, and have been used in this thesis.
The first set of questions was about terms used in relation to nutrition. Respondents were shown a card and told 'These are some terms relating to diet and eating. Which if any of these terms would you not feel confident explaining to someone else? Please call out all those that apply.' The card contained twelve terms plus the options 'none of these' and 'don't know'. For the purposes of this thesis the term's 'cholesterol,' 'polyunsaturated fat' and 'saturated fat' were felt to be of the most interest, as they referred to fat. These three questions were therefore included in chapter III (results). There were no terms connected to fruit and vegetable consumption. The term 'balanced diet' was referred to on the card, but only 9% of survey respondents were not confident about explaining the term, this would have been too few respondents for the purposes of the thesis.
The second set of questions from the Health and Lifestyle Survey was concerned with heart disease. Respondents were again presented with a list, this time of interventions and asked 'which if any of these can people do to reduce their chances of getting heart disease or a heart attack?' The options on the card were:

- Control body weight
- Reduce sugar intake
- Reduce fat intake
- Increase starch and fibre intake
- Eat a balanced diet
- Limit alcohol consumption
- Give up or cut down on smoking
- Eat plenty of fresh fruit and vegetables
- Reduce salt intake
- Take regular exercise
- Reduce stress

Of these controlling body weight, reducing fat intake, and eating plenty of fruit and vegetables were felt to be of the most relevance and were included in the analysis of results.

The third set of questions chosen for the thesis was about the fat content of foods. Women were shown a list of foods on a card and asked 'which of the foods on this card do you think are high in fat?' options were,

- Red meat
- Chicken
- White fish
- Pies, pasties and quiches
- Pasta and noodles
- Potatoes (not chips)
- Whole milk
- Cheese
- Soft margarine
- Fruit
- Butter
- Crisps
- Biscuits

Of these options knowing that red meat, pies, whole milk, soft margarine and butter were high in fat were felt to be of the most interest. Women who responded to these questions were included in the results.

The final question that was chosen asked the women 'How would you explain a healthy diet?' The most popular answers to this question were,

- Fresh fruit
- Fresh vegetables/salad
- High fibre cereals
- Fish
- White meat
- Pasta/rice

Responses that indicated that a healthy diet should contain fresh fruit or be well balanced were analysed and included in this thesis.

From the analysis of these four sets of questions a total of ten questions were included in a cluster analysis that looked at the relationship between women's knowledge and socio-economic factors. The results that were obtained from asking these questions are expressed as percentages of low and high fat intake for groups of women who were knowledgeable and for women who were not knowledgeable. Results are only presented in Chapter III if they showed a relationship between knowledge and fat intake or knowledge and fruit and vegetable intake. Other results are presented in Appendix 3 (Tables 6.14-6.16).

2.1e) **Measurement of women's attitudes**

The literature review found that many papers did not clearly define attitudes. Often an attitude was a positive or negative feeling towards something. The Penguin Dictionary of Psychology *(Drever 1979)* defines attitude as, 'a more or less stable set or disposition of opinion, interest, or purpose, involving expectancy of a certain kind of experience, and readiness with an appropriate response'. The Health and Lifestyle Survey asked a number of questions about the respondents' confidence towards cooking foods. It was felt that although cooking techniques in themselves are not attitudes, the feeling of confidence in ones ability to employ a specific technique fitted into the definition of attitude. Since the respondent had both a disposition of opinion i.e. a confidence, and an expectancy of a certain kind of experience, e.g. the outcome of the cooking technique. The range of questions involved techniques that might be felt to be more commonly used by either low fat or high fat consumers e.g. shallow/deep frying and steaming/

grilling/poaching. Questions about types of food also included a range that was expected to distinguish between the different types of consumer e.g. red meat and oily fish. The questions were; 'Which if any of these cooking techniques do you feel confident about using?'

- Boiling
- Steaming
- Shallow frying
- Deep frying
- Grilling
- Poaching
- Oven-baking or roasting
- Stewing/braising/casseroling
- Microwaving
- Stir frying

'Which if any of these foods do you feel confident about cooking?'

- Red meat
- Chicken
- White fish
- Oily fish
- Pulses such as beans and lentils
- Pasta
- Rice
- Potatoes (not chips)
- Fresh green vegetables (e.g. cabbage, broccoli, spinach)
- Root vegetables (e.g. carrots, parsnips, swede)

Results are only presented in Chapter III if they showed a relationship between confidence in cooking and fat intake or confidence and fruit and vegetable intake. All the remaining results are presented in Appendix 4 of the thesis (Tables 6.27-6.32).

2.2) **National Food Survey**

In order to examine the possibility that a need for a specific nutrient or nutrients may be a factor in choosing a diet that is low in fat or high in fruit and vegetables a population whose food choice was restricted by income was examined. Data from the National Food Survey *(MAFF 1998)* has been used to differentiate nutrient intake between households in various income brackets. The NFS collects data from the responses of a random sample of about 6,000 private households through out Great Britain. Participating households record details of all items of food brought into the home for human consumption during the course of a week. Soft drinks, alcoholic drinks and confectionery are included. Half of the selected households also record details of all meals, snacks and drinks consumed outside the home. In 1998 the responding sample was 5,973 households representing 64.7% of the eligible sample. This low level of response must inevitably introduce bias into the results. The profile of the sample is compared with previous years to estimate sampling errors. The 1998 sample included more low-income heads of households than the 1997 sample did. The report does not estimate how representative of the general population the 1998 survey was. It may be supposed that the survey respondents are more interested in food than non-responders. They may also represent households who feel that they have more time than other households do. They may also represent householders who feel more confident of their abilities to keep records than other householders. Respondents may also be less concerned about others scrutinising their purchases than non-responders.

The survey records only food entering the household, not the actual quantities consumed by individuals. The person principally responsible for domestic food arrangements is asked to keep a record of all food, intended for human consumption entering the home each day for seven days. The main survey excludes food eaten outside the home unless it is prepared from the household supply, for example packed lunches. The main diary keeper notes the description, quantity in imperial or metric units and the cost of the foods. The diary keeper also notes which persons are present at each meal and describes the type of food served. Records are also kept of the number and nature of any meals obtained outside the home by each member of the household. No account is taken of food stocks, which may be depleted or may accumulate during the week of the survey. Data presented as per person per day or week are subject to error because no data on the actual amount of food consumed by individuals is recorded.

Nutrient analysis is based on food composition tables. Page 80/81. The energy content of the food is calculated from the protein, fat, available carbohydrate and alcohol contents using the respective conversion factors (4, 9, 3.75 and 7 kcals per gram). Niacin is expressed as niacin equivalent, which includes one-sixtieth of the tryptophan content of the protein in the food. Vitamin A is expressed as micrograms of retinol equivalent, that is the sum of the weights of retinol and one-sixth of the β-carotene. Results are presented per person per day and as a percentage of the Reference Nutrient Intake (RNI) published by the Department of Health (Report on Health and Social Subjects 41, 1991). The 'per person per day' calculations do not take into account the contribution made by meals taken outside the home, or without the diary keepers knowledge. No allowance is made for wastage of edible food or for the presence of small children in the household.
Results presented as a proportion of the RNI take into account family composition in terms of age, sex and possible pregnancy, allowance is also made for meals eaten outside the home. The presence of visitors is also taken into account by redefining the number of people consuming the household food. The estimated energy and nutrient contents are reduced by 10% to allow for wastage of edible food. These considerations tend to make the nutritional values presented as a percentage of RNI more accurate than the 'per person per day' figures.

2.3) **Statistical analysis of the survey data**

The data presented in this thesis were analysed using the Statistical Package for Social Science (SPSS) for Windows (version 9). The sample was weighted at the analysis stage to give equal numbers of men and women. Initial analysis of the data is to rule out the possibility that the results obtained were due to chance. This can be done by hypothesis testing or by estimation and confidence intervals *(Margetts & Nelson 1997)*.

2.3a) **Confidence intervals**

Confidence intervals (CI) are presented as an alternative to testing the hypothesis using χ^2 and P-values. Hypothesis testing gives a probability that the original hypothesis is true or untrue and allows rejection or acceptance of the hypothesis on the basis of the calculated probability. Hypothesis testing gives no indication of the size of an effect. If the sample size is large, small differences between groups can be statistically significant, which may be misleading. Confidence intervals indicate the likely magnitude of the effect. The lower number indicates how small the effect might be in the population and the higher number indicates how large the effect might be *(Hopkins 2000)*. Confidence intervals are used to present the range within which 95% of the population might be expected to fall. Narrow confidence intervals suggest the result is unlikely to be due to chance alone. Wide confidence intervals that show overlap between two groups suggest that there is a greater possibility that results are due to chance alone, and should therefore be treated with caution.

Confidence intervals are calculated from the standard error, which in turn is calculated from the sample size and standard deviation.

Figure 2.1: Calculation of confidence intervals.

95% confidence interval = sample mean $\pm$ 1.96 $\times$ SE

$$SE = \frac{SD}{\sqrt{samplesize}}$$

For any given mean and standard deviation a large sample size will give narrow confidence intervals and a small sample size will give wide confidence intervals. A greater amount of variability for a fixed sample size will give a wider confidence interval. A wide confidence interval can therefore indicate both a small sample size and a greater amount of variability about the mean in a larger sample size. The use of log values in the calculation as in a regression analysis will result in an asymmetrical distribution around the mean. Confidence intervals are always in the units of the original sample, in this case either numbers or percentages of people.

The 95% confidence interval corresponds roughly with the 5% level of statistical significance as assessed using hypothesis testing and *P*-values. Confidence intervals are used to describe the relationship between fruit and vegetable intake and socio-economic data presented in tables 3.1-3.11.

Confidence intervals are also used in conjunction with Odds Ratios in later analysis. When these confidence intervals include the reference value, which has always been taken as 1 in this thesis then the results are not statistically significant.

2.3b) **Cluster analysis**

Cluster analysis is a generic term describing classification techniques which look empirically for the presence of groups of cases or individuals where members of each group are as similar or like each other as possible in terms of some specified characteristics, and as unlike members of other groups. The object of the analysis is to see whether respondents fall into a natural system of groups. Cluster analysis is a way of grouping together a number of associated variables. The investigator is not required to specify in advance the basis of group membership, or the number of groups *(Armitage & Berry 1994).*

Cluster analysis was used on data from the Dutch National Food Consumption Survey *(Hulshof et al 1992)* to classify individuals into a limited number of groups on the basis of similarity of nutrient intake. Wirfalt & Jeffery *(1997)* used cluster analysis to examine food patterns in relation to energy intake. Cluster analysis was also used to characterise groups of men by particular dietary patterns *(Huijbregts et al 1995)* in the Zutphen Elderly Study.

In this thesis cluster analysis was used to examine the association between four socio-economic variables (having good qualifications, being in non-manual employment, owning ones own home and owning a car) and two dietary variables, low fat intake and high fruit and vegetable consumption. The four socio-economic variables were chosen following a regression analysis on eleven variables (Results, table 3.14, page 104) which suggested that having good qualifications, being in non-manual employment, owning ones own home and owning a car were the most strongly associated factors with both fat and fruit and vegetable consumption. Other factors, living in the South of England and not being a single parent were strongly associated with increased fruit and vegetable consumption but were much less strongly associated with low fat intake. It is necessary to preselect the number of clusters. The analysis was done for two clusters and three clusters. On examination of the results it was felt that using three clusters gave numbers that were too small to make further analysis meaningful.

2.3c) **Logistic regression analysis**

Regression analysis is used to fit a straight line through a set of data. The null hypothesis assumes that there is no relationship between two variables, a relationship best described by a horizontal line with slope 0. The alternative hypothesis would be that the slope of the line is something other than 0, regression analysis is used to determine the equation of the line that best fits the data. Logistic regression is used in situations where the dependant variable is dichotomous, in this case either low or high fat and low or high fruit and vegetable intake. Logistic regression coefficients are used to estimate odds ratios (OR) for each of the independent variables in the model. The odds ratio is the ratio of the odds of exposure for cases to the equivalent odds for controls, odds ratios greater than one represent an increase in risk and odds ratios less than one indicate a reduction in risk.

The letters in table 2.1 and figure 2.2 are used to illustrate how odds ratios are calculated.

Table 2.1: Distribution of exposure amongst cases and controls.

	Cases	Controls
Exposed	A	B
Unexposed	C	D

Figure 2.2: Calculation of odds ratio.

$$\left(\left(\frac{ad}{bc}\right) \pm 1.96\sqrt{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}}\right)$$

For the purposes of this thesis cases are either low fat, or high fruit and vegetable consumers and controls are high fat or low fruit and vegetable consumers. The exposures of interest are knowledge, attitudes and socio-economic factors. Table 2.2 and figure 2.3 use results from table 6.23 (Appendix 4) to illustrate the relationship between cases and controls.

Table 2.2: Low fat intakes and knowledge about the fat content of red meat in women.

Knowledge	Low fat intake	High fat intake
Red meat/high fat	135	277
Red meat/not high fat	95	313

Figure 2.3: Calculation of odds ratio for knowledgeable women having a low fat diet.

$$\left[\left(\frac{135x313}{277x95}\right) \pm 1.96\sqrt{\frac{1}{135}+\frac{1}{277}+\frac{1}{95}+\frac{1}{313}}\right]$$

$$\left[1.61 \pm 1.96\sqrt{0.025}\right]$$

$$1.61 \pm 0.31$$

The odds ratio was calculated by SPSS to be 1.61, 95% confidence intervals 1.18-2.19. The difference in confidence intervals calculated by SPSS and using the formula illustrated above was due to the log values used by SPSS. The odds of a women who is knowledgeable about the fat content of red meat having a low fat diet is 1.61 to 1. Odds ratios are presented with their respective 95% confidence intervals (95% CI). The confidence interval represents the range within which the variable being estimated is likely to lie giving an indication of the magnitude of the effect. Small sample sizes tend to give rise to wide confidence intervals and large sample sizes to narrower confidence intervals. In some cases is it possible to grade the exposure (e.g. bed standard table 3.9) finding a trend tends to reinforce the idea that the exposure is affecting the outcome.

2.3d) **Multiple regression analysis**

Multiple regression analysis used where there are two or more independent variables. It is a tool for answering the question 'what can two or more independent variables tell us about a dependant variable?' if we know that there is a relationship between fat intake and a person's level of educational attainment or their employment. Multiple regression can be used to answer the question what can education and employment taken together say about fat intake *(Hopkins 2000)*. SPSS is used to calculate how much the independent variables tell us about the dependant variable. Multiple regression analysis is also used to answer the question what is the effect of something when we have taken into account something else? For example women with good qualifications may be more likely to have lower fat intakes than other women, but is this because the they have 'better' jobs. Using multiple regression we can take into account the effect of good qualifications on getting a 'better' job and look at the relationship between fat and employment, which may no longer be important. Results of multiple regression analysis are presented as odds ratios with their confidence intervals. Confidence intervals are not symmetrically distributed about the odds ratios which tend to be closer to the lower value of the CI. This is due to the use of the log scale in the calculation.

2.3e) **Cronbach's alpha**

This is not used in the statistical analysis of data in this thesis but has been used to investigate the test-retest reliability and as a measure of internal reliability in some of the papers quoted in the literature review. Cronbach's alpha co-efficient is a model of internal consistency used in reliability analysis, based on the average inter-item correlation.

2.4) **Summary**

Subjects

- 879 women, aged 20-34 years nationally representative cross-section of English adults, 70% response

Exposure variables

Secondary analysis of Health & Lifestyle Survey measuring

- Socio-economic factors
- Knowledge
- Attitudes

Outcome variables

- Low fat intake ≤ 71g fat
- High fat intake > 71g fat
- Low fruit and vegetable consumption, fruit **or** vegetables daily
- High fruit and vegetable consumption, fruit **and** vegetables daily

Statistical analysis

- Data analysed using SPSS 9.0.
- Logistic regression analysis
- Confidence intervals
- Odds ratios
- Cluster 1 - lower qualifications, manual employment, rented homes and no car
- Cluster 2 - good qualifications, non-manual employment, homeowners, and use of a car.

National Food Survey

- 64.7% response rate
- Household food supply only
- Not based on individual consumption

2.5) **Conclusion**

Lack of information on income makes it difficult to satisfactorily quantify the impact of money on food choice within our population of young women. A second population group obtained from the NFS *(MAFF 1998)* has therefore been included to explore income and food choice further.

Low response rates in both data sets introduce bias, which affect the generalisability of the results to other population groups.

The following section of the thesis uses the methods outlined here to obtain a set of results that can be considered to answer the question outlined in section 1.7.

Chapter III: Results

Introduction

This chapter is divided into five sections; each section presents the results that are related to one of the aims:

- To estimate the influence of socio-economic factors on fat and fruit and vegetable consumption in women aged 20-34 years.
- To quantify the link between knowledge, socio-economic factors and fat and fruit and vegetable consumption in young women.
- To assess the connection between confidence in cooking skills, socio-economic factors and low fat and high fruit and vegetable consumption in young women.
- To investigate the links between income and fat and fruit and vegetable consumption.
- To develop a model that accounts for all the known variance.

The first section presents the results of an analysis of the fat and fruit and vegetable intake of the young women, a series of tables shows fat and fruit and vegetable consumption in relation to socio-economic characteristics. The results of this analysis allow key socio-economic variables to be identified and used in a logistic regression analysis to calculate the influence of these factors on low fat consumption and fruit and vegetable intake. These socio-economic variables are used to divide the women into two socio-economic clusters. These clusters are then used in the following three sections of results to investigate the relationship between knowledge, confidence in cooking skills and socio-economic influences.

Fat and fruit and vegetable intake are presented in relation to a range of indices of the women's knowledge about foods. The socio-economic factors identified in section two are examined to eliminate effect modification and confounding factors on the influence of knowledge on choice of low fat or high fruit and vegetable intake. The socio-economic factors are used in a multivariate logistic regression analysis to calculate an odds ratio for the influence of socio-economic factors on knowledge and choice of low fat and high fruit and vegetable intake.

Section three looks at young women's confidence in their cooking ability and cooking skills in relation to their fruit and vegetable and fat intake. The influence of socio-economic factors on confidence in cooking skills and food choice is calculated using multivariate logistic regression analysis.

The relationship between income and food choice is investigated in section four of the results.

The final section brings together the key results from the previous sections to provide a summary at the end of the chapter.

3.1) **Socio-economic factors and fat and fruit and vegetable intake.**

Aim

- To estimate the influence of socio-economic factors on fat and fruit and vegetable consumption in women aged 20-34 years.

In the following tables the category 'low fruit and vegetable intake' includes those respondents who ate only fruit or only vegetables daily, whilst the category 'high fruit and vegetable intake' includes those respondents who ate both fruit and vegetables every day. The low and high fat consumption categories were calculated on the basis of DRV's for fat intake *(Department of Health 1991a)*. This document recommended that women should obtain 33% of total energy from fat, and estimated the average energy requirement for women to be 8.10 MJ/day. Fat provides 37kj of energy per gram so low fat consumption was calculated to be less than or equal to 71g fat daily and high fat consumption to be greater than 71g of fat daily.

3.1a) **Results: Socio-economic factors and fat and fruit and vegetable intake.**

Table 3.1 shows how many young women in each age group fall into the low and high intake groups for fruit and vegetables and fat. The actual numbers in each group are given together with the percentage of women in each age group who have a low or high intake, the percentages are given in parenthesis. Confidence intervals for the percentages have been calculated and are shown for the women in the younger age group. Confidence intervals are not given for women in both age groups as to do so would not add any extra information to the picture.

Table 3.1: Low and high intakes of fruit and vegetables and fat for young women.

	Female 20-24 years	Female 25-34 years
Fruit & vegetable intake		
Low (%)	148 (53.4)	290 (48.5)
High (%,CI)	129 (46.6, CI 41-53)	308 (51.5, CI 48-56)
Fat intake		
Low (%, CI)	70 (27.5, CI 22-33)	160 (28.4, CI 25-32)
High (%,)	185 (72.5)	404 (71.6)

Table 3.1 showed that women aged 25-34 years were more likely to eat fruit and vegetables every day (51.5%), compared with only 46.4% of young women aged 20-24 years. Confidence intervals show that although women in the younger age group are more likely to fall into the low consumption group than the women aged 25-34 years the difference is not significant as the confidence intervals for the two groups overlap.
The total number of women for whom a fruit and vegetable intake was recorded was 875.
Table 3.1 shows that there is no difference between the fat intake of women aged 20-24 years and those between 25 and 34 years. In both age groups about 28% of women have a low fat intake and about 72% have a high fat intake. Data on fat intake were available for 819 women.
Table 3.2 takes women aged 20-34 years as a whole group and divided into four categories according to their fat and fruit and vegetable consumption. Percentages are presented for the entire table not within each category. Data for both fat and fruit and vegetable consumption were available for 818 women. Low fruit and vegetable intake is fruit or vegetables daily and high fruit and vegetable intake is fruit and vegetables daily.
Table 3.2: Fruit and vegetable intake by fat intake in young women.

	Low fruit & veg. Intake (%)	High fruit & veg. Intake(%)
Low fat consumption	106 (13.0)	125 (15.2)
High fat consumption	309 (37.8)	278 (34.0)

The results in table 3.2 showed that 15.2% of women fell into the low fat/high fruit and vegetable intake category. This category could be said to represent the healthy eaters.

The largest category containing 37.8% of the young women was the high fat/low fruit and vegetable group, the least healthy combination.

Table 3.3 presents levels of fruit and vegetable and fat consumption by educational attainment for young (20-34 years of age) women. Educational attainment is defined in one of three ways; no formal qualifications, General certificate of secondary education (GCSE), or Advanced (A) level qualifications and higher. Data were available for both education and fruit and vegetable consumption for 870 women and for both education and fat consumption for 840 women. Percentages of women with high and low intakes for each educational group are given in parenthesis. Confidence intervals are shown, so that comparison between women with high fruit and vegetable intakes in different educational groups can be made. Confidence intervals are also given for low fat intakes.

Table 3.3: Educational level of young women by fruit and vegetable and fat intake.

Educational level	No formal qualifications. (%, CI)	Other qualifications. (%, CI)	'A' levels and higher (%, CI)
Fruit & vegetable intake			
Low	72 (66.4)	250 (52.9)	112 (38.9)
High	37 (33.6, CI 25-43)	223 (47.1, CI 43-52)	176 (61.1, CI 55-67)
Fat intake			
Low	24 (18.3, CI 13-26)	116 (26.5,CI 23-31)	90 (33.2, CI 28-39)
High	107 (77.6)	322 (73.5)	181 (66.8)

The table 3.3 showed that woman with 'A' level and higher qualifications were more likely to have a high (61.1%) intake of fruit and vegetables than a low (38.9%) intake. Women with no formal qualifications were more likely to have a low (66.4%) intake of fruits and vegetables. The difference in fruit and vegetable intake between women with 'A' level qualification and other qualifications was significant, as was the difference between women with 'A' level qualification and no qualifications.

Women with 'A' levels and higher qualifications were also more likely to have a low fat consumption (33.2%) than women with fewer qualifications, and significantly more likely to have a lower fat consumption than women with no qualifications were. The association with education and fruit and vegetable intake was stronger than the association between fat and fruit and vegetables as can be seen by the 95% confidence intervals.

The women were divided into groups according to their socio-economic status, but this resulted in too many groups with too few numbers in them to give meaningful results so the women were divided according to their own employment in non-manual and manual jobs. Data were available on fruit and vegetable consumption and employment status for 862 women and on fat intake and employment status for 809 women. Table 3.4 shows the women divided into low and high consumers of fat and fruit and vegetables according to their own employment (not that of their partner or head of household). As in previous tables percentages of women with high and low intakes in each employment group are given in parenthesis. Confidence intervals are presented for high fruit and vegetable intakes and low fat intakes, so that comparisons can be made across the employment groups.

Table 3.4: Manual and non-manual status of young women by fruit and vegetable and fat intake.

	Non-manual (%, CI)	Manual (%, CI)	Never Worked (%, CI)
Fruit & vegetable intake			
Low	231 (44.0)	170 (60.5)	30 (53.6)
High	294 (56.0, CI 52-60)	111 (39.5, CI 34-45)	26 (46.4,CI 34-59)
Fat intake			
Low	148 (30.3, CI 26-35)	61 (22.8, CI 18-28)	18 (33.3, CI 22-47)
High	340 (69.7)	206 (77.2)	36 (66.7)

The results in table 3.4 showed that women in non-manual occupations were more likely to have a high intake of fruit and vegetables (56.0%) than women in manual jobs (39.5%).

The 95% confidence intervals indicated that there was a significant difference in fruit and vegetable intake between women in non-manual and manual occupation. There were too few women in the never worked category to rule out significant difference between these women and non-manual women. Women with non-manual occupations were also more likely to have a low fat (30.3%) intake than women who were in manual employment (22.8%), but the 95% confidence intervals overlap so the association was not as strong as that seen between fruit and vegetable intake and occupation. Women most likely to have a low fat intake were those who had never worked (33.3%), this group only contained 54 women so the confidence intervals were very wide, suggesting that as few as 22% of the women could have had a low fat intake or as many as 47%.

Table 3.5 shows the fat and fruit and vegetable intakes of young women with families. Data were available for the fat intake of 506 women with children, and 284 women without children. Information on the fruit and vegetable intake of 492 women with children and 305 women without children was also available.

Table 3.5: Women with and without children by fruit and vegetable and fat intake

	Single person (%,CI)	Couple (%, CI)	Single parent (%, CI)	Two adults + children. (%, CI)	> Two adults + children. (%, CI)	Receiving family credit. (%, CI)
Fruit & Vegetable intake						
Low	44 (48.4)	92 (43)	50 (65.8)	185 (50.3)	34 (56.7)	20 (60.6)
High	47 (51.6, CI 42-62)	122 (57.0, CI 50-64)	26 (34.2, CI 25-44)	183 (49.7, CI 45-55)	26 (43.3, CI 32-56)	13 (39.4, CI 25-56)
Fat intake						
Low	34 (39.1, CI 30-50)	62 (31.5, CI 25-38)	15 (21.1, CI 13-32)	92 (26.3, CI 22-31)	16 (30.2, CI 20-44)	8 (25.0, CI 13-42)
High	53 (60.9)	135 (68.5)	56 (78.9)	258 (73.7)	37 (69.8)	24 (75)

The results in table 3.5 showed that women who were single parents were the least likely of all the family groups to have a high fruit and vegetable intake (34.2%). Even with a small sample there was a significant difference between these women and women who lived in families of two adults and children or women without children who lived as a couple. Women in families that were receiving family credit were also less likely to be eating a diet with a high intake of fruits and vegetables (39.4%) than families with more than two adults (43.3%), although the 95% confidence intervals suggested that the differences between the two groups were not significant. There were only 33 women in the group receiving family credit, the large confidence intervals are likely to be a reflection of the small sample size rather than variability about the mean. The difference in fruit and vegetable intake between the two groups may have been significant if the sample size had been greater. Women, who lived as part of a couple with no children, were the most likely to be eating a diet high in fruits and vegetables (57.0%). Women who were single parents were the least likely to have low fat intake (21.1%), and single women with no children were most likely to have a low fat intake (39.1%). The 95% confidence intervals for all the groups overlapped indicating that the association between fat intake and family structure was not strong.

Table 3.6 shows data on the numbers and percentages of respondents and their body mass index (BMI) by their fat and fruit and vegetable intake. Data were available on fruit and vegetable consumption and BMI for 812 women and on fat intake and BMI for 763 women.

Table 3.6: Body mass index of young women by fruit and vegetable and fat consumption.

BMI (kg/m^2)	< 20 (%, CI)	20-25 (%, CI)	26-30 (%, CI)	>30 (%, CI)
Fruit & Vegetable intake				
Low	53 (50.5)	228 (48.8)	96 (55.5)	36 (53.7)
High	52 (49.5, CI 40-59)	239 (51.2, CI 46-56)	77 (44.5, CI 37-52)	31 (46.3, CI 35-58)
Fat intake				
Low	20 (19.8, CI 13-29)	130 (29.6, CI 26-34)	51 (31.7, CI 25-39)	18 (29.0, CI 19-41)
High	81 (80.2)	309 (70.4)	110 (68.3)	44 (71.0)

Women with a normal BMI were more likely to have a diet with a high fruit and vegetables intake (51.2%), than women who were overweight (44.5%), or obese (46.3%) were. These differences were not significant. Women who were under weight were less likely to have a low fat intake (19.8%) than other women (CI 29.0-31.7%) were. There was no difference in the fat intake of women who were of normal weight, overweight or obese.

Table 3.7 gives an indication of the relationship between cigarette smoking and fruit and vegetables and fat intake. Data are presented for respondents who are current smokers, ex smokers and women who never smoked cigarettes, by fruit and vegetable and fat intake. Data were available on fruit and vegetable consumption and smoking status for 870 women and on fat intake and smoking status for 815 women.

Table 3.7: Cigarette smoking status by fruit and vegetable and fat intake in young women.

Smoking status	Current smoker (%, CI)	Ex smoker (%, CI)	Never smoked (%, CI)
Fruit & Vegetable intake			
Low	178 (60.5)	94 (40.3)	164 (47.8)
High	116 (39.5, CI 34-45)	139 (59.7, CI 53-66)	179 (52.2, CI 47-57)
Fat intake			
Low	72 (25.7, CI 21-31)	63 (29.7, CI 24-36)	95 (29.4, CI 25-35)
High	208 (74.3)	149 (70.3)	228 (70.6)

Table 3.7 showed that women who were ex smokers were more likely to have a high fruit and vegetable (59.7%) consumption than other respondents were. Confidence intervals indicate that there was a significant difference between fruit and vegetable consumption of women who were current smokers and both women who were ex-smokers and women who had never smoked. Current smokers were more likely to have a low fat intake (25.7%) than ex smokers (29.7%), or non-smokers (29.4%) were.

Table 3.8 shows data on the numbers and percentages of respondents who own their own homes by their fat and fruit and vegetable intake. Data were available on fruit and vegetable consumption and housing tenure for 857 women and on fat intake and housing tenure for 806 women.

Table 3.8: Housing tenure of young women by fruit and vegetable and fat consumption.

Tenure	House owner (%, CI)	Rented home (%, CI)
Fruit & Vegetable intake		
Low	258 (44.0)	167 (61.6)
High	328 (56.0, CI 52-60)	104 (38.4, CI 33-44)
Fat intake		
Low	162 (29.5, CI 26-33)	63 (24.5, CI 20-30)
High	387 (70.5)	194 (75.5)

Women who owned their own homes were significantly more likely to have a diet with a high fruit and vegetables intake (56.0%), than women who lived in rented accommodation (38.4%) were. Women who owned their home were also more likely to have a low fat intake (29.5%) than women who lived in rented accommodation (24.5%) were. The 95% confidence intervals indicated that the association between fruit and vegetable intake and home ownership was much stronger than the association between fat intake and home ownership.

Table 3.9 gives an indication of the standard of housing and its association with fruit and vegetables and fat intake. Data are presented for respondents who live in accommodation that meets the bedroom standard, for accommodation that is below the standard and for accommodation that is above, by fruit and vegetable and fat intake. Data were available on fruit and vegetable consumption and housing status for 857 women and on fat intake and housing status for 803 women.

Table 3.9: Bedroom standard by fruit and vegetable and fat intake in young women.

Bed standard	Below (%, CI)	Meets (%, CI)	Above (%, CI)
Fruit & Vegetable intake			
Low	25 (55.8)	173 (55.3)	226 (45.3)
High	19 (44.2, CI 30-58)	140 (44.7, CI 39-50)	274 (54.7, CI 50-59)
Fat intake			
Low	11 (26.8, CI 16-42)	85 (28.8, CI 24-34)	130 (27.8, CI 24-32)
High	30 (73.2)	210 (71.2)	337 (72.2)

Table 3.9 showed that women who lived in accommodation above the bedroom standard were more likely than other respondents to have a high fruit and vegetable (54.7%) consumption. Confidence intervals indicate that there was a difference between fruit and vegetable consumption of people whose accommodation met the bed standard and those people whose accommodation was above it. To few people were in the group whose accommodation failed to meet the bed standard to draw any conclusion about their fruit and vegetable intake. Results from the analysis of fat intake and bedroom standard were inconclusive.

Table 3.10 shows data for high and low intake of fruit and vegetables and fat and car use. Data were available on fruit and vegetable consumption and car use for 873 women and on fat intake and employment status for 817 women.

Table 3.10: Car use amongst young women by fruit and vegetable and fat intake.

Use of car	Yes (%, CI)	No (%, CI)
Fruit & vegetable intake		
Low	319 (47.1)	117 (60.3)
High	360 (52.9, CI 49-57)	77 (39.7, CI 33-47)
Fat intake		
Low	188 (29.8, CI 26-34)	42 (22.5, CI 17-26)
High	442 (70.2)	145 (77.5)

Women who had the use of a car were significantly more likely to have a high fruit and vegetable intake (52.9%) than women who did not have the use of a car (39.7%). Women who had the use of a car were also more likely to have a low fat intake than other women were although this relationship was not significant, a larger sample may have given a narrower confidence interval. This relationship between car use and food choice was further investigated by asking women if their ability to transport food was a factor in their choice of food. Results to this question are presented in table 3.11. Data were only available on fruit and vegetable consumption for 65 women who felt that the ability to carry and transport food was a factor in food. Data were available for fruit and vegetables intake for 808 women who felt that the ability to carry food was not an influence on food choice. There were data on fat intake for 62 women who were influenced by the ability to carry food and for 756 women who were not influenced.

Table 3.11: Car use and ability to carry and transport food as a factor in food choice.

Ability to carry food/influence food choice	Yes (%,CI)	Yes (%,CI)	No (%,CI)	No (%,CI)
Use of car	Yes	No	Yes	No
Fruit & veg. Intake				
Low	14 (66.7)	26 (59.1)	305 (46.4)	91 (60.7)
High	7 (33.3, CI 17-55)	18 (40.9, CI 28-56)	353 (53.6, CI 50-57)	59 (39.3, CI 32-47)
Fat intake				
Low	5 (25.0, CI 11-47)	11 (26.2, CI 15-41)	183 (30.0, CI 27-34)	32 (21.9, CI 16-29)
High	15 (75.0)	31 (73.8)	427 (70.0)	114 (78.1)

The results presented in table 3.11 show that women who had the use of a car and did not feel that ability to carry foods was a factor in their choice of food, were significantly more likely to have a high fruit and vegetable consumption (53.6%), than women who did not have the use of a car, but felt their choice of food was not influenced by their ability to carry shopping (39.3%). There were too few women who felt that there ability to carry goods influenced their food choice to get a significant result, but women without a car (40.9%) were more likely to have a high fruit and vegetable intake than women with a car (33.3%). Women who did not have the use of a car but did not feel that the ability to transport foods influenced their food choice were the least likely to have a low fat diet (21.9%). Women who had the use of a car but did not feel that the ability to carry foods influenced their food choice were the most likely to have a low fat diet (30.0%) but the 95% confidence intervals indicated that it was not a strong association.

There are studies in the literatures that consider food consumption and marital status. Dividing these young women into groups according to their marital status, resulted in small numbers of women in the single, partner, separated and divorced categories so it was decided to look at the group in terms of whether or not there was a partner present in the household. Table 3.12 shows the presence of a partner in the household of the young women and fruit and vegetable and fat consumption. Data were available on fruit and vegetable consumption and partners for 874 women and on fat intake and partners for 819 women.

Table 3.12: Presence of partner in household of young women by fruit and vegetable and fat intake.

Partner present	Yes (%, CI))	No (%, CI)
Fruit & vegetable intake		
Low	271 (48.9)	166 (51.9)
High	283 (51.1, CI 47-55)	154 (48.1, CI 43-54)
Fat intake		
Low	145 (27.8, CI 24-32)	85 (28.6, CI 24-34)
High	377 (72.2)	212 (71.4)

Table 3.12 showed that women living with a partner were more likely to have a high fruit and vegetable intake (51.1%) than women who did not have a partner present (48.1%). There was no real difference between the fat intake of women living with a partner and other women.

Some studies suggest regional variations in fruit and vegetable consumption. The data were used to divide England into three regions, North, Midlands and South. Table 3.13 shows the regional variation in young women's fruit and vegetable and fat consumption. Data were available on fruit and vegetable consumption and region of residence for 875 women and on fat intake and residential region for 820 women.

Table 3.13: Regional variation in the fruit and vegetable and fat intake of young women.

Region	North (%, CI)	Midlands (%, CI)	South (%, CI)
Fruit & vegetable intake			
Low	142 (60.2)	102 (56.4)	194 (42.4)
High	94 (39.8, CI 34-46)	79 (43.6, CI 37-51)	264 (57.6, CI 53-62)
Fat intake			
Low	64 (28.8, CI 23-35)	38 (22.8, CI 17-30)	129 (29.9, CI 26-34)
High	158 (71.2)	129 (77.2)	302 (70.1)

Table 3.13 showed that women who were living in the South of England were significantly more likely to have eaten a high fruit and vegetable (57.6%) diet than women living in the North of England (39.8%) or the Midlands (43.6%). Women who lived in the South of England were also more likely to have a low fat diet (29.9%) than women who lived in the Midlands (22.8%) were.

In order to explore the relationship between the socio-economic factors, BMI and smoking and fruits and vegetable and fat consumption further logistic regression analysis was done (odds ratios and logistic regression analysis are outlined in chapter 2, section 2.5). Table 3.14 presents the crude odds ratio for the influence of education, socio-economic group, housing tenure, car use, bed standard, region of residence, receipt of family credit, family structure, BMI and smoking on low fat intake and high fruit and vegetable intake.

Table 3.14: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) for the effects of socio-economic variables on low fat intake and high fruit and vegetable intake in young women using logistic regression analysis.

	Low fat OR (95% CI)	High fruit & vegetable intake OR (95%CI)
Education		
A level	1.38 (0.99-1.92)	1.76 (1.30-2.36)
Other qualification *(reference)*	1	1
Socio-economic group		
Non-manual	1.47 (1.04-2.07)	1.94 (1.44-2.60)
Manual *(reference)*	1	1
Housing tenure		
Home owner	1.30 (0.93-1.82)	2.05 (1.53-2.76)
Rented accommodation *(reference)*	1	1
Car use		
Use of car	1.47 (1.00-2.14)	1.70 (1.23-2.35)
No use of car *(reference)*	1	1
Bed standard		
Above	1.04 (0.51-2.12)	1.55 (0.83-2.90)
Meets	1.09 (0.53-2.26)	1.04 (0.55 1.98)
Below *(reference)*	1	1
Partner present		
Yes	0.96 (0.70-1.31)	1.13 (0.86-1.48)
No *(reference)*	1	1
Region		
South	1.05 (0.73-1.49)	2.05 (1.49-2.82)
Midlands	0.72 (0.45-1.14)	1.17 (0.79-1.73)
North *(reference)*	1	1
Family credit		
No	1.24 (0.54-2.84)	1.52 (0.74-3.09)
Yes *(reference)*	1	1
Single Parent		
No	1.54 (0.85-2.80)	2.05 (1.25-3.37)
Yes *(reference)*	1	1

Table 3.14: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) for the effects of socio-economic variables on low fat intake and high fruit and vegetable intake in young women using logistic regression analysis (cont).

	Low fat OR (95% CI)	High fruit & vegetable intake OR (95%CI)
Body Mass Index (kg/m²)		
< 20	1.63 (0.78-3.39)	0.88 (0.48-1.62)
20-25	0.96 (0.54-1.73)	0.82 (0.49-1.36)
26-30	0.87 (0.46-1.65)	1.07 (0.61-1.89)
>30 (reference)	1	1
Cigarette habit		
Current smoker	1.20 (0.84-1.72)	1.67 (1.22-2.29)
Ex smoker	0.95 (0.67-1.42)	0.74 (0.53-1.04)
Never smoked (reference)	1	1

Table 3.14 showed that having an 'A' level or higher qualification was associated with being more likely to have a low fat diet and being significantly more likely to have a high consumption of fruits and vegetables. Being in non-manual employment was also significantly associated with both low fat intake and high fruit and vegetable consumption. Odds ratios and 95% confidence intervals were 1.47 (1.04-2.07) and 1.94 (1.44-2.60) for low fat and high fruit and vegetable intake respectively, the reference category was manual employment. Owning ones own home rather than living in rented accommodation was also associated with both low fat and high fruit and vegetable consumption although the 95% confidence intervals for low fat consumption included 1 the reference number indicating that the relationship was not significant. Homeowners were twice as likely to have a high intake of fruit as those living in rented accommodation were (95% CI 1.53-2.76). Having the use of a car was also associated with having a low fat diet (OR 1.47 95% CI 1.00-2.14) and a high fruit and vegetable consumption (OR 1.70 95%CI 1.23-2.35). Living in the South of England rather than the North doubled the chance of having a high fruit and vegetable consumption (OR 2.05, 95%CI 1.49-2.82). Not being a single parent also doubled the chance of having a high fruit and vegetable intake although the 95% confidence intervals were very wide (1.25-3.37) due to the small number (26) of single mothers in the sample. Four socio-economic variables were felt to be influential on fat and fruit and vegetable intake. Socio-economic group and car-use were both

significantly associated with both low fat intake and high fruit and vegetable intake. Both having an 'A' level qualification and being a homeowner were significantly associated with high fruit and vegetable intake and also associated with low fat intake with confidence intervals close to one. Three other factors were significantly associated with high fruit and vegetable intake, living in the South of England, being a current cigarette smoker and not being a single mother. Living in the South of England was not significantly associated with a low fat intake (OR 1.05, 95% CI 0.73-1.49), nor was being a current cigarette smoker (1.20, 95% CI 0.84-1.71). There were only 26 single mothers with a high fruit and vegetable intake (Table 3.5) and 15 with a low fat intake it was felt that the sample size was too low to justify including this variable in further analysis.

In order to explore these associations more fully a series of simple analyses were done, the tables containing the results of these analyses can be seen in the appendix (Tables 6.14-6.28). An association was found between levels of qualification and many of the other socio-economic variables including; socio-economic group, home ownership, car use, region of residence, presence of a partner and receiving family credit. An association was also found between qualification and history of smoking and qualification and being overweight. The relationship between socio-economic group and other variables was not as clear although there was an association with home ownership. In order to see if any of these variables might act as an effect modifier in the relationship between low fat and high fruit and vegetable intake and knowledge or confidence in cooking ability the women were stratified into groups (e.g. smokers, ex smokers and never smokers), for regression analysis. The results of these investigations can be seen in the appendix (Tables 6.34 – 6.45, pages 227-238 & 6.52-6.58, pages 245-251). None of the stratified odds ratios suggested that any of the variables was acting as an effect modifier.

Four of the socio-economic variables were chosen as being the most influential on both low fat intake and high fruit and vegetable intake. The four were education, socio-economic group, housing tenure and car ownership. The relationship between these socio-economic variables was investigated further by adjusting each variable for the influence of the three other variables in a regression analysis; the results are shown in table 3.15.

Table 3.15: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) for low fat intake and high fruit and vegetable intake in young women using logistic regression adjusted for other socio-economic factors.

Socio-economic factors	Low fat OR (95% CI)	High fruit & vegetable OR (95% CI)
'A' level (unadjusted)	1.38 (0.99-1.92)	1.76 (1.30-2.36)
Adjusted for non-manual	1.31 (0.92-1.86)	1.63 (1.19-2.23)
Adjusted for home owner	1.36 (0.97-1.91)	1.64 (1.21-2.23)
Adjusted for car use	1.37 (0.99-1.91)	1.73 (1.28-2.34)
Non-manual, home owner, car use	1.30 (0.91-1.85)	1.53 (1.12-2.11)
Non-manual, (unadjusted)	1.47 (1.04-2.07)	1.94 (1.44-2.60)
Adjusted for 'A' level	1.22 (0.84-1.78)	1.71 (1.23-2.37)
Adjusted for home owner	1.49 (1.04-2.13)	1.79 (1.32-2.42)
Adjusted for car use	1.42 (1.00-2.01)	1.82 (1.35-2.46)
Adjusted for; non-manual, home owner, car use	1.28 (0.87-1.89)	1.62 (1.15-2.27)
Home owner, (unadjusted)	1.30 (0.93-1.82)	2.05 (1.53-2.76)
Adjusted for 'A' level	1.12 (0.76-1.65)	1.78 (1.28-2.50)
Adjusted for non-manual	1.22 (0.84-1.75)	1.84 (1.34-2.53)
Adjusted for car use	1.16 (0.81-1.68)	1.85 (1.35-2.54)
Adjusted for; 'A' level, non-manual, car use	1.07 (0.80-1.65)	1.62 (1.11-2.36)
Car use, (unadjusted)	1.47 (1.00-2.14)	1.70 (1.23-2.35)
Adjusted for 'A' level	1.15 (0.76-1.76)	1.45 (1.00-2.09)
Adjusted for non-manual	1.25 (0.83-1.90)	1.49 (1.05-2.13)
Adjusted for home owner	1.38 (0.91-2.10)	1.35 (0.95-1.93)
Adjusted for 'A' level, non-manual, homeowner	1.05 (0.65-1.17)	1.17 (0.77-1.80)

The results in table 3.15 suggest that having 'A' level or higher qualifications is the most important influence on low fat and high fruit and vegetable intake. The unadjusted odds ratio for low fat intake in those women who have 'A' levels or higher qualifications is influenced most by adjusting for non-manual employment. Non-manual employment and homeownership influenced the unadjusted odds ratio for high fruit and vegetable intake in these women equally. The odds ratio for high fruit and vegetable intake in women who had the use of a car was most influenced by homeownership.

The four variables that were positively associated with low fat intake and high fruit and vegetable consumption were then grouped together to examine their joint contribution to low fat and high fruit and vegetable intake using cluster analysis (Chapter II, 2.3b). SPSS was asked to find two clusters that grouped the most closely associated variables together. Cluster analysis is a tool for combining individuals into groups of associated variables. It allows the researcher to take account of the fact that the variables may be correlated with each other as well as with the dietary intake. The results of the cluster analysis are shown in table 3.16. Data were available on employment status, qualifications, tenure and car use for 693 women.

Table 3.16: The association between socio-economic factors in young women using cluster analysis

Number of women	Employment	Qualifications	Tenure	Car use
Cluster 1 278	Manual	Lower qualifications	Rented home	No
Cluster 2 415	Non-manual	Higher qualifications	Homeowner	Yes

Table 3.16 showed that when woman were classified on the basis of the four socio-economic variables, they were likely to have:

- Cluster 1: Lower qualifications, manual employment, live in rented homes and not have the use of a car.
- Cluster 2: Higher qualifications, non-manual employment, their own homes and have the use of a car.

Cluster 1 was characterised by women in manual employment and cluster 2 was characterised by the presence of women in non-manual employment. It should not be assumed that all the women in cluster 1 are in manual employment. 'Cluster centres' are used to indicate the percentage of women with each characteristic that are present within each cluster. The final cluster centres are shown below in table 3.17.

Table 3.17: Final cluster centres.

	Cluster 1, Manual	Cluster 2, Non-manual
Non-manual employment	0.33	0.93
'A' level qualification	0.12	0.53
Home owner	0.44	0.95
Car user	0.59	0.97

Table 3.17 shows that 33% of the women in cluster 1 were in non-manual employment compares with 93% of women in cluster 2. Only 12% of women in cluster 1 had an 'A' level qualification compared with 53% of cluster 2 women.

The percentages of women in each cluster with low fat and high fruit and vegetable intakes were calculated and are shown below in table 3.18. Data were available on fruit and vegetable consumption and the four socio-economic variables for 644 women and on fat intake and the variables for 692 women. The percentages do not add up to 100 because data on high fat intake and low fruit and vegetable intake are not presented in the table.

Table 3.18: Number of women in each cluster with low fat and high fruit and vegetable intakes.

	Cluster1, Manual (%)	Cluster 2, Non-manual (%)
Low fat	64 (24.6)	119 (31.0)
High fruit & vegetable	117 (42.2)	247 (59.5)

The results in table 3.18 suggested that there might be a real difference in the fat and fruit and vegetable intake of women in different socio-economic clusters. The odds ratios for low fat intake and high fruit and vegetable intake were then calculated for each clusters.

Cluster 1 was used as the reference category. The results of this logistic regression analysis are shown in table 3.19.

Table 3.19: Logistic regression analysis with 95% confidence intervals for low fat and high fruit and vegetable intake using two socio-economic clusters.

Cluster	Low fat OR (95% CI)	High fruit & vegetable OR (95% CI)
Cluster 2 Non-manual, high qualifications, home & car owners.	1.36 (0.94-1.94)	2.01 (1.48-2.74)
Cluster 1 Manual, low qualifications, rent home, no car. *(Reference)*	1	1

The results in table 3.19 show that the combination of socio-economic factors that makes Cluster 2 is associated with a low fat consumption. Women in Cluster 2 have an odds ratio for low fat consumption of 1.36, but the confidence intervals for the odds ratio include 1 so the associations is not significant. Cluster 2 women have an odds ratio of 2.01 (CI 1.48-2.74) for high intake of fruit and vegetable intake, they are significantly more likely than women in Cluster 1 were to have a high fruit and vegetable intake.

3.1b) **Summary**

The purpose of this section of the results was:

- To estimate the influence of socio-economic factors on fat and fruit and vegetable consumption in women aged 20-34 years.

The main findings were

- Having 'A' level or higher qualifications increased the likelihood of having a high fruit and vegetable intake by 1.76 to 1(1.30-2.36).
- Being in non-manual employment increased the likelihood of having a high fruit and vegetable intake by 1.94 to 1 (1.44-2.60).
- Owning ones own home increased the likelihood of having a high fruit and vegetable intake by 2.05 to 1(1.53-2.76).

- Having the use of a car increased the likelihood of having a high fruit and vegetable intake by 1.70 to 1 (1.23-2.35).
- Living in the South of England increased the likelihood of having a high fruit and vegetable intake by 2.05 to 1 (1.49-2.82).
- Not being a single parent increased the likelihood of having a high fruit and vegetable intake by 2.05 to 1 (1.25-3.37).
- Being a current cigarette smoker increased the likelihood of having a high fruit and vegetable intake by 2.69 to 1 (1.22-2.29).

The socio-economic factors had less influence on fat intake. Four socio-economic factors were found to have the most significant association with low fat intake.

- Having 'A' level or higher qualifications increased the likelihood of having a low fat intake by 1.38 to 1 (0.99-1.92).
- Being in non-manual employment increased the likelihood of having low fat intake by 1.47 to 1 (1.04-2.07).
- Owning ones own home increased the likelihood of having a low fat intake by 1.30 to 1 (0.93-1.82).
- Having the use of a car increased the likelihood of having a low fat intake by 1.47 to 1(1.00-2.14).

The socio-economic variables were correlated with each other so cluster analysis was used to group the variables together and examine their combined influence on women's food choice. The four socio-economic variables were chosen because they influenced both fat and fruit and vegetable intake.

- Being in the cluster combining good qualifications, non-manual employment, home ownership and car use increased the likelihood of having a high fruit and vegetable intake by 2.01 to 1.

3.1c) **Conclusion**

This section of the results has established that a variety of socio-economic factors affect fruit and vegetable and fat consumption. The socio-economic factors have been grouped together using cluster analysis to take account of the interactions between the different socio-economic variables. The relationship between the socio-economic clusters and the choice of low fat or high fruit and vegetable intake has been quantified.

In order to answer the main study question the next section of the results (3.2) looks at the relationship between knowledge and fruit and vegetable and fat intake and then uses the socio-economic clusters that have been established in this section to investigate the relationship between socio-economic factors, knowledge and the choice of a low fat or high fruit and vegetable intake.

The socio-economic clusters are also used in section 3.3 of the results to look at the socio-economic influence on confidence in cooking skills in the choice of low fat and high fruit and vegetable intake.

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3.2) **Knowledge, socio-economic factors and fat and fruit and vegetable consumption**

Aim

- To quantify the link between knowledge, socio-economic factors and fat and fruit and vegetable consumption in young women.

This section of results can be divided into two parts, the initial section looks at the relationship between knowledge about foods and low fat and high fruit and vegetable consumption. The second section presents results on the affect of socio-economic factors on knowledge and food choice. The socio-economic clusters that were derived in the previous section are used to investigate the relationship between knowledge and socio-economic influences.

Young women were presented with a list of terms related to food and health and asked 'which if any of these terms would you not feel confident explaining to someone else?' The terms included 'cholesterol,' 'polyunsaturated fat' and 'saturated fat.' They were also presented with a list of interventions and asked 'which if any of these can people do to reduce their chances of getting heart disease or a heart attack?' The women were shown a list of foods on a card and asked 'which of the foods on this card do you think are high in fat?' The results that were obtained from asking these questions are expressed as percentages of low and high fat intake for groups of women who were knowledgeable and for women who were not knowledgeable. The percentage of women with low and high fruit and vegetable intake, within the knowledgeable and less knowledgeable groups are also given. Confidence intervals were calculated to assess whether the differences between the proportions of knowledgeable women having low fat intakes were different from the proportion of less knowledgeable women who had low fat intakes. Table 3.20 illustrates the results obtained for fat and fruit and vegetable intakes of women who indicated that they were confident about explaining the term cholesterol. Data were available on fruit and vegetable consumption and cholesterol for 875 women and on fat intake and cholesterol for 809 women.

3.2a) **Results: Knowledge and fat and fruit and vegetable intake**

Table 3.20: Fruit and vegetable intake of young women by ability to explain the term 'cholesterol'.

Explain 'cholesterol'?	Confident (%)	Not Confident (%)
Fruit & vegetable intake		
Low	304 (47.9)	134 (57.0)
High	336 (52.5, CI 49-56)	101 (43.0, CI 37-49)
Fat intake		
Low	173 (29.0, CI 25-33)	58 (26.0, CI 21-32)
High	424 (71.0)	165 (74.0)

Results showed that young women who were confident about explaining the term 'cholesterol' to other people, were more likely than women who were not confident, to have a higher intake of fruits and vegetables (52.5% vs. 43.0%). Women who felt confident were also more likely to have a lower fat intake (29.0%) than other women (26.0%) were. Confidence intervals indicated that there was a 95% chance that the observed mean of 52.5% of confident women having a high fruit and vegetable intake would lie between 49 and 56. The relatively small range reflected the large number of women (640), who were confident that they could explain the term 'cholesterol'. The narrow confidence interval makes the estimate more likely to be precise. The confidence interval for the high fruit and vegetable intake of women who were not confident about explaining the term cholesterol was wider (37-49). A wide confidence interval can be a reflection of a smaller number in a group, or it can indicate greater variability about the mean. Both confidence intervals include the number 49, indicating that it would be possible for 49% of both groups of women to have a high fruit and vegetable consumption. There may be no difference between the chances of women in either group having a high fruit and vegetable intake. As the 49 was at the lower boundary of one group and the upper boundary of the other group it seems likely that the two groups of women really are different with respect to fruit and vegetable intake.

The confidence intervals for the mean low fat intake for the two groups of women show much greater overlap, 25-33 and 21-32 indicating that the different percentage of women with low fat intakes in the knowledgeable and less knowledgeable groups was probably due to chance alone.

A total of 15 questions were used as indicators of knowledge. The results obtained from these calculations were used to assess whether knowledge about a certain food related issue could be used to differentiate between those women who had low fat intakes or high fruit and vegetable intakes and those who did not. The results can be found in Appendix, 4 (tables 6.29-6.33, pages 222-226).

From these results the following indicators of knowledge were felt to be worth analysing further to investigate the relationship between knowledge and fruit and vegetable consumption.

- Confidence in ability to explain the term cholesterol.
- Knowing that controlling body weight would help reduce chances of heart disease.
- Knowing that eating fresh fruit and vegetables would help reduce the chances of heart disease.
- Knowing that red meat can be high in fat.
- Knowing that pies, pasties and quiches are high in fat.
- Knowing that soft margarine is high in fat.
- Knowing that a healthy diet is well balanced.

The following indicators of knowledge were chosen because the results indicated that they were linked with low fat intake.

- Knowing that red meat can be high in fat.
- Knowing that soft margarine is high in fat.
- Knowing that butter is high in fat.

A crude odds ratio was then calculated for low fat intake and high fruit and vegetable intake using each of the above indicators in a logistic regression analysis. Each indicator was used for both fruit and vegetable intake and low fat consumption, although only two in indicators of knowledge were linked to both fat and fruit and vegetable intake. Ideally more indicators that were associated with both fat and fruit and vegetable consumption should have been found, but using data that was not specifically collected for this analysis made this difficult. Table 3.21 shows the results of a logistic regression analysis on the link between knowledge and a high fruit and vegetable intake and a low fat intake. Women who were not knowledgeable were used as the reference category.

Table 3.21: Crude odds ratio and 95% confidence intervals (95% CI) for the influence of various indices of knowledge on high fruit and vegetable intake and low fat intake.

Knowledge	OR (95%CI) For low fat intake	OR (95% CI) For high fruit & vegetable
Ability to explain 'cholesterol'	1.17 (0.82-1.65)	1.46 (1.08-1.98)
Reduce heart disease;		
Controlling body weight	1.32 (0.93-1.87)	1.47 (1.09-1.98)
Eating fresh fruit & vegetables	1.05 (0.77-1.42)	1.42 (1.09-1.86)
Knowledge of fat content of;		
Red meat	1.61 (1.18-2.19)	1.22 (0.94-1.59)
Pies, pasties and quiches	1.23 (0.90-1.68)	1.33 (1.02-1.74)
Whole milk	1.28 (0.91-1.80)	1.35 (1.01-1.80)
Soft margarine	1.48 (1.08-2.01)	1.40 (1.07-1.83)
Butter	1.85 (1.14-3.00)	1.19 (0.82-1.73)
A healthy diet;		
Should be well balanced	1.31 (0.87-1.97)	1.96 (1.35-2.84)
Did not know *(reference)*	1	1

Table 3.21 showed that knowing that red meat, soft margarine and butter were high in fat was associated with having a low fat diet. Knowing that pies, pasties and quiches and whole milk were high in fat was also associated with having a low fat diet but in these instances the confidence intervals included one so the associations were not significant and could have been due to chance alone. The associations between knowledge about foods and eating a diet high in fruits and vegetables were slightly different than the association between knowledge and low fat intake. There was no association between knowing that chicken was high in fat and eating a diet high in fruits and vegetables (OR 0.89, 95% CI

0.40-1.95). The association between knowledge about red meat and high fruit intake and knowledge about butter and fruit intake could have been due to chance. Women who knew that it was important to eat a well balanced diet were almost twice as likely to have a high fruit and vegetable intake (OR 1.96, 95%CI 1.35-2.84) as other young women were. There was no relationship between knowing that a healthy diet should contain fruits and vegetables and eating a diet that contained lots of fruits and vegetables (OR 1.19, 95%CI 0.85-1.65).

3.2b) **Results: Knowledge, socio-economic factors and fat and fruit and vegetable consumption**

In order to find out more about the relationship between women's knowledge about food and low fat and/or a high fruit and vegetable intake a number of logistic regression analysis were done. The odds ratios for the influence of each knowledge question on the chance of having a low fat intake and the chance of having a high fruit and vegetable intake were calculated. Each odds ratio was then stratified for the influence of qualifications, type of employment, tenure and car ownership. The stratified odds ratios were then compared with the unstratified ratios. These four factors were chosen because they were shown to be positively associated with low fat intake and high fruit and vegetable intake in table 3.15. These analyses were done to test for interaction between the socio-economic factors and choosing a low fat or high fruit and vegetable diet. In this way it was possible to find out if any of these variables were acting as confounders or effect modifiers. The results of these analyses are in Appendix 4 (Tables 6.19-6.26). None of the four socio-economic variables was acting as an effect modifier so they were included in a multiple logistic regression analysis. This was done to quantify the collective influence of these variables on the affect of knowledge on fat and fruit and vegetable content of the diet. The results of this analysis are shown on table 3.22.

Table 3.22: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) adjusted for the influence of socio-economic factors and knowledge on low fat intake in young women using multivariate logistic regression analysis.

Knowledge	Low fat, Crude OR (95%CI)	Low fat, Adjusted OR (95%CI)
Explain 'cholesterol'	1.17 (0.82-1.65)	1.21 (0.80-1.83)
Reduce heart disease;		
Controlling body weight	1.32 (0.93-1.87)	0.88 (0.56-1.37)
Eating fresh fruit & vegetables	1.05 (0.77-1.42)	0.99 (0.69-1.43)
Knowledge of fat content of;		
Red meat	1.61 (1.18-2.19)	1.57 (1.11-2.23)
Pies, pasties and quiches	1.23 (0.90-1.68)	0.97 (0.68-1.38)
Whole milk	1.28 (0.91-1.80)	1.12 (0.75-1.67)
Soft margarine	1.48 (1.08-2.01)	1.33 (0.94-1.90)
Butter	1.85 (1.14-3.00)	2.27 (1.20-4.29)
A healthy diet;		
Should be well balanced	1.31 (0.87-1.97)	1.07 (0.68-1.69)
Should contain fresh fruit	0.98 (0.67-1.43)	0.96 (0.62-1.49)
Did not know *(reference)*	1	1

Table 3.22 showed that the odds ratios adjusted for the effect of socio-economic factors on the influence of knowledge on the consumption of low fat foods decreased for all the indices of knowledge except knowing that butter was high in fat and being able to explain cholesterol. These results suggest that having good qualifications, being employed in a non-manual occupation, being a homeowner and having the use of a car influence the effects of knowledge about food on low fat consumption. When these socio-economic influences are accounted for knowledge has less influence on the choice of low fat foods. Knowledge is more important in those women who have less good socio-economic circumstances. These calculations were repeated to examine the influence of these factors on high fruit and vegetable consumption. Table 3.23 shows the results obtained when the

odds ratio for the influence of knowledge on high fruit and vegetable consumption was adjusted to account for` the four socio-economic factors mentioned above.

Table 3.23: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) adjusted for the influence of socio-economic factors and knowledge on high fruit and vegetable intake in young women using multivariate logistic regression analysis.

Knowledge	High fruit & vegetable, Crude OR (95% CI)	High fruit & vegetable, Adjusted OR (95% CI)
Explain 'cholesterol'	1.46 (1.08-1.98)	1.34 (0.93-1.91)
Reduce heart disease;		
Controlling body weight	1.47 (1.09-1.98)	1.51 (1.02-2.24)
Eating fresh fruit & vegetables	1.42 (1.09-1.86)	1.19 (0.86-1.65)
Knowledge of fat content of;		
Red meat	1.22 (0.94-1.59)	1.08 (0.79-1.47)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.27 (0.93-1.73)
Whole milk	1.35 (1.01-1.80)	0.98 (0.69-1.39)
Soft margarine	1.40 (1.07-1.83)	1.27 (0.93-1.73)
Butter	1.19 (0.82-1.73)	0.98 (0.61-1.56)
A healthy diet;		
Should be well balanced	1.96 (1.35-2.84)	1.46 (0.97-2.20)
Should contain fresh fruit	1.19 (0.85-1.65)	1.15 (0.78-1.70)
Did not know *(reference)*	1	1

Table 3.23 showed that the odds ratios for the effect of knowledge on a high fruit and vegetable intake tended to decrease when the four socio-economic factors were adjusted for. The decrease was seen for all the knowledge questions except for women who believed that controlling body weight would reduce the chances of heart disease. These results suggest that the chances of women who were knowledgeable about specific foods having a high fruit and vegetable intake were reduced when having good qualifications, being employed in a non-manual occupation, being a homeowner and having the use of car were controlled for. In order to see if it would be useful to investigate this

relationship further, the socio-economic clusters (Table 3.18) were used to calculate what percentage of women in each cluster would be knowledgeable. The results that are shown in table 3.24 are given as numbers and percentages of women.

Table 3.24: Cluster analysis of women's knowledge.

Knowledge	Cluster 1 Manual, low qualifications, rent home, no car (%).	Cluster 2 Non-manual, high qualifications, home & car owner. (%)
Explain 'cholesterol'	191 (68.7)	333 (80.0)
Reduce heart disease;		
Controlling body weight	191 (68.7)	332 (80.0)
Eating fresh fruit & vegetables	231 (83.1)	332 (80.0)
Knowledge of fat content of;		
Red meat	142 (51.1)	212 (51.1)
Pies, pasties and quiches	154 (55.8)	262 (63.0)
Whole milk	187 (67.3)	319 (76.7)
Soft margarine	136 (48.9)	247 (59.5)
Butter	237 (85.3)	372 (89.4)
A healthy diet;		
Should be well balanced	35 (12.6)	90 (21.6)
Should contain fresh fruit	231 (83.1)	332 (80.0)

The results in table 3.24 show that women in Cluster 2 (Non-manual) were more likely to be confident about explaining the term 'cholesterol' (80%) and knowledgeable about controlling body weight to reduce the chances of heart disease (80%) than other women (68.7% and 68.7%). They were also more likely to know that pies, whole milk, soft margarine and butter were high in fat than other women were. Cluster 2 women were the most likely to know that a healthy diet should be well-balanced (21.6% vs. 12.6%). Cluster 2 women tended to have low fat intakes and a high consumption of fruits and vegetables (Table 3.20). They were characterised by working in non-manual employment, being highly qualified and owning their own homes. Women in Cluster 2 tended to be more knowledgeable than Cluster 1 women were. Cluster 1 represented the most socio-economically disadvantaged women. The results in table 3.24 suggested that the differences between the clusters were worth investigating further. Only 10-20% of women knew that a healthy diet should be well balanced too few women to include in further analysis. Logistic regression analysis was used to quantify the influence of socio-economic characteristics that made up Clusters 1 and 2 on knowledge and food choice, Cluster 1 was used as the reference category. The results of these analyses are shown in tables 3.25-3.29. The same knowledge questions were used as in the previous analysis.

Table 3.25: Odds ratio & 95% CI for the influence of the ability to explain cholesterol on low fat and high fruit and vegetable intake, adjusted for socio-economic clusters.

Knowledge	Low fat, OR (95%CI)	High fruit & vegetable, OR (95% CI)
Explain 'cholesterol'	**1.17 (0.82-1.65)**	**1.46 (1.08-1.98)**
Cluster 2	1.21 (0.81-1.84)	1.32 (0.93-1.89)
Cluster 1 *(reference)*	1	1

The results in table 3.25 showed that young women who were knowledgeable about the term cholesterol had an odds ratio of 1.46 for high fruit and vegetable consumption, but the odds for the women having a low fat diet were lower. When being knowledgeable was adjusted for, using the socio-economic factors that were associated with being in cluster 1 the odds ratio dropped to 1.32. This suggested that when the influence of being in non-manual employment, having 'A' levels or higher qualifications and home ownership was adjusted for being knowledgeable about cholesterol there was still an associated between knowledge and high fruit and vegetable intake, but the association was reduced.

Table 3.26: Odds ratio & 95% CI for the influence of knowledge about reducing heart disease on low fat and high fruit and vegetable intake, adjusted for socio-economic clusters.

Reduce heart disease;	Low fat, Crude OR (95%CI)	High fruit & vegetable, Crude OR (95% CI)
Controlling body weight	**1.32 (0.93-1.87)**	**1.47 (1.09-1.98)**
Cluster 2	1.22 (0.81-1.85)	1.30 (0.91-1.86)
Cluster 1 *(reference)*	1	1
Eating fresh fruit & vegetables	**1.05 (0.77-1.42)**	**1.42 (1.09-1.86)**
Cluster 2	0.87 (0.62-1.23)	1.24 (0.91-1.68)
Cluster 1 *(reference)*	1	1

The results in table 3.26 showed similar patters to the results in table 3.25. Adjusting for Cluster 2 reduced the influence of knowledge on high fruit and vegetable consumption and low fat intake. The odds ratio for high fruit and vegetable consumption dropped from 1.47 to 1.30 when knowing that controlling body weight would reduce the chances of heart disease was adjusted for Cluster 1.

Table 3.27: Odds ratio & 95% CI for the influence knowledge of the fat content of foods on low fat and high fruit and vegetable intake adjusted for socio-economic clusters

Knowledge of the fat content of;	Low fat, Crude OR (95%CI)	High fruit & vegetable, Crude OR (95% CI)
Red meat	**1.61 (1.18-2.19)**	**1.22 (0.94-1.59)**
Cluster 2	1.59 (1.12-2.25)	1.12 (0.83-1.52)
Pies, pasties and quiches	**1.23 (0.90-1.68)**	**1.33 (1.02-1.74)**
Cluster 2	0.97 (0.69-1.39)	1.31 (0.96-1.78)
Whole milk	**1.28 (0.91-1.80)**	**1.06 (0.68-1.66)**
Cluster 2	1.16 (0.78-1.72)	1.04 (0.74-1.47)
Soft margarine	**1.48 (1.08-2.01)**	**1.40 (1.07-1.83)**
Cluster 2	1.35 (0.95-1.91)	1.28 (0.94-1.74)
Butter	**1.85 (1.14-3.00)**	**1.19 (0.82-1.73)**
Cluster 2	2.25 (1.19-4.26)	0.96 (0.60-1.52)
Cluster 1 *(reference)*	1	1

The results presented in table 3.27 show the same trend as the results in tables 3.25 and 3.26, although the crude odds ratios for the influence of knowledge on low fat consumption tended to be higher than the odds ratios for high fruit and vegetable intake. This may have been because the questions were specifically about the fat content of foods. Adjusting for the clusters reduced the odds ratios for the influence of knowledge on high fruit and vegetable intake and low fat consumption in every case except for women who were knowledgeable about the fat content of butter.

Table 3.28: Odds ratio & 95% CI for the influence of knowing that a healthy diet should contain fresh fruit on low fat and high fruit and vegetable intake adjusted for socio-economic clusters.

Knowledge about a healthy diet;	Low fat, Crude OR (95%CI)	High fruit & vegetable, Crude OR (95% CI)
Fresh fruit	**0.98 (0.67-1.43)**	**1.19 (0.85-1.65)**
Cluster 2	0.95 (0.62-1.47)	1.53 (1.02-2.29)
Cluster 1 *(reference)*	1	1

The results in table 3.28 showed that the odds ratio for women who knew that a healthy diet should contain fresh fruit, eating a diet that was high in fruit and vegetables was 1.19 (CI 0.85-1.65). When this was adjusted for socio-economic factors the odds ratio increased to 1.53 (CI 1.02-2.29). Cluster 2 women who knew that a healthy diet should contain fresh fruit, were significantly more likely to have a high fruit and vegetable intake than less knowledgeable women even when socio-economic factors were accounted for. In order to meet the aim of this section of results, (To quantify the link between knowledge, socio-economic factors and low fat and high fruit and vegetable consumption), the crude odds ratio for all the knowledge questions was calculated. This was done using the sum of the young women who were knowledgeable about any of the variables shown in tables 3.25-3.28. Women who could explain the term cholesterol were combined with women who knew that controlling body weight and eating fruit and vegetables could reduce the risk of heart disease and with women who knew that red meat was high in fat etc. The fat intake and fruit and vegetable intake of all these knowledgeable women was compared with the choice of all the women who were less knowledgeable. Odds ratios for the influence of knowledge on low fat and high fruit and vegetable intake are shown in table 3.29. The odds ratios for the influence of each socio-economic cluster on knowledge on food choice was then calculated and presented the table 3.29. Cluster 1, the worst off in socio-economic terms was again used as the reference category.

Table 3.29: Odds ratio & 95% CI for the influence of knowledge on low fat and high fruit and vegetable intake, adjusted for socio-economic clusters.

Knowledge	Low fat, OR (95%CI)	High fruit & vegetable, OR (95% CI)
Crude	**2.30 (0.79-6.72)**	**2.24 (0.78-6.43)**
Cluster 2	1.48 (0.44-4.94)	1.38 (0.46-4.18)
Cluster 1 *(reference)*	1	1

The results indicated that the crude odds ratios for all the knowledgeable women were higher for both high fruit and vegetable consumption and low fat consumption than any of the individual odds ratios.

3.2c) **Summary**

The purpose of this section of the results was:

- To quantify the link between knowledge, socio-economic factors and low fat and high fruit and vegetable consumption.

The main findings were:

- Women who were knowledgeable about the fat content of foods were more likely than less knowledgeable women to have a low fat intake (OR 2.30, CI 0.79-6.72).
- Knowledgeable women were more likely to have a high fruit and vegetable intake (OR 2.24, CI 0.78-6.43) than other women.
- When good socio-economic circumstances were adjusted for the odds ratio for low fat intake dropped to 1.48 (CI 0.44-4.94).
- The odds ratio for high fruit and vegetable intake in knowledgeable women dropped to 1.38 (CI 0.46-4.18) when good socio-economic circumstances were adjusted for.

3.2d) **Conclusion**

The results in this section have not shown a significant relationship between knowledge, socio-economic factors and fat and fruit and vegetable consumption.

3.3) **Confidence in cooking ability, socio-economic factors and fruit and vegetable and fat intake.**

Aim

- To evaluate the influence of socio-economic factors and attitudes on fruit and vegetable and fat intake in women aged 20-34 years.

This section of the results is again divided into two parts. The initial section looks at the relationship between the confidence that women have in their cooking ability and the fat and fruit and vegetable content of their diet. The final part examines the influence of socio-economic factors on those positive attitudes towards cooking and food choices.

3.3a) **Results: Confidence in cooking ability and fruit and vegetable and fat intake.**

Young women were asked how confident they felt about cooking from basic ingredients as opposed to using convenience foods or cook chill dishes. Table 3.30 shows the results obtained when the fat and fruit and vegetables content of the women's diets were calculated for the different groups of women. The results are given as percentages for low and high fruit and vegetable intake and low and high fat intake for each group of women. Confidence intervals were then calculated to assess whether women who were very confident about their cooking were likely to have a higher intake of fruit and vegetables or a lower intake of fat than other women were or whether the results were likely to be due to chance alone.

Table 3.30: Young women's confidence about cooking by fat and fruit and vegetable consumption.

Attitudes towards cooking	Very confident (%)	Fairly confident (%)	Not very confident (%)	Not at all confident (%)
Fruit & veg intake				
Low	195 (42.7)	189 (57.4)	36 (57.1)	15 (75.0)
High	262 (57.3, CI 53-62)	140 (42.6, CI 37-48)	27 (42.9, CI 31-55)	5 (25.0, CI 11-47)
Fat intake				
Low	134 (31.2, CI 29-38)	83 (26.7, CI 22-32)	9 (16.1, CI 8-28)	4 (22.2, CI 9-45)
High	296 (68.8)	228 (73.3)	47 (83.9)	14 (77.8)

These results in table 3.30 showed that young women who were very confident about their ability to cook from basic ingredients were significantly more likely to have a high intake of fruit and vegetables (57.3%) in their diet than women who were only fairly confident were. Those young women who were not at all confident about their ability to cook from basic ingredients were significantly less likely to have a high intake of fruits and vegetables in their diet (25.0%) than very confident women were. Women who were very confident about their ability to cook from basic ingredients were also most likely to have a low fat intake (31.2). There were very few women in the later two groups (27 and 5 respectively) suggesting that these results are not very reliable, both these sets of confidence intervals include 42.6% the mean number of women who were fairly confident about their cooking who had a high fruit and vegetable intake.

In order to try and quantify the effect of positive attitudes towards cooking ability on consumption of fruits and vegetables and fat intake, a logistic regression analysis was performed. The reference category was taken as not being very confident in ones own cooking ability. Table 3.31 shows the results of the logistic regression analysis on women's confidence about their cooking abilities and it's association with a low fat diet and a high fruit and vegetable intake.

Table 3.31: Crude odds ratios (OR) with their respective 95% confidence intervals (95%CI) for low fat intake and high fruit and vegetable intake in young women using logistic regression analysis.

Attitude	Low fat OR (95%CI)	High fruit & vegetable OR (95%CI)
Very confident	2.12 (1.13-3.98)	2.19 (1.35-3.54)
Fairly confident	1.25 (0.90-1.73)	1.81 (1.36-2.41)
Not at all confident *(reference)*	1	1

Table 3.31 showed that women who were very confident about their ability to cook were more likely to have a low fat diet, (OR 2.12 95%CI 1.13-3.98) or a diet high in fruits and vegetables, (OR 2.19 95%CI 1.35-3.54) than women who were less confident about cooking ability (OR 1.25 95%CI 0.90-1.73 for low fat and 1.81 1.36-2.41 for high fruit and vegetable intake). The 95% confidence intervals for low fat consumption overlapped with 1 when women were fairly confident about their cooking ability. As it seemed likely that there was a relationship between women's attitude towards cooking and their fruit and vegetable and fat intake further analysis was done.

The women were then asked if they felt confident about using particular cooking techniques and if they felt confident about cooking particular foods. The results obtained from asking these questions were used to divide the women into two groups representing those who were confident and those who were not confident. The proportion of women from each group that fell into the low fat and the high fruit and vegetable categories was then calculated and confidence intervals used to determine whether there were real relationships between the women's attitudes towards cooking foods and their fat and fruit and vegetable intakes. These results can be seen in Appendix 5 (tables 6.27 to 6.34). The results indicated that women who had positive attitudes towards;

- steaming food,
- cooking oily fish,
- pulses,
- pasta,
- rice,

- fresh green vegetables
- root vegetables

were more likely to have a high fruit and vegetable intake than women who were not confident about these things. In the remaining instances there were too few women with positive attitudes to give reliable results. Women who were positive in their attitude towards,

- steaming food,
- cooking pulses,
- rice,
- fresh green vegetables
- root vegetables

were more likely than other women to have a low fat intake.

3.3b) **Results: Confidence in cooking ability, socio-economic factors and fat and fruit and vegetable consumption**.

The variables identified in section 3.3a were then subjected to the stratified logistic regression that was used with the knowledge variables in section 3.2b to determine whether any of the socio-economic factors was acting as a confounder or effect modifier. The results of these analysis can be found in Appendix 5 (tables 6.33–6.36). None of the socio-economic variables was found to be an effect modifier. The variables were used in a multiple regression analysis to examine the relationship between socio-economic factors and confidence in ones ability to cook using specific methods or specific foods on fruit and vegetable and low fat consumption. Table 3.32 shows the results obtained when the crude odds ratios for the influence of attitudes on low fat consumption and high fruit and vegetable intake were adjusted for non-manual employment, having 'A' levels or higher qualifications, being a home owner and having the use of a car.

Table 3.32: Crude and adjusted odds ratio (OR) with their respective confidence intervals (95%CI) for the influence of confidence and socio-economic factors on low fat consumption and high fruit and vegetable intake in young women using logistic regression analysis.

Confidence in ability towards:	Crude OR (95% CI) for high fruit & vegetable	Adjusted OR (95% CI) for high fruit & vegetable intake	Crude OR (95%CI) for low fat intake	Adjusted OR (95%CI) For low fat intake
Steaming food	2.44 (1.85-3.22)	2.20 (1.60-3.03)	1.45 (1.06-2.00)	1.24 (0.87-1.78)
Cooking oily fish	1.68 (1.28-2.20)	1.56 (1.14-2.13)	1.37 (1.01-1.86)	1.13 (0.80-1.60)
Cooking pulses	1.60 (1.23-2.09)	1.43 (1.05-1.95)	1.60 (1.18-2.19)	1.62 (1.14-2.31)
Cooking pasta	2.11 (1.39-3.20)	1.62 (0.98-2.69)	1.72 (1.03-2.85)	1.43 (0.77-2.65)
Cooking rice	2.60 (1.66-4.06)	1.91 (1.11-3.29)	2.04 (1.18-3.54)	1.84 (0.94-3.62)
Cooking fresh green veg.	2.26 (1.30-3.93)	1.87 (0.92-3.79)	3.53 (1.50-8.35)	2.91 (1.03-8.22)
Cooking root vegetables	2.56 (1.62-4.05)	3.38 (1.88-6.07)	1.75 (1.01-3.02)	1.53 (0.80-2.92)
Not confident (reference)	1		1	1

Table 3.32 showed that women who were confident about steaming foods were almost two and a half times (OR 2.44, 95% CI 1.85-3.22) more likely than other women to have a high intake of fruits and vegetables. And one and a half times more likely than other women to have low fat diets (OR 1.45, 95% CI 1.06-2.00). The odds ratio 3.53 (95% CI 1.50-8.35) also showed that women were more likely to have a low fat diet if they had confidence in their ability to cook fresh green vegetables. The confidence intervals are

very wide because only a small number of women were confident about their ability to cook green vegetables. The odds ratios tended to be higher for the influence of attitudes on fruit and vegetable consumption than on fat intake. This is partly due to the fact that more of the indicators were chosen for further analysis because of their influence on fruit and vegetable consumption that for fat consumption. When the odds ratios are adjusted for the four socio-economic variables there is a decrease in all but two cases. The odds ratio for the influence of confidence in ones ability to cook root vegetables on high fruit and vegetable consumption increased from 2.56 to 3.38. The odds ratio for the influence of attitude towards cooking pulses increased by 0.02 when adjusted for socio-economic variables. These results suggest that the combination of socio-economic factors influence the effect of confidence towards cooking to increase the chances of eating a low fat and high fruit and vegetable diet.

As table 3.32 clearly indicated that socio-economic factors were influencing the effect of women's attitudes towards cooking foods on their food choice it seemed appropriate to use cluster analysis to further investigate the relationship. The following tables show the results obtained when cluster analysis was used to separate women with positive attitudes towards their cooking into four separate socio-economic groups. The results are shown in table 3.33 as percentages of women in each cluster who had positive attitudes towards cooking certain foods.

Table 3.33: Cluster analysis to show the relationship between socio-economic factors and confidence towards cooking foods.

Confidence in ability towards:	Cluster 1 Manual, low qualifications, rent home, no car (%).	Cluster 2 Non-manual, high qualifications, home & car owner. (%)
Steaming food	161 (57.9)	261 (62.7)
Cooking oily fish	103 (37.1)	206 (49.6)
Cooking pulses	130 (46.8)	232 (55.8)
Cooking pasta	235 (84.5)	383 (92.1)
Cooking rice	242 (87.1)	385 (92.8)
Cooking fresh green veg.	259 (93.2)	397 (95.4)
Cooking root vegetables	255 (91.7)	376 (90.4)

Table 3.33 showed that women from Cluster 2 tended to be most confident about their ability to cook specific foods. There were enough women in the clusters who were confident about their cooking ability to enable more investigations to be done. Each cluster was used to adjust the odds ratio for both low fat and high fruit and vegetable intake for each attitude. The results are shown in tables 3.34 and 3.35.

Table 3.34: Crude odds ratios for the influence of confidence on low fat and high fruit and vegetable consumption adjusted for each socio-economic cluster.

Confidence in ability towards:	Low fat, Crude OR (95%CI)	High fruit & vegetable, Crude OR (95% CI)
Steaming food	**1.45 (1.06-2.00)**	**2.44 (1.85-3.22)**
Cluster 2	1.26 (0.88-1.81)	2.19 (1.59-3.01)
Cluster 1 *(reference)*	1	1
Cooking oily fish	**1.37 (1.01-1.86)**	**1.68 (1.28-2.20)**
Cluster 2	1.14 (0.81-1.61)	1.59 (1.17-2.16)
Cluster 1 *(reference)*	1	1
Cooking pulses	**1.60 (1.18-2.19)**	**1.60 (1.23-2.09)**
Cluster 2	1.63 (1.15-2.32)	1.45 (1.07-1.97)
Cluster 1 *(reference)*	1	1
Cooking pasta	**1.72 (1.03-2.85)**	**2.11 (1.39-3.20)**
Cluster 2	1.49 (0.81-2.75)	1.72 (1.04-2.84)
Cluster 1 *(reference)*	1	1
Cooking rice	**2.04 (1.18-3.54)**	**2.60 (1.66-4.06)**
Cluster 2	1.85 (0.94-3.63)	1.95 (1.14-3.34)
Cluster 1 *(reference)*	1	1

Table 3.34 showed that adjusting the odds ratio for the influence of confidence in ones ability to cook specific foods on high fruit and vegetable consumption and low fat intake by socio-economic factors reduced the odds ratio in all but one instance. Young women who were confident about cooking rice had an odds ratio for high fruit and vegetable intake of 2.60 (CI 1.66-4.06). When socio-economic circumstances were adjusted for the odds ratio dropped to 1.95 (CI 1.14-3.34).

Table 3.35: Crude odds ratios for the influence of confidence on low fat and high fruit and vegetable consumption adjusted for each socio-economic cluster.

Confidence in ability towards:	Low fat, Crude OR (95%CI)	High fruit & vegetable, Crude OR (95% CI)
Cooking fresh greens	**3.53 (1.50-8.35)**	**2.26 (1.30-3.93)**
Cluster 2	2.80 (1.10-7.87)	1.75 (0.87-3.50)
Cluster 1 *(reference)*	1	1
Cooking root vegetables	**1.75 (1.01-3.02)**	**2.56 (1.62-4.05)**
Cluster 2	1.48 (0.78-2.81)	3.12 (1.75-5.55)
Cluster 1 *(reference)*	1	1

Table 3.35 showed that adjusting for socio-economic clusters resulted in the odds ratio dropping in three out of four instances.

To meet the aim of this section of the results, (To evaluate the influence of socio-economic factors and positive attitudes on fruit and vegetable and fat intake in women aged 20-34 years.) the mean crude and adjusted odds ratios for the attitude of each cluster was calculated. Attitude was taken as the sum of all the women who were confident for each individual type of cooking. The results are shown in table 3.36.

Table 3.36: *Mean odds ratio & 95% CI for the influence of attitudes on low fat and high fruit and vegetable intake, adjusted for socio-economic clusters.*

Attitude	Low fat, OR (95%CI)	High fruit & vegetable, OR (95% CI)
Crude	**1.58 (1.14-2.20)**	**1.92 (1.41-2.59)**
Cluster 2	1.36 (0.93-1.97)	1.72 (1.22-2.44)
Cluster 1 *(reference)*	1	1

The results in table 3.36 suggest that positive attitudes towards cooking foods increased the chances of being a low fat consumer and of having a high fruit and vegetable consumption. The odds ratios being 1.58 (CI 1.14-2.20) and 1.92 (CI 1.41-2.59) respectively. When these odds ratios are adjusted for socio-economic clusters they are reduced to 1.36 (CI 0.93 –1.97) and 1.72 (CI 1.22-2.44).

3.3c) **Summary**

The purpose of this section of the results was:

- To evaluate the influence of socio-economic factors and attitudes on fruit and vegetable and fat intake in women aged 20-34 years.

The main findings were:

- Women with positive attitudes towards their cooking abilities were significantly more likely to have a high fruit and vegetable intake 1.92 (CI 1.41-2.59) than other women were.
- When good socio-economic circumstances were adjusted for the effect of positive attitudes on high fruit and vegetable intake was diminished but still remained significant OR, 1.72 (1.22-2.44).
- Women with positive attitudes towards their cooking abilities were significantly more likely to have a low fat intake 1.58 (CI 1.14-2.20) than other women were.
- When good socio-economic circumstances were adjusted for the effect of positive attitudes on low fat intake was diminished OR, 1.36 (CI 0.93-1.97).

3.3d) **Conclusion**

The results obtained from data collected in the Health and Lifestyle Survey have now been completed. The following section looks at other sources of information to try and see how income and expenditure relate to socio-economic factors and influence food choice.

3.4) **Income and fat and fruit and vegetable intake.**

Aim

- To investigate the links between income and fat and high fruit and vegetable intake.

The literature suggested that in order to meet this aim it would be useful to answer the following questions.

- What is the nutrient profile of low-income diet?
- What happens to the nutrient level if fat is reduced, fruit and vegetables increased and expenditure remains constant?

This section of the results is divided into two parts; each part looks at one of the questions.

3.4a) Results: **Nutrient profile of a low-income diet.**

The nutrient profile of a low-income diet can be seen by looking at data from the National Food Survey *(MAFF 1998).* (See Appendix 6 tables 6.59-6.69, pages 252-276)

- The nutrient profile of low-income diet is lower in iron, zinc, magnesium and potassium than the diet of households with the high budgets.

3.4b) **Results: What happens to the nutrient level if fat is reduced, fruit and vegetables increased and expenditure remains constant?**

In order to see if it was possible on a low income to buy a diet that met the government recommendations for vitamins and minerals as well as healthy eating guidelines for fat and fruit and vegetables a theoretical diet was constructed from the National Food Guide, (chapter1, 1.1e, page 12). Table 3.37 shows the portions of food that make up the NFG Balance of Good Health recommended by health professionals in the *UK (Gatenby et al 1995).* Ethnic food such as plantain, sweet potato, nan bread and chapati have not been included, as it was felt their high cost would give an unrealistic estimate of the cost of a healthy diet.

Table 3.37: Balance of Good Health, food groups, daily measures and advice.

Bread, other cereals & potatoes	Fruit & vegetables	Meat, Fish & alternatives	Milk & dairy foods	Fatty foods	Sugary foods
6-14 portions/day	5 or more portions/day	2-4 portions/day	2-3 portions/day	1-5 portions/day	≤2 portions/day
Choose high fibre	Choose a wide variety	Choose lower fat foods	Choose lower fat foods	Try not to eat these too often, and when you do, have small amounts.	
3 tbs. Breakfast cereal	1 medium portion vegetables	3 medium slices meat	1 medium glass of milk	1 tsp. butter	3 tsp. sugar
2 tbs. Muesli	1 medium portion salad	3 medium slices liver, chicken, fish	1 small pot yoghurt	1 tsp. margarine	1 heaped tsp. Jam/ honey
1 slice of bread/toast	1 medium fresh fruit	2 eggs	Cheese, 1 small matchbox	2 tsp. Low fat spread	
Half a large bread roll	6 tbs. stewed fruit	5 tbs. baked beans	Cottage cheese, Large portion	1 tsp. oil/ghee	
2 egg sized boiled potatoes	6 tbs. Tinned fruit	4 tbs. Cooked lentils	1 large portion of fromage frais	1 tbs. mayonnaise	
3 crackers/ crispbread	1 small glass fruit juice	2 tbs. nuts or peanut butter		1 tbs. Cream	

Additional portions of bread and starchy foods are; 2 heaped tablespoons of boiled rice, 3 heaped tablespoons of boiled pasta and half a packet of boiled egg noodles. The daily measures shown in table 3.37 were then used to construct a healthy diet, the foods included and their cost are shown in table 3.38.

Table 3.38: Cost of a healthy diet.

Food	Bread, other cereals & potatoes	Fruit & vegetables	Meat, Fish & alternatives	Milk & dairy foods	Fatty foods
Food	2 slices wholemeal bread, 76g	200mls fruit juice	Chicken, 70g	Skimmed milk, 200mls	1 tsp. Margarine 5g
Cost, pence	7.2	7.4	20.9	9.1	0.5
Food	6 tbs. Bran flakes, 48g	1 apple 100g	Fish, 60g	Low fat yoghurt, 150g	1 tsp. Vegetable oil, 3g
Cost, pence	7.9p	8.3	47.9	28.5	0.2
Food	—	Carrots, 60g	—	—	—
Cost, pence		0.2			
Food	Potato, 80g	Peas, 70g	—	—	—
Cost, pence	1.8	4.5			
Food		Swede, 60g	—	—	—
Cost, pence		3.5			
Total cost (pence)	17.1	23.9	68.8	37.6	0.7

The minimum number of suggested portions was used. Weights of foods were taken from the booklet Food Portion Sizes *(MAFF 1988)*. Costs of foods were taken from the Tesco web site (www.tesco.com) during November 2000, wherever possible 'value' products were used. Sugary foods have not been included as part of a healthy diet. Total cost of the foods in each food group is given at the bottom of each column.

The most expensive foods are the meat and alternatives group. Cheaper alternatives would have been baked beans and eggs. The total cost of all the food in the table is 149 pence per day, or £10.43 per week. This is comparable to the £12.72 spent by the low-income household in 1998, as it does not include drinks, confectionery, alcohol or any miscellaneous items. The nutrient content of the foods used to construct the healthy diet were calculated using McCance & Widdowson's The Composition of Foods *(Paul et al 1978)*. Energy and iron, zinc, magnesium and potassium were investigated because these were the four nutrients shown to be below the RNI in table 3.39. The fat content of the diet was included because the literature review suggested that fat intake may be increased in diets that were low in nutrients *(Murphy et al 1992, Peterson et al 1999)*. The results of this exercise are shown in table 3.42 and compared with the nutrient content of the low-income household's diet.

Table 3.39: Nutrient content of food servings.

Foods	Energy (Kcals)	Fat (g)	Iron (mg)	Zinc (mg)	Mg (mg)	K (mg)
Wholemeal bread, 76g	164	2.0	1.9	1.52	71	167
Bran flakes, 48g	202	1.4	5.7	1.3	53	187
Potato, 80g	64	Tr	0.24	0.16	12	254
Fruit juice, 200mls	68	—	0.6	0.4	24	360
Apple, 100g	46	—	0.3	0.1	5	120
Carrots, 60g	11	—	0.24	0.18	6	52
Peas, 70g	29	—	0.98	0.49	16	91
Swede, 60g	11	—	0.18	—	4	60
Chicken, 70g	99	2.8	0.35	0.7	18	231
Fish, 60g	58	0.7	0.24	0.3	16	210
Skimmed milk, 200mls	66	0.2	0.1	0.72	24	300
Low fat yoghurt, 150g	143	1.5	0.36	0.94	26	330
Margarine, 5g	37	4.1	0.02	—	—	—
Vegetable oil, 3g	27	2.9	—	—	—	—
Totals	1025	15.6	11.11	6.81	275	2372
Total for low income household	1610	90	8.6	6.7	199	2340

The results in table 3.39 show that following the recommendations in the Balance of Good Health takes a large proportion of the household budget, but provides only 49% of the previous energy intake which was already only 77% of the EAR. An alternative method of constructing a healthy diet was needed. Information from the National Food Survey *(MAFF 1998)* was used to look at the amount of each food group consumed and how much money was spent on each group of foods and the nutrient provided. By increasing expenditure on every product in the families shopping basket by a fixed amount it was possible to see which items provide the best value for money in terms of nutrients, this is called a cost sensitivity analysis. The NFS *(MAFF 1998)* lists food products in the amounts purchased by the average household, this data was used to produce a cost sensitivity analysis to find the cheapest sources of energy, fat, iron, zinc, potassium and magnesium from the low budget diet. The results of these analyses are shown in Appendix 6 (Tables 6.49-6.54). Using the cost sensitivity data the original low cost diet was altered to implement healthy eating changes to each of the food groups in turn. For example the fruit and vegetable consumption was increased to five portions per day. In order to remain within the budget money spent on foods shown to provide few nutrients per pence were reduced. Finally all the individual healthy eating changes were put together, this resulted in an over spend of £1.24. The resulting changes to the nutrient content of the diet are shown in table 3.40

Table 3.40: Daily nutrient intake and % change obtained by following the Balance of Good Health recommendations, within a budget of £12.72/week.

Foods	Energy (Kcals)	Fat (g)	Iron (mg)	Zinc (mg)	Mg (mg)	K (mg)
Bread, cereals & potatoes	1,803 -1%	76.3 0%	9.3 1.2%	8.4 -6.4%	268 24.7%	2088 -5.1%
Fruit & vegetables	1605 -12%	55.9 -26.7	9.6 3.9%	6.8 -5.4%	229 7%	2493 13%
Meat, Fish & alternatives	1,345 -26%	38.3 -49.8%	7.7 -16.1%	5.6 -22.1%	201 -6.3%	2113 -4.0%
Milk & dairy foods	1,575 -13.5%	52.7 -30.9%	8.6 -6.4%	6.9 -4.2%	214 -0.2%	2293 4.2%
Healthy diet, £1.24 overspend	1198	28.5	9.1	8.0	294	2592
Original diet	1,820	76.3	9.2	7.2	215	2201
% change	-34.2	-62.7	-0.9	11	36.8	17.7

The results shown in table 3.40 show that each 'healthy eating' change resulted in a fall in the energy intake. The increase in bread, cereals and potatoes only reduced the energy intake by 1% but the other changes resulted in energy reductions of between 12% and 26%, when all the changes were made together the energy intake fell by 34% despite a small increase in weekly expenditure.

The exercise was repeated without budget restraints, adding in extra foods to ensure that the energy levels did not fall. The results are shown in table 3.41. The total nutrient content of the diet is not the sum of the nutrients provided by the food groups shown because it includes the sugar and preserves, confectionery, beverages and alcohol provided in the original low-income diet.

Table 3.41: Daily nutrient intake, cost and % change obtained by following 'Balance of Good Health' recommendations, without budget restraints.

Foods	Cost (£)	Energy (Kcals)	Fat (g)	Iron (mg)	Zinc (mg)	Mg (mg)	K (mg)
Bread, cereals & potatoes	0.47	786	18	4.5	3	147	750
Fruit & vegetables	0.67	170	0.3	2.9	1.4	56	718
Meat, Fish & alternatives	0.83	259	12	1.5	2.3	37	501
Milk & dairy foods	0.37	1.7	2.0	0.45	1.7	50	640
Fats & oils	0.3	152	17	0.02	0	0	0
Total	2.52	1,827	50.7	10.6	8.9	322	2886
Original diet	1.82	1,820	76	9.2	7.2	215	2201
% change	39	0	-33	16	23	50	31

Table 3.41 showed that the healthy diet was 39% more expensive than the low budget diet. The healthy diet contained 16% more iron, 23% more zinc, 50% more magnesium and 31% more potassium than the low budget diet and 33% less fat.

3.4c) **Summary**

The purpose of this section of results was:

- To investigate the links between income and fat and fruit and vegetable intake.

By answering the following questions;

- What is the nutrient profile of low-income diet?
- What happens to the nutrient level if fat is reduced, fruit and vegetables increased and expenditure remains constant?

The main findings were:

- The nutrient profile of low-income diet is lower in iron, zinc, magnesium and potassium than the diet of households with the high budgets.
- If fat intake is reduced by 31% by changing high fat dairy foods to low fat dairy foods and expenditure remains constant then energy intake is reduced by 13.5%. Iron intake is reduced by 6.4% and zinc intake by 4.2%. Magnesium intake remains constant and potassium intake is increased by 4.2%.
- If fat intake is reduced by 38% by reducing meat and meat products and increasing poultry intake and expenditure remains constant then energy intake is reduced by 49.8%. Iron intake is reduced by 16% and zinc intake by 22%. Magnesium intake is reduced by 6% and potassium intake is reduced by 4%.
- If fruit and vegetable intake is increased, and expenditure remains constant, energy intake drops by 12%, fat intake by 27%, iron intake increases by 3.9% and zinc intake falls by 5.4%. Magnesium intake increases by 7% and potassium intake increases by 13%.

3.5) **Summary of results: Final integrated model**

Aim

- To develop a model that accounts for all the known variance.

Introduction

This section of the results aims to draw together the results from previous sections in order to start to answer the original question, which was:

- To what extent do socio-economic status, knowledge, and confidence in cooking skills, account for young women's food choice. What other factors may influence food choice in this group?

The results from the previous sections are outlined below:

- Having good socio-economic circumstances increased the likelihood of women aged 20-24 years having a high fruit and vegetable intake by 2 to 1.
- Having good socio-economic circumstances increased the likelihood of women aged 20-24 years having a high fruit and vegetable intake by 2 to 1.
- Being knowledgeable made young women more likely to choose a diet that was low in fat or high in fruits and vegetables but the difference was not significant. When good socio-economic circumstances were taken into account the influence of knowledge on food choice was reduced.
- Women with positive attitudes towards their cooking abilities were significantly more likely to have a high fruit and vegetable intake, 1.92 (CI, 1.41-2.59) than other women.
- When good socio-economic circumstances were adjusted for, the effect of positive attitudes on high fruit and vegetable intake was diminished but still remained significant OR, 1.72 (CI, 1.22-2.44).
- Women with positive attitudes towards their cooking abilities were significantly more likely to have a low fat intake, 1.58 (CI, 1.14-2.20) than other women were.

- When good socio-economic circumstances were adjusted for the effect of positive attitudes on low fat intake was reduced and no longer significant OR, 1.36 (CI, 0.93-1.97).

In order to answer the original question it is necessary to combine all the above factors and any others that might influence food choice in a single calculation that allows an estimate of the extent to which the factors can account for food choice. A binary logistic regression was used to take account of all the variables that have been shown to influence food choice. The initial calculation was done using socio-economic status, education, tenure, and car use were added into the calculation one after the other in a simple stepwise fashion. The single knowledge variable from table 3.27and the influence of positive attitudes towards cooking were added in next, followed by living in the South of England, not being a single parent, being normal weight and never having smoked a cigarette. These variables were included because the results in table 3.12 suggested that they might have some influence.

The results of this regression analysis are shown in table 3.42, cumulative % variance together with odds ratios and their respective 95% confidence intervals for the addition of each new variable are presented.

Table 3.42: Cumulative % variation accounted for by variables on low fat intake and high fruit and vegetable consumption in young women with odds ratio & 95% confidence intervals.

Variables	% variation in low fat intake (OR, 95% CI)	% variation in high fruit & vegetable intake, (OR & 95% CI)
socio-economic group,	0.6, (1.47, 1.04-2.07)	2.4, (1.94, 1.44-2.60)
level of qualification	0.6, (1.31, 0.92-1.86)	3.2, (1.63, 1.19-2.23)
housing tenure	0.7, (1.01, 0.73-1.65)	4.5, (1.70, 1.19-2.43)
car use	0.8, (1.05, 0.65-1.71)	4.5, (1.17, 0.77-1.80)
& knowledge	0.8, (1.46, 0.44-4.87)	4.6, (1.37, 0.45-4.19)
& cooking skills	1.2, (1.34, 0.92-1.95)	5.7, (1.68, 1.19-2.34)
& living in the South	1.2, (1.03, 0.73-1.48)	7.0, (1.63, 1.19-2.25)
& not being single parent,	1.3, (0.73,0.33-1.62)	7.1, (0.69, 0.35-1.37)
& being normal weight	1.3, (1.12, 0.77-1.60)	8.5, (1.01, 0.72-1.41)
& never smoked	1.3, (0.93, 1.02-0.70)	8.5, (0.95, 0.68-1.33)

The results shown in tables 3.42 indicate that socio-economic group, level of education, owning ones own home and having the use of a car together explain 0.8% of the variation in having a low fat intake. These four factors are more effective in explaining the variation in fruit and vegetable intake. Together they account for 4.5% of the variation in the choice of a high fruit and vegetable consumption. Both having an 'A'level or higher qualification, and owning ones own home make a significant contribution to the variation in high fruit and vegetable intake. When being knowledgeable about food is included in the calculation it has no extra effect on explaining the choice of a low fat diet and accounts for only an additional 0.1% of the variation in choice of a diet high in fruits and vegetables. The inclusion of having a positive attitude towards ones ability to cook accounts for a further 0.4% of the variation in choice of a low fat intake and 1.1% of the variation in choice of a high fruit and vegetable intake, a significant additional proportion of the variance (OR 1.68, CI 1.19-2.34). Living in the South of England explained an additional 1.3% of the variation in choice of a diet high in fruits and vegetables, again a significant amount (OR 1.63, CI 1.19-2.25), but did not affect fat consumption. Not being a single parent added 0.1% on the variation in both low fat and high fruit and vegetable consumption. Being of normal weight did not affect the choice of low fat foods but did account for 1.4% of the variation in choice of fruit and vegetable consumption. Finally having never smoked a cigarette did not affect low fat or high fruit and vegetable consumption.

All the factors combined account for 8.5% of the variation in fruit and vegetable intake and 1.3% of the variation in fat consumption.

This suggests that 91.5% of the variance in choice of a diet that is high in fruit and vegetables is unexplained and 98.7% of the variance in choice of a diet that is low in fat remains unexplained.

Section 3.4 of the results looked at the effects of low income on food choice, the following results were obtained;

- The nutrient profile of a low-income diet is lower in iron, zinc, magnesium and potassium than the diet of households with higher budgets.
- If fat intake is reduced by 31% by changing high fat dairy foods to low fat dairy foods and expenditure remains constant then energy intake is reduced by 13.5%. Iron intake is reduced by 6.4% and zinc intake by 4.2%. Magnesium intake remains constant and potassium intake is increased by 4.2%
- If fat intake is reduced by 38% by meat and meat products and increasing poultry intake and expenditure remains constant then energy intake is reduced by 49.8%. Iron intake is reduced by 16% and zinc intake by 22%. Magnesium intake is reduced by 6% and potassium intake is reduced by 4%
- If fruit and vegetable intake is increased and expenditure remains constant, energy intake drops by 12%, fat intake by 27%, iron intake increases by 3.9% and zinc intake falls by 5.4%. Magnesium intake increases by 7% and potassium intake increases by 13%.

These results indicated that low-income diets had a different nutrient profile from diets in higher income household and that following healthy eating advice to reduce fat intake on a fixed budget resulted in a reduction of energy intake. The Health and Lifestyle Survey asked respondents about their income but too few people answered the question so it was not possible to include income as a variable in the analysis of the results. Data on the receipt of family credit was available, see tables 3.5 and 3.14. Respondents to the survey had been asked: 'if affordable prices was a factor in their decision to shop at a specific store?' A simple cross tabulation of this variable with fat and fruit and vegetable intake was done to explore the relationship. The results are shown in table 3.43. Data were available for the fruit and vegetable intake of 875 women and the fat intake of 820 women.

Table 3.43: Women who shop where 'prices are affordable' by fruit and vegetable and fat intake

	'Prices are affordable'	Not concerned by 'affordable price'
Fruit & Vegetable intake		
Low (%)	152 (60.3)	285 (45.8%)
High (%, CI)	100 (39.6, CI 33.8-45.8)	338 (54.2, CI 50.3-58.1)
Fat intake		
Low (%, CI)	69 (28.7, CI 23.4-34.8)	161 (27.8, CI 24.3-31.5)
High (%)	171 (71.3)	419 (72.2)

The results in table 3.43 show that there is a significant difference in fruit and vegetable consumption between women who feel that they need to shop at places where 'prices are affordable' and other women. Only 39.6% of women who were concerned about prices had a high fruit and vegetable consumption compared with 54.2% of other women. Women who were concerned that the prices in shops were affordable were just as likely as other women to have low fat intakes.

These two variables were then included in the regression analysis (initial results table 3.42); the results are shown in table 3.44.

Table 3.44: Cumulative % variation accounted for by variables on low fat intake and high fruit and vegetable consumption in young women, with odds ratios & 95% confidence intervals.

Variables	% variation in low fat intake, (OR & 95% CI)	% variation in high fruit & vegetable intake, (OR & 95% CI).
In receipt of family credit	1.4, (0.73, 0.23-2.34)	8.5, (0.82, 0.31-2.20)
'Prices are affordable'	2.2, (1.62, 1.07-2.45)	8.8, (0.76, 0.52-1.12)

Table 3.44 shows that being in receipt of income support did not explain any further change in choice of fruit and vegetable intake. Choosing a shop on the basis of it's prices being affordable explained 0.3% of the variance in choice of a diet high in fruit and vegetables and an additional 0.8% of the variation in choice of a low fat intake.

Table 3.45 is a final summary table to show the percentage of the variation in fat and fruit and vegetable consumption explained by all the variables considered in this thesis. The variables include socio-economic group, level of qualification, housing tenure, car ownership, knowledge of foods, positive attitudes towards cooking ability, living in the South of England, not being a single parent, being normal body weight (BMI 20-25), never having smoked, not being in receipt of family credit and not being concerned about whether prices are affordable.

Table 3.45: % variation accounted for by all variables on low fat intake and high fruit and vegetable consumption in young women.

Variables	% variation in low fat intake	% variation in high fruit & vegetable intake
All variables	2.2	8.8

Table 3.45 shows the results obtained when all the variables were taken into account. All the variables combined only account for 2.2% of the variation in fat intake in this group of young women and 8.8% of the fruit and vegetable consumption.

These results indicate that 97.8% of the variation in fat intake and 91.2% of the variation in fruit and vegetable consumption remain unexplained.

There is a need to look for other influences on food choice because even taking into account problems with the methodology and data collection in this study there is still a large proportion of unexplained variation in food choice. The following section of the thesis takes the results outlined in this section and discusses them with reference to information gained from the literature review of other studies, for example the % variation in fat and fruit and vegetable intake explained by these results is compared with results from other studies. The discussion aims to explore what these results add to our understanding of the influences on food choice and outline what is specific to young women and what is more generalisable.

Chapter IV: Discussion of results

Introduction

Aim

- To examine the validity of the survey data
- To discuss the results obtained from the analysis of the survey data with respect to the literature review and the first part of the original question which was:
- To what extent do socio-economic status, knowledge and confidence in cooking skills, account for young women's food choice.
- To propose other factors that may account for the large unexplained variance in fat and fruit and vegetable intake.

Introduction

This chapter is concerned with the validity of the survey data and the interpretation of the results. Section 1 of the chapter considers the validity of the survey data, which can be assessed by taking into account a number of issues. The external validity of the findings depends on the applicability of the results to other populations. The internal validity of the results depends on whether the results are a true measure of what the investigator intended to measure. The validity of all studies is affected by bias. Different types of bias and their respective influence on the results are discussed. The survey questionnaire and the DINE questionnaire were affected by bias but not necessarily in the same ways. Section 2 considers the results (Chapter III) in relation to the literature review (Chapter I). The final section of this chapter looks at other factors that may account for some of the large unexplained variance in fat and fruit and vegetable intake.

4.1) Validity of the survey data

The study can be said to be valid if its findings are felt to be a reasonable representation of the true situation *(Margetts & Nelson 1997)*.
Examining both the external validity and the internal validity of the data collected from the survey can help to assess whether the survey measured what it set out to measure. A study cannot be said to be externally valid unless it is internally valid.

4.1a) **Internal validity**

If a study is internally valid the information obtained from the respondents must be a true measure of what the investigator intended to measure. There should be no bias in the way that data are collected, analysed or interpreted *(Margetts & Nelson 1997)*. In the Health and Lifestyle Survey socio-economic information was collected and a number of variables were measured. The variables included, fat intake, fruit and vegetable intake, knowledge about the fat content of foods, attitudes towards food shopping, and cooking skills. The results may be more reliable in one area than in another. Section 4.1a,i-vi discusses the validity of each set of variables in turn. The validity of the results obtained in section 3.4 (Chapter III: Results, Income and fat and fruit and vegetable intake) are also discussed.

4.1ai) **Assessment of socio-economic factors**

Socio-economic data were collected in the initial interview by asking respondents a number of questions about their homes, cars, employment, spouses' employment, and income from benefits and income from employment. Data on income from employment would have been very helpful for this thesis but too few people answered the question, to allow its inclusion in the data set. The socio-economic data obtained should have been a reasonable measure of education, employment status, and car use etc. The lack of data on income suggests that people who did not wish to give information said so rather than making it up. The fact that an interviewer was used to obtain completed questionnaires may have made the answers more accurate or it may have made people more inclined to embellish facts to impress the interviewer. The problem with socio-economic data lies not in whether it is a true measure of the variables, but in whether the variables can be said to truly account for or explain socio-economic status. The problems associated with the assessment of socio-economic status using the Registrar General's classification have been discussed (Chapter II, section 2.1b, page 73). Other indicators of socio-economic status such as educational attainment and car use have been used to supplement the information obtained from the Registrar General's classification. The assessment of socio-economic status in this survey was probably the best that could be realistically obtained with out a complete set of data on income. There were no data available on people who were asked to participate in the survey and did not respond or on people who could not be contacted. Their socio-economic circumstances may have been different from people who agreed to participate in the study. This lack of information needs to be taken into account when discussing the results to the study.

A wide range of socio-economic factors was considered in Chapter III of the thesis. Fruit and vegetables and fat intake were considered in relation to educational attainment, employment status, family structure, presence of a partner, housing tenure, bed standard, car use and region. These factors were considered to see if they gave any additional information on the relationship between socio-economic variables and food choice.

4.1aii) **Measurement of fat intake**

Information about the fat content of people's diets was obtained using the DINE questionnaire. The DINE questionnaire was originally developed for primary care staff without nutrition knowledge to use in health clinics. It was validated by comparison with a detailed 4-day diet record in a population of 206 factory workers. There was an exact agreement of categorisation for 53% of fat intakes. The Pearson correlation coefficient between the two methods was 0.51 for fat *(Roe et al 1994)*; this compares with 0.52 reported by Jain *(et al 1996)*. Jain validated a self administered food frequency questionnaire and an interviewer administered detailed diet history against a 7-day food record on a population based sample of 95 men and 108 women in Canada. Pietinen *(et al 1988)* reported a higher value of 0.64. Pietinen validated a self-administered food use questionnaire against food consumption records kept for 12 two-day periods. A total of 121 men filled in the food questionnaire. Gross misclassification occurred on average for only 4% of subjects *(Pietinen et al 1988)*. Only 6% of fat intakes were grossly misclassified *(Roe et al 1994)*. To make a judgement on the validity of the data for fat intake, it is important to consider the accuracy of the original validation study. This was carried out as part of a health check programme for employees of the Rover Group in Oxford *(Roe et al 1994)*. Invitations to attend a health check and participate in the validation study were mailed to the home addresses of 401 employees from three different departments. The departments were chosen in order to ensure that women and non-manual workers were adequately represented. In response to a single invitation 226 employees (56%) attended a health check during the study period, and 206 (86%) of these completed 4 days of diet records (128 men, 78 woman). The subjects were predominantly white and ranged from 17 to 62 years of age with a mean age of 46 years for men and 43 years for women. Skilled manual workers accounted for 76% of the sample (83% men, 66% women) the remaining people were administrative staff.

Three nurses, from the occupational health department, administered the DINE questionnaire and the 4-day diet record. They were trained to ensure consistency in the data collection. The food portions on the diet records were coded by three nutritionists and checked for consistency by one nutritionist. The NIBBLES diet analysis programme was used to analyse the diet records. The NIBBLES programme uses a database from the fourth edition of the Composition of Foods *(McCance & Widdowson)* supplemented by data from commercial manufacturers.

Four days would not normally be considered long enough to accurately rank fat intake. Nelson *(et al 1989)* suggested 7 days, Marr *(et al 1986)* proposed that a week would be adequate for 80% reliability of classification into top and bottom thirds. It may have been more appropriate to validate the DINE questionnaire against a 7-day weighed intake. The original questionnaire was validated on a different population by different interviewers. The original population included both men and women, with an average age of 46 years for men and 43 years for women.

The interviewers in the validation study were three nurses of the Rover Group Occupational Health Department. Respondents may be more honest with an interviewer in their own home than in an occupational health or a primary care setting which they may perceive to be more judgmental, this might improve the quality of the data obtained. Respondents in this study completed the DINE questionnaire in their own homes as part of a longer interview than the Rover Group participants were given. It is possible that they gave less thought to their responses, this may have made the estimation of food intake less accurate because it was not deemed to be particularly important, or it may have made it more accurate because the respondent was not trying to impress the interviewer. Surveys of food intake are often thought to give a biased view of actual intake because the respondent tends to under report intakes of fat and increase intake of fruit and vegetables *(Feskanich et al 1993)*. This response may have been less likely to occur as part of a long interview, where there was less focus on actual food intake, than as part of the validation study tending to make the results more representative of true intake. The validation study classified the data into three categories, high, medium and low, this thesis uses only high and low categories, which would tend to increase the accuracy of the classification. No estimate was made of respondents who were likely to have under-reported their fat intake.

The DINE questionnaire was also validated for use in General Practice *(Little at al 1999)*. A randomised block design was used to test a number of dietary assessment questionnaires including the DINE questionnaire and a 24 hour recall against a 7-day weighed record. Para amino benzoic acid (PABA) was used test the agreement between assessed protein intake and urinary nitrogen. The validation study participants consisted of 61 high risk cardiovascular patients and 50 adults randomly selected from age and sex stratified lists generated by the practice computer. All the participants were from one practice in suburban Southampton. The DINE questionnaire had a Spearman rank correlation of 0.51 for fat intake when compared with the weighed record. Excluding under-reporters did not change levels of agreement, suggesting that people who under-report for the standard probably under-report for all the assessment instruments. The obese were much more likely to be under-reporters than other subjects (60% vs 30%) were; no other factor predicted under-reporting once obesity was controlled for. There was good correlation (Spearman rank correlation 0.57) between the mean of two 24-hour urine collections and protein intake from the weighed record, this would support the validity of the weighed record.

Low energy reporters have been estimated as comprising about one third of dietary survey respondents *(Stallone et al 1997)*, with a bias towards lower socio-economic groups. The DINE questionnaire does not estimate total energy intake so it is not possible to make an accurate adjustment for low energy reporters.

If the Schofield *(DoH 1991)* equation for calculating BMR is used to estimate the energy requirements of women aged 20-34 and weight is taken as an estimated 60kg, then BMR is 5.756 MJ/day

Figure 4.1: Schofield equation for women aged 18-29 years.

BMR = 0.062 (weight kg) + 2.036

BMR = 0.062 x 60 + 2.036

BMR = 5.756

Low energy reporters are taken to be those women whose energy intake is less than 1.2 times their BMR *(Willet et al 1985 Pryer et al 1995)*, which would be 6.907MJ/day. If we estimate that the women in this study consume a similar amount of fat to those women in the National Food Survey then the average fat intake of our population would have been 43% of energy consumption in 1991. If energy intake is taken as BMR x Physical Activity Level and a PAL of 1.4 is used then energy intake is 8.058 MJ/day.

Figure 4.2: Calculation of energy intake.

E = BMR x PAL

E = 5.756 x 1.4

E = 8.058 MJ/d

Energy intake from fat is 43% of total energy intake, which is 3.465 MJ/day. As 1g of fat contains 37kj, 3.465MJ must be provided by 94g of fat. Any women consuming less than 80g fat/day (43% of 6.9MJ) could be assumed to be a low energy reporter. This would mean that the entire low fat group was comprised of low energy reporters. Without some measure of body weight and total energy intake it is difficult to estimate low energy reporters. If it was assumed that one third of the respondents were low energy reporters, it is still not possible to identify which third. If it was assumed that the bottom third of the fat intake was reported by low energy reporters, this would be the entire low fat group which account for 34% of the total sample. Clearly the issue of low energy reporters is important in interpreting the results. A Danish study *(Heitmann et al 2000)* examined under-reporting as part of the Danish MONICA project. A random sample of 4,581 adults was drawn from the National Personal Register in 1982, 79% of this group participated in a baseline health examination. A subset of 522 subjects participated in a dietary survey. All the subjects were re-invited 5 years later in 1993, they were weighed and had their height measured and collected a 24 hour urine sample whilst taking PABA to monitor completeness. Electrical impedance was measured and used to estimate body fat, which was used to calculate basal energy expenditure. Average 24-hour energy expenditure was calculated using BMI and PAL. Absolute fat intake did not differ in the two surveys. When fat was calculated as a percentage of total energy it was significantly ($P<0.01$) lower in 1993 for both men and women. Total energy intake was under reported more then energy from protein in both surveys. This suggests that the other macronutrients must have been under reported too. The difference was greater in 1993 (29%) than 1987 (15%). The authors were aware that the lack of independent estimate of fat intake make it impossible to say what proportion of the under reporting was due to fat and what was due to carbohydrate. The magnitude of underreporting was assessed in the Finmonica (Finnish arm of the MONICA, heart disease) study in 1982 and 1992 *(Hirvonen et al 1997).* People whose energy intake was below 1.27*BMR were identified as under-reporters. Under reporting in women increased from 33.4% in 1982 to 46.4% in 1992. Under reporting was twice as common in women with BMI's over 30kg/m^2 compared with women with BMI's less than 25kg/m^2. The proportion of energy intake from fat did not differ greatly when under-reporters were excluded from the sample, although percentage energy from fat was significantly less in 1992 than it had been in 1982. The authors concluded that under-reporting did not distort the results from the survey with regard to macronutrients. The Health and Lifestyle Survey data did not provide information on body weight or energy intake that could have been used to estimate the percentage of women who were low energy reporters. Data on BMI and fat intake were available, table 3.6 (results) showed that BMI was not associated with fat intake except for those women who were underweight (BMI < 20 kg/m^2). Underweight women were the least likely to have a low fat intake (19.8%) compared with normal weight, (29.6%), overweight (31.7%) and obese women (29.0%). If obese women are more likely to under-report than non-obese women *(Little et al 1999)* then the lack of association between BMI and fat intake may be incorrect. This would tend to distort the survey results if obese women made up a large proportion of the respondent or if they were disproportionately represented in the socio-economic variables, or if they were more/less knowledgeable or more/less confident in their cooking ability than other women were. Tables 6.20 and 6.27 (Appendix) showed that obesity was not associated with socio-economic group but being normal weight was associated with having 'A' level qualifications or higher. In 1992 The Dietary and Nutritional Survey of British Adults found that 16% of women were obese *(Gregory et al 1994)*, only 12% of women of all ages from the Health and Lifestyle Survey respondents were obese. The discrepancy between 16% and 12% is very large and suggests that the Health and Lifestyle respondents were not accurate in their reporting of height and/or weight.

The DINE questionnaire was also used in a General Practice setting *(Silagy et al 1993)* as part of an assessment of cardiovascular risk on 5,803 subjects. No comments were made on its validity.

4.1aiii) **Measurement of fruit and vegetable intake**

The interviewers asked respondents how often fruit and vegetables were consumed, giving respondents a choice of three different categories. Only two of the three categories from the original HEA survey were used for this analysis in order to maximise the number of respondents in each group. In the results section the category 'low fruit and vegetable intake' includes those respondents who ate only fruit or only vegetables daily, whilst the category 'high fruit and vegetable intake' includes those respondents who ate both fruit and vegetables daily. This means that the minimum intake in the high fruit and vegetable group is 14 servings of fruit/vegetables per week. A woman in the low fruit and vegetable group could possibly also be eating 14 servings of fruit or 14 serving of vegetables a week. The assessment of fruit and vegetable intake was much simpler than the assessment of fat intake. Respondents may over report their fruit and vegetable consumption (see recall bias, below). Current healthy eating guidelines encourage people to consume five portions of fruit and vegetable daily. This information was not available from the survey and so could not be used as the high intake category. It is possible that respondents from both categories ate five portions of fruit **or** vegetables daily. Problems with the validity of this data are the accuracy of the reported fruit and vegetable consumption. The difference in fruit and vegetable consumption between the two groups and the extent to which a measure of fruit and vegetable consumption can be said to be representative of a healthy diet (Chapter I, section I).

The DINE questionnaire was validated in a general practice setting *(Little et al 1999)*. It under estimated fruit and vegetable consumption and vitamin C intake when compared with a 7-day weighed record. Other methods of dietary assessment compared in the same study tended to over estimate fruit and vegetable intake. The authors suggest that even though all the participants were drawn from one practice the results should be generalizable because socio-economic characteristics of those who agreed to participate were not different from the general population.

In conclusion the DINE questionnaire provided a reasonable estimate of both fat intake and fruit and vegetable consumption. But the division between low and high fruit and vegetables consumption is not distinctive enough to be sure that the two groups are different.

4.1aiv) **Use of questions as indices of knowledge**

Knowledge about diet has been assessed by a number of researchers. The United States Department of Agriculture included a Diet and Health Knowledge Survey in its Continuing Survey of Food Intake of Individuals. Knowledge was assessed by respondents' ability to distinguish between pairs of foods, identifying the correct food *(Variyam et al 1996)*. The 'Green Keyhole' nutritional campaign in Sweden *(Larsson & Lissner 1996)* assessed women's knowledge by means of an open-ended question. Those women who had seen the symbol were asked to give a short written description of what it meant. The European Health and Behaviour Survey assessed health knowledge in University students from 20 European countries. Students were presented with a matrix of seven health problems including heart disease and high blood pressure and nine factors including eating animal fat and eating salt. They were asked to tick the appropriate box if they considered that the health question was influenced by the factor. Test-retest stability of the knowledge section of the survey was not assessed on the grounds that exposure to the questions on the first occasion might stimulate information seeking and exchange, leading to genuine changes of opinion *(Wardle & Steptoe 1991)*. The development and validation of a nutrition knowledge questionnaire, *(Towler & Shepherd 1990)* used 64 subjects and 74 foods in a pilot study. Foods were only included in the revised version of the questionnaire if the question was judged to be a good discriminator between respondents. Cronbach's alpha co-efficient was calculated as a measure of internal reliability. Stafleu *(et al 1996)* used a nutrition knowledge questionnaire that was assessed for internal consistency (Cronbach's alpha), test-retest reliability and discriminate validity before being used as a survey instrument. A nutrition knowledge questionnaire developed in 1994 in the UK *(Parmenter & Wardle 1999)* consisted of five sections, 120 items were selected by four psychologist and four dietitians. Nine hundred pilot questionnaires were distributed to a variety of organisations. A total of 43.3% of the questionnaires were completed and returned. The majority of the respondents were white (95%), female (72%), aged between 18 and 44 years (72%) and in non-manual occupations (82%). The results were analysed for item difficulty, item discrimination and internal consistency. Item difficulty was assessed by the percentage of respondent who had answered the question correctly. Items were rejected if more than 90% or fewer than 30% of respondents answered the question correctly. Respondents' comments were used to reduce ambiguity and increase the clarity of the questions. These analyses reduced the number of items to 50. The final version of the questionnaire was administered to two groups known to differ in their nutrition knowledge to test the ability of the questionnaire to discriminate between the two groups. The questionnaire was then repeated to examine test-retest reliability.

The use of the questions to measure knowledge about food and nutrition in this thesis (Chapter II, 2.1d) could not be considered a thorough examination of women's knowledge about food. All the questions, including the knowledge section, were piloted at 10 sampling points, 50 pilot interviews were conducted overall, and interviewers were briefed and debriefed and the questions revised as a result. The questions were not assessed for internal consistency or their ability to discriminate accurately between people with different levels of knowledge. They were not standardised against any other measure of nutrition knowledge and no test-retest reliability was assessed. These factors are taken into account when discussing the results. Fifteen knowledge questions were originally used, of these only seven were found to be associated with high fruit and vegetable intake and three with low fat intake. Two of the questions were associated with both low fat and high fruit and vegetable intake. In total nine of the original fifteen questions were analysed further. Different results would have been obtained if all the original Health and Lifestyle Survey questions had been analysed. Bias was introduced into the results by the selection of these particular questions.

4.1av) **Measurement of women's attitudes.**

Attitudes towards foods and cooking were assessed using the questions discussed in Chapter II, 2.1e. Other researchers have looked at attitudes *(Lloyd et al 1993)* using 6 questions as part of a longer survey that included socio-demographic questions and a Food Frequency Questionnaire designed to look at fat intake. All the responses were on a seven-point scale. Subjects were asked to rate their attitude towards making changes on a scale labelled, 'extremely favourable' to 'extremely unfavourable.' Results were analysed by summing the individual attitude responses to give a total attitude score. The European Health and Behaviour Survey *(Wardle & Steptoe 1991)* assessed attitudes with a series of 10-point scales for 25 items including avoiding animal fat. The test-retest stability of the attitudes were statistically significant for all items *($P < 0.005$)*.

Shepherd & Stockley *(1985)* used a similarly labelled seven-point scale to assessed attitudes towards high fat foods. Nutrition knowledge and attitudes towards high fat foods and low fat alternatives were assessed in three generations of women *(Stafleu et al 1996)* using a self administered questionnaire. The questionnaire consisted of two attitude questions for each of ten foods. Respondents were asked to indicate on a 5-point Likert-scale their answers to the statements 'I like eating this food' and 'eating the food is very good/very bad'. The authors calculated Cronbach's alpha and test-retest reliability scores for the questionnaire *(Stafleu et al 1994)*.

The questions used in this thesis to measure attitudes cannot be considered a valid measure since they have not been tested to see if they do in fact measure attitudes towards food and cooking foods. Ideally the questions should have been formulated after holding focus group meeting to see what kinds of attitudes people held towards foods. The questions should then have been tested on a group of people representative of the population to see if they did distinguish between people with different attitudes. The questions should have been used again on the same group of people to measure the test-retest reliability. This would be the only way of knowing if the attitude questions were internally valid.

4.1avi) **Measurement of low cost diet**

The nutrient profile of a low-income diet was investigated by looking at data from the National Food Survey *(MAFF 1998)*. The NFS results are derived from a random sample of 6,000 private households throughout Great Britain, details of the methodology can be found in Chapter II (Methods section 2.2). The results cannot be taken to represent a true measure of individual nutrient intake. The survey records details of foods, soft drinks, alcohol and confectionery brought into the home for human consumption. Some information on the numbers of meals eaten outside the home but not the cost or content is recorded by all households. The data is presented as individual intake but has been estimated from household consumption. The NFS data has been used in this thesis to compare nutrient profiles of diets from different income brackets. The nutrient information has been obtained in the same way for each income bracket so problems of validity are only important if there is differential bias. Half of the selected households were asked to record details of all meals, snacks and drinks consumed outside the home. This showed that households in the highest two income groups spent £10.23 per person per week on food and drink eaten out. Households in the lowest income groups spent £2.41 per person per week. This would tend to make the nutrient intakes for higher income households an under estimate of true intake. Nutrient intake for lower income households would tend to be a truer representation of real intakes in these circumstances. Any comparison of nutrient intakes between low and high-income households would tend to underestimate the actual differences.

Comparisons between amount of money spent on various food groups by low and high-income households (Chapter III table 3.36, page134) would also be subject to the same bias if the premise that higher income households consume more foods away from home were correct. Income group comparisons are also subject to errors associated with the measure of income. The NFS uses head of household income as a measure of household income. Head of household income takes no account of the number of persons in the household or of other income available to the household. It is based on gross income. The collection of NFS data is felt to be unobtrusive and possibly less prone to under-recording than other methods of data collection.

4.1b) **External validity; applicability of the results to other populations**

The external validity of any study depends on whether the results obtained from the study population can be generalised to other populations. In order to make this assessment it is necessary to consider the ways in which a study population differs from other populations and whether these differences are relevant. In this thesis the study population was women aged 20-34 years. The way in which the sample was obtained was outlined in Chapter II. Care was taken to ensure that the respondents were representative of all women aged 20-

34 years living in England, so that the results would be applicable to other women of this age in England. Unfortunately the response rate was only 70%, introducing selection bias (see 4.1ci, page 163). The results may also be generalisable to other populations, for example to young women living in Northern Europe, or there may be cultural differences that make it difficult to generalise the data, for example to young women in Southern Europe. An assessment must be made of the characteristics of the study population and the relevance of those characteristics to the findings before an assessment of generalisability can be made.

The socio-demographic differences between the young women of the study population and the Health and Lifestyle Survey population as a whole are examined in Appendix 3, (tables 6.3-6.13, pages 205-213). Young women were more likely than the general population to have some form of qualification, be in non-manual employment, to have never worked, to be looking after the home and living in rented accommodation. They were also more likely than the general population to be receiving family credit and to be living in the traditional two adult plus children family. It may be that some aspects of these characteristics are more relevant to the findings of the study than the gender or age of the sample. For example woman in non manual employment were more likely to have a high intake of fruit and vegetables than women in manual employment (table 3.4, page 92) were. If women in the general population are more likely to be in non-manual employment than men are and women are more likely to have a high fruit and vegetable consumption then it is possible that the true association lies between employment and fruit and vegetable consumption and gender is acting as a confounding factor. In such an instance a study on women would have results that were generalisable to men.

Tables 6.14 to 6.28 (Appendix 3, pages 214-221) examine the interaction between these factors, associations were found between levels of qualification and; socio-economic group, home ownership, car use, region of residence, receipt of family credit, history of smoking and being overweight. These variables were investigated further using stratified odds ratios (tables 6.34-6.45, appendix 4, pages 227-238 and tables 6.52-6.58 appendix 5, pages 245-251) to explore whether they might be acting as effect modifiers.

It is possible that although younger people and women are more likely than the general population to act in certain ways the influences on and reasons behind their actions may be similar to those of other people in the general population and could be applied to a wider population. It may be that some aspect of these characteristics is more relevant to the finding of the study than the gender or age of the sample. The literature review showed that being female was associated with having a more positive attitude towards low fat foods and the consumption of low fat milks than being male. Women were also found to have more negative attitudes towards the consumption of meat, meat products and dairy foods than men had. Women were more likely to have a low fat intake than men were; they were also more likely to have a high fruit and vegetable consumption than men were. The literature review also showed that younger people were more likely to have a higher intake of vitamin C than older people were.

The same issues of external validity also apply to the National Food Survey which can only be a true measure of household food if the survey respondents were representative of households within the general population. The response rate of only 65% makes it unlikely that the data collected are generalisable to every household. The nature of bias has not been explored by the NFS beyond comparison with previous years to estimate sampling errors. Possible biases were suggested in section 2.2 (Methods, page 79)

4.1c) **Interpretation of the results**

A number of questions must be addressed when interpreting a set of results. It is important to consider that the results may be due to chance alone (see Chapter II methods, page71), to some bias or to some other factor *(Margetts & Nelson 1997)*. The following sections discuss issues of interpretation.

It is important to consider the types of bias that may affect a study so that as much as possible can be eliminated at the planning stage. Bias may be introduced into a study when the participants are selected, by the way in which the interviewer phrases the questions and by the tool used to assess food intake or the other variables. All these forms of bias are discussed. Bias may also be introduced during the analysis of the results. The effects of confounding and effect modification are discussed.

4.1ci) **Selection bias**

Selection bias refers to bias introduced into the study by the participation of subjects or respondents who are in some way different from the subjects whom the investigator

wishes to investigate. In the case of the Health & Lifestyle Survey the aim was to include people who were representative of the general population of England. The original sample was gathered in a methodical way (see Chapter II, Methods, 2.1, page 71) designed to ensure that a sample representative of the general population was obtained. Only 70% of the original targeted sample agreed to participate, this would introduce bias into the study if the other 30% were in some way different from those who agreed to participate. Information on the individuals who did not take part in the survey was not available so the nature of the bias is unknown. A number of people where not contactable after repeated calls at their homes, other people declined to take part in the survey. It is possible to speculate that people who agreed to take part in the survey were more interested in health than those who declined. This assumption depends on whether the interviewers gave people information on the nature of the survey before getting their consent to participate. A well-trained interviewer would not have divulged the nature of the survey. People may have declined due to lack of time or because they did not want to answer questions. A greater number of people may have declined to take part in the survey if it had been substantially longer; a possible increase in selection bias had to be weighed against a possible increase in accuracy obtained by a more substantial dietary survey. A proportion of non-responders were people with whom no contact could be made, these people may have been away from home for longer periods of time than the general population, calls to the house were made at different times of day to take account of shift workers, to reduce this source of bias.
If the people who agreed to participate in the survey were more interested in health issues than non-participants, this would cause the results to show healthier behaviours than would be found in a more representative sample. This bias needs to be taken into account when discussing the results.
For the purposes of this thesis a subset of the Health & Lifestyle sample was used, the subset consisted of women aged 20-34 years, these women were subject to the same bias as the rest of the Health & Lifestyle sample.

4.1cii) **Interviewer bias**

The use of different interviewers can introduce bias into a study, respondents may react differently towards different interviewers perhaps perceiving one individual to be more sympathetic then another and thus answering questions differently. When respondents are required to answer lists of questions more attention may be given to initial questions, interviewers are trained to present the list in a different order for different respondents, but interviewers may differ in their diligence. Trained and experienced interviewers should minimise bias. The large numbers in this study would reduce the proportion of respondents interviewed by each individual interviewer, minimising bias. A firm that specialised in interviewing members of the public obtained the data used in this study. The interviewers used were trained to minimise interviewer bias.

4.1ciii) **Recall bias**

Bias may have been introduced into the study during the assessment of dietary intake. Simple questionnaires such as the one used in this study tend to give results that are different to results obtained from a weighed dietary record. Respondents may under-report fatty food and over-report fruit and vegetable consumption when responding to an interviewer *(Jain et al 1996)*. Bingham *(et al 1994)* reported that vegetable consumption assessed by questionnaire was almost double that assessed from weighed records. Bias of this type would tend to apply to all the respondents equally, not affecting comparison between groups. If respondents were under reporting fat intake, and over-reporting fruit and vegetable consumption this would tend to make the survey respondents appear to be healthier eaters than they actually are. This type of bias is known as social desirability bias *(Herbert et al 1995)*. If recall bias is different amongst different respondents *(Coughlan 1990)* for example higher socio-economic groups may be more likely to over-report fruit and vegetable consumption than lower socio-economic groups then the difference in actual consumption between the two groups will be less than that suggested by the survey results.

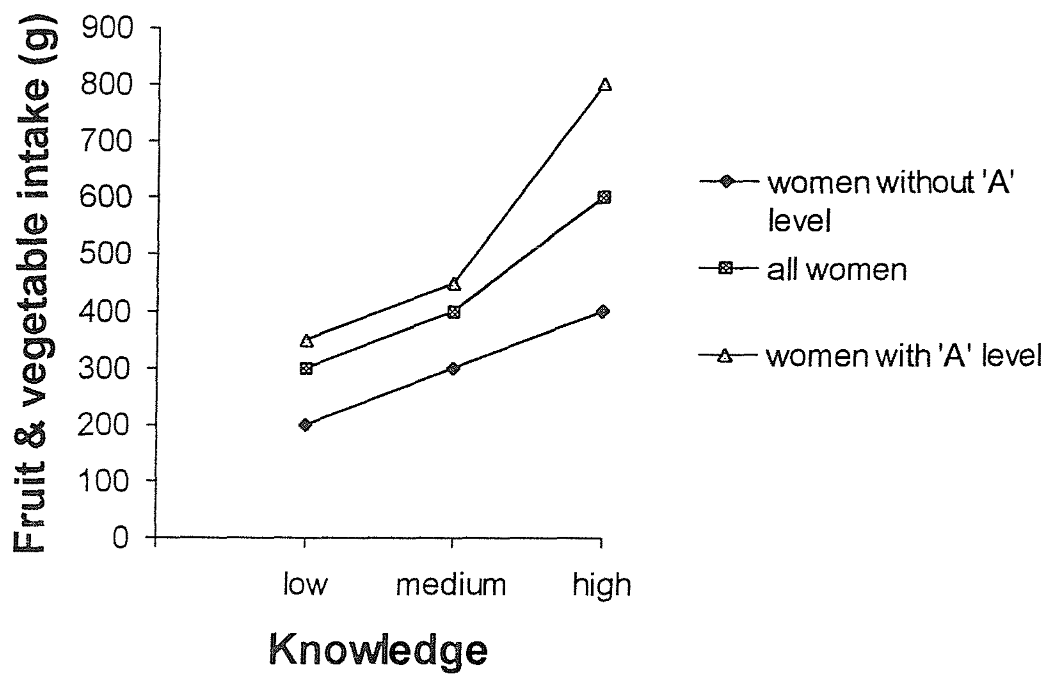
4.1c) Summary

The Health and Lifestyle Survey respondents were probably more interested in their health and health issues than the general population was. This observation would suggest that the respondents were more likely to make low fat and high fruit and vegetable choices than the general population. It may make the influences knowledge and confidence in cooking ability more highly correlated to food choice in these individuals than in other people. The respondents may be more likely than the general population to seek out and act on information about healthy food choices so they may be more knowledgeable than the general population about healthy foods. For example a higher proportion of the respondents may be aware that controlling body weight could help to reduce the instance of heart disease. They may also be more likely than the general population to act on this information and moderate their weight by choosing low fat foods or a high intake of fruits and vegetables. The effects of differences in socio-economic status on food choice in this population would tend to be less obvious than in the general population for example an individual with less income than average but with a greater interest in health would be more likely to spend money on healthy foods than an individual with a similar income but less interest in health. An individual with no access to a car but with an interest in health might be more highly motivated to carry fruits and vegetables than a less interested individual. Thereby reducing the impact of car use on food choice. This issue can only be addressed by careful interpretation of the results in relation to their applicability to other populations.

4.1d) **Confounding**

The term confounding refers to the possibility that the outcome measures, in this example fruit and vegetable intakes may have been affected by other things than the variables e.g. knowledge, attitude, and socio-economic factors that were investigated. A confounding factor is one that is associated with the risk factor under study and that also independently influences the outcome. A confounder cannot lie in the causal pathway. 'A' level or higher qualifications are associated with high fruit and vegetable intake (*Hjartåker & Lund 1998, Agudo et al 1999*), women with 'A' level or higher qualifications may be more likely to be knowledgeable about food than other women are. Figure 4.3 shows a possible association between women, knowledge and fruit and vegetable intake that is similar to the association between women, qualifications and fruit and vegetable intake. In the circumstances illustrated having qualifications is a confounding factor. The presence of women with different levels of qualification alters the magnitude of the result, but not the nature of the relationship between fruit and vegetables and knowledge. The problem of confounding could be addressed by using only women with the same level of qualification in the study or correcting for the association in the analysis of results. In this thesis four socio-economic factors, BMI and smoking were individually adjusted for using logistic regression analysis (Tables 6.34-6.45, pages 227-238 &6.52-6.58, pages 245-251) so that their influence as confounding factors could be assessed. In the population under study women in a restricted age range were used so that gender and age were eliminated as confounding factors.

Figure 4.3: Qualifications acting as a confounding factor.



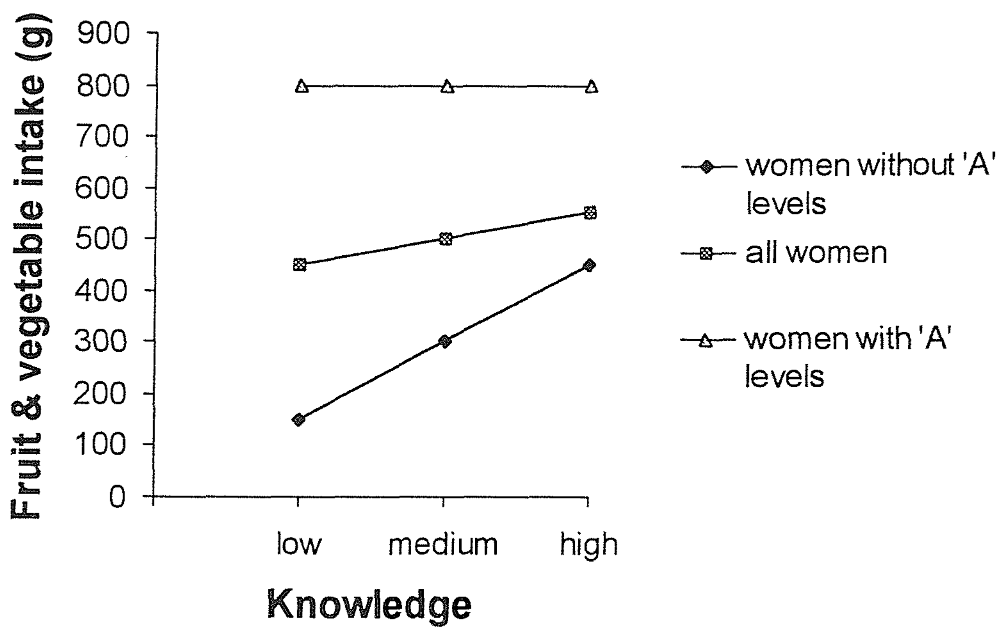
Residual confounding is an inability to accurately measure the confounding factor, resulting in incomplete correction for confounding. Exaggerated confounding occurs when the measuring instrument exaggerates the relationship between exposure and confounder. The effects of confounding must be considered when analysing results.

4.1e) **Effect modification**

An effect modifier is a variable that causes the nature of the relationship between the exposure and the outcome to be altered. An effect modifier interacts with both the exposure and the outcome. An effect modifier differs from a confounding factor because it lies in the causal pathway *(Margetts & Nelson 1997)*, for example being knowledgeable may lead to women gaining more qualifications.

Figure 4.4 shows a theoretical relationship between qualifications, knowledge and fruit and vegetable intake in women. In this example the relationship between fruit and vegetables consumption and knowledge in women with good qualifications is different from the relationship between fruit and vegetable consumption in women without 'A' level qualifications.

Figure 4.4: Qualifications acting as an effect modifier.

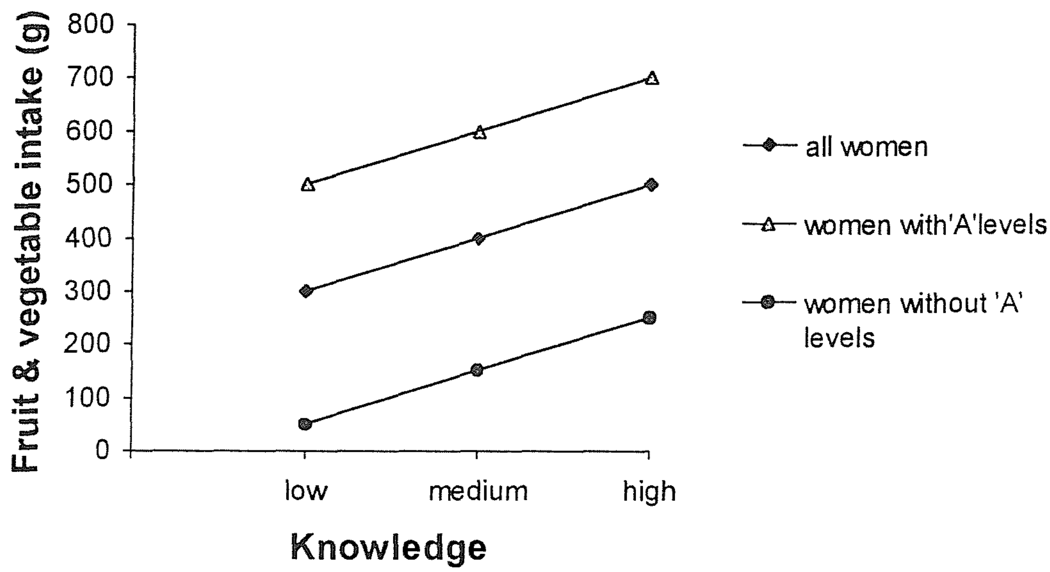


If women with an 'A' level qualification spend more money on fruit and vegetables then having an 'A' level qualification acts as an effect modifier. Analysing qualified and less qualified women together gives the wrong impression of the true relationship between knowledge and fruit and vegetable consumption.

4.1f) **Outcome modifiers**

Outcome modifiers have an effect on the outcome variable but are independent of the exposure of interest *(Margetts & Nelson 1997)*. They do not lie in the causal pathway. An outcome modifier cannot alter the slope of the line depicting the relationship between the exposure and the risk. In figure 4.5 having 'A' level qualifications is acting as an outcome modifier. The proportion of women with 'A' level qualifications in the sample will influence the estimate of fruit and vegetable intake.

Figure 4.5: Qualifications acting as an outcome modifier.



4.2) **Survey results and results of the literature review**.

This section of the discussion considers the results (Chapter III) in relation to the literature review (Chapter I). Each of the variables is discussed in turn.

4.2a) **Socio-economic variables and fruit and vegetable and fat consumption**

Aim

To assess whether the choice of a diet with a high fat, low fruit and vegetable content by a proportion of women aged 20-34 years could be partly accounted for by socio-economic status

The literature review and analysis of the results of the HEA survey suggest that certain socio-economic variables are associated with a high fruit and vegetable consumption or a low fat intake. Table 4.1 summarises the association between each variable and fat and fruit and vegetable consumption and shows whether the association was found in the literature review or the survey results.

Table 4.1: Crude odds ratios with their 95% confidence intervals for low fat and high fruit and vegetable intake for socio-economic characteristics.

Socio-economic variable	Literature review Low fat intake	Survey results Low fat OR (95% CI)	Literature review High fruit & vegetable intake or high vitamin C intake	Survey results High fruit & vegetable intake OR (95%CI)
Higher socio-economic status			A meta-analysis of eleven studies De Irala-Estévez et al 2000	
'A' level or years of education	Winkleby 1992, Hjartåker & Lund 1998	1.38 (0.99-1.92)	Braddon 1988, Hjartåker & Lund 1998, Agudo et al 1999	1.76 (1.30-2.36)
Non-manual occupation or higher status occupation	Bolton-Smith 1990, 1991 Prättälä 1992, Hjartåker & Lund 1998	1.47 (1.04-2.07)	Braddon 1988, Hulsof 1991, Bolton-Smith 1991, Marmot et al 1991, Smith & Baghurst 1993 Järvinen et al 1994, Roos 1996, Hjartåker & Lund 1998	1.94 (1.44-2.60)
Home owner		1.30 (0.93-1.82)		2.05 (1.53-2.76)
Use of car		1.47 (1.00-2.14)		1.70 (1.23-2.35)

Table 4.1 showed that both the survey results and the literature review found a link between non-manual occupations and low fat intake in young women. There were also a number of studies in which no link was found *(Braddon et al 1988, Wynn et al 1990, Hulsof et al 1991, Pardo et al 1994, & Roos et al 1996).* The literature review also found associations between non-manual occupations and high fruit and vegetable intake and between having 'A' level qualifications and high intake of vitamin C. Survey results agree with the association between educational attainment and high fruit and vegetable intake. There were no papers in the literature review that looked at home ownership or car use and food intake. Survey results indicate that both these variables are associated with high fruit and vegetable intake and low fat consumption, although confidence intervals for the

odds ratio for the association between home ownership and low fat intake do not include one, suggesting that this relationship is not significant.

The four socio-economic variables affect each other and cannot be regarded as entirely separate influences on food intake. In order to make an assessment of their influence on each other logistic regression analysis was done to adjust each variable for the other three variables. The results of this analysis (Chapter III: Results, table 3.13) showed that having 'A' level or higher qualifications was the most influential of the socio-economic variables on low fat intake and high fruit and vegetable intake. The survey results showed education to be more influential then socio-economic status. This agreement with the literature review, which was much more consistently in support of education influencing food choice than socio-economic status, is encouraging. The authors of the meta-analysis also suggested that education was the strongest determinant of socio-economic differences *(De Irala-Estévez et al 2000)*. It is important to consider that these results may have been influenced by social desirability bias *(Coughlan 1990)*. It is possible that better educated people have greater knowledge of healthier food items and would tend to exaggerate their true consumption of fruit and vegetables. However Margetts *(et al 1997)* found that the belief in 'fruit and vegetables' as the main characteristic of a healthy diet was more prevalent amongst those in lower socio-economic and educational levels, more highly educated people suggested that 'balance and variety' were the main constituents of a healthy diet.

Cluster analysis was used to find which socio-economic factors and food choices were most closely associated with each other. Table 3.14 (Chapter III, Results, page103) showed that when woman were classified into two groups on the basis of the four socio-economic variables, the characteristics of the clusters were,

- **Cluster 1** - lower qualifications, manual employment, rented homes and no car.
- **Cluster 2** - good qualifications, non-manual employment, homeowners, use of car.

Cluster 2 women were significantly more likely to have a high fruit and vegetable intake than women in cluster 1 were.

Cluster 2 women were more likely to have a low fat intake than women in cluster 1 were.

The combination of factors in Cluster 2 accounts for a proportion of the association between socio-economic variables and low fat and high fruit and vegetable intake. This may be because these factors are markers for income.

The findings on socio-economic factors and food choice should be generalisable to a wider population than young English women. The study group may have been biased towards women who were more interested in health matters or more confident about their ability to take part in a survey but the large sample size included enough women to compare socio-economic variables. Bias in the sample would have tended to over emphasise positive effects of socio-economic circumstances so by controlling for good socio-economic circumstances the effects of bias were minimised.

Factors such as age and gender acting as confounders make it useful to do studies in portions of the population that are limited by age and gender but they do not prevent the results of the studies from being generalisable to a wider population.

4.2b) **Income and fat and fruit and vegetable intake.**

Aim

To assess whether the choice of a diet with a high fat, low fruit and vegetable content by a proportion of women aged 20-34 years could be partly accounted for by levels of income and expenditure

Investigation of the relationship between income/expenditure and food choice has been done by reviewing the literature and using data from three sources;

- the Health and Lifestyle Survey, socio-economic factors
- the National Food Survey
- cost of implementing healthy eating advice.

The literature review indicated that

- High-income households with 2 adults and 3 children spend £16.41 per person per week, whilst similar low-income households spend £7.27 *(MAFF 1998)*
- Groups of people who were meeting UK dietary goals spent an average £3.27 more per week than people consuming the average UK diet did (*Cade & Booth 1990*).
- Low income is associated with lower fruit and vegetable intakes *(Subar et al 1992, Dowler & Calvert 1995b, MAFF 1998)*

4.2bi) **Socio-economic factors and income**

There was not sufficient data on income available from the Health and Lifestyle Survey to use income as a variable so other factors such as education, occupation, housing standard and car ownership were used instead. Section 4.2a indicated that of the socio-economic variable education was the most consistently associated with food choice. There was very little available in the literature review on home ownership and car use and their relationship to food choice, but data analysis showed car use to be significantly associated with both low fat intake and high fruit and vegetable intake. Home ownership was significantly associated with high fruit and vegetable intake. The use of a car may be an indication of access to food, the increase in out of town supermarkets making it harder for non-car users to transport food, particularly heavy items such as fruits and vegetables. In a paper on food poverty and shopping deserts Lang *(1998)* suggests that income has a strong influence on what people purchase and where they shop. The results presented in table 3.9 (Chapter III, page 98) showed that women who had the use of a car and did not feel that the ability to carry foods was a factor in their choice of food, were significantly more likely to have a high fruit and vegetable consumption (53.6%), than women who did not have the use of a car, but felt their choice of food was not influenced by their ability to carry shopping (39.3%). There were too few women who felt that their ability to carry goods influenced their food choice to get a significant result.

Single parents and people in receipt of family credit might be expected to have lower incomes then other families. When the association between being a single parent and having a diet low in fat or high in fruit and vegetables was examined single parenthood was associated with being less likely to have a high intake of fruit and vegetables (OR 0.49, CI 0.30-0.80). Being a single parent was also associated with being less likely to have a low fat diet but the confidence intervals included one (Chapter III Results Table 3.5, page 94). Receiving family credit was also associated with being less likely to have a low fat or high fruit and vegetable intake, but confidence values were wide reflecting the small numbers in the sample.

Including receipt of family credit in a regression analysis indicated that it explained only 0.1% in the variance of fat intake and none of the variation in fruit and vegetable consumption. Including women whose choice of shop was influenced by 'prices are affordable' accounted for a further 0.8% of the variation in fat consumption and 0.3% of the variation in fruit and vegetable intake.

4.2bii) **Comparison of income group food expenditure using NFS data**

National Food Survey data *(MAFF 1998)* was used to look at differences in nutrient intake amongst different income groups. Results from Tables 3.35 and 3.36 showed that the nutrient profile of low-income diets was different from other diets. Low-income households (category D, head of the household earning less than £160/week) met RNI's for all nutrients except energy, iron, zinc, magnesium, and potassium. Nutrient intakes for nine other nutrients were less for low-income households than for other higher income households. Table 4.2 illustrates the difference in daily intake between individuals in low income and high-income households. Although the data are presented as nutrient intake per person per day it is important to remember that RNI's are based on population averages not individuals. Food survey data are collected from households and as such are subject to errors when expressed per person.

Table 4.2: Nutrient intake of households (/person/day).

Nutrient as % of RNI	Group A ≥ £640	Group D ≤ £160
Energy	86	77
Fat (% of food energy)	38.9	38
Iron	99	81
Zinc	101	85
Potassium	91	75
Magnesium	95	76

The trends illustrated in table 4.2 do not take into account the differences in eating away from the home between the income groups. Income group D spent £2.41 per person per week away from the home and income groups A1 and A2 spent on average £10.23 per person per week on food and drink eaten away from the home. This would tend to increase the differences in nutrient intakes between the households.

4.2diii) **Cost of implementing healthy eating advice**

The literature review suggested that groups of people who were meeting UK dietary goals spent an average £1.19 more per week than people consuming the average UK diet did (*Cade & Booth 1990*). This study was done using data from food diaries costed at a large Southampton supermarket in 1988, in order to compare relative costs it may be useful to consider £1.19 as a 9 % increase on the cost of the average UK diet as costed in the same study.

A healthy eating diet was constructed using the 'Balance of Good Health' food groups and cost sensitivity data calculated from the NFS *(MAFF 1998)* as shown in section 3.4 of Chapter

III: Results. The changes in nutrient intake for the four nutrients, iron, zinc, magnesium and potassium that were found to be low in low income households and for energy and fat intake and cost are shown in table 4.3.

Table 4.3: Daily nutrient intake, cost and % change obtained by following 'Balance of Good Health' recommendations, without budget restraints.

Foods	Cost (£)	Energy (Kcals)	Fat (g)	Iron (mg)	Zinc (mg)	Mg (mg)	K (mg)
Bread, cereals & potatoes	0.47	786	18	4.5	3	147	750
Fruit & vegetables	0.67	170	0.3	2.9	1.4	56	718
Meat, Fish & alternatives	0.83	259	12	1.5	2.3	37	501
Milk & dairy foods	0.37	1.7	2.0	0.45	1.7	50	640
Fats & oils	0.3	152	17	0.02	0	0	0
Total	2.52	1,827	50.7	10.6	8.9	322	2886
Original diet	1.82	1,820	76	9.2	7.2	215	2201
% change	39	0	-33	16	23	50	31

Table 4.3 showed that the healthy diet was 39% more expensive than the low budget diet. This is greater than the 9% increase in cost reported by Cade & Booth (1990), however the 9% increase in costs was a comparison between the average UK diet and diets meeting the dietary goals. A difference between a low budget diet and a healthy diet would be expected to be greater. The costing were also done a decade apart, differences between relative prices may have changed in this time. The time frame involved makes it difficult to compare results obtained from studies looking at costs, as relative incomes also change over time. Results in table 4.3 show that the healthy diet contained 16% more iron, 23% more zinc, 50% more magnesium and 31% more potassium than the low budget diet and 33% less fat.

The findings from this study using food survey data and costings from a supermarket should be applicable to both men and women of varying ages in England. The findings would not be generalisable to populations in other parts of Great Britain or Europe because of relative differences in costs of foods. For example fruits and vegetables may be relatively more expensive than other products in Scotland but relatively cheaper in Mediterranean countries.

4.2c) **Knowledge and fat and fruit and vegetable intake.**

Aim

- To assess whether the choice of a diet with a high fat, low fruit and vegetable content by a proportion of women aged 20-34 years could be partly accounted for by knowledge

The literature review suggested that increased knowledge is associated with higher fruit and vegetable intake (*Braddon 1988, Hjartåker & Lund 1998, Agudo et al 1999 & Roos G. et al 2000).* Evidence is less clear for an association between increased knowledge and lower fat intake. Some studies report an association *(Shepherd & Sims 1990, Shepherd & Towler 1992, Larsson et al 1999*) but not *(Shepherd & Stockley 1987, Anderson 1993, Larsson & Lissner 1996, Stafleu et al 1996, Koikkalainen et al 1999*) others.

Results from the Health and Lifestyle survey are summarised in table 4.4 below.

Table 4.4: Odds ratio & 95% CI for the influence of knowledge on low fat and high fruit and vegetable intake, adjusted for socio-economic clusters.

Knowledge	Low fat, OR (95%CI)	High fruit & vegetable, OR (95% CI)
Crude	**2.30 (0.79-6.72)**	**2.24 (0.78-6.43)**
Cluster 2	1.48 (0.44-4.94)	1.38 (0.46-4.18)
Cluster 1 *(reference)*	1	1

When women who were knowledgeable about food were compared with women who were not knowledgeable, the knowledgeable women were more than twice as likely to have a high intake of fruit and vegetables or a low intake of fat. When socio-economic circumstances were adjusted for using cluster analysis, knowledgeable women were more likely than other women to have a high fruit and vegetable intake and a low fat intake (OR 1.38 & 1.48), although the confidence intervals included 1 the reference value indicating that the relationship was not significant.

The results from the Health and Lifestyle Survey agree with most of the studies in the literature review, which suggest that the choice of low fat food is not significantly related to knowledge. The results suggest that the relationship between knowledge and the choice of a high fruit and vegetable intake is more tenuous than between fat and knowledge. This may be because the knowledge questions were more concerned with fat, cholesterol and heart disease than fruit and vegetable intake and its benefits. Correcting for the impact of socio-economic factors had a big effect on the odds ratio. A number of studies showed a link between number of years of education and fruit and vegetable consumption *(Braddon et al 1988, Hjartåker & Lund 1998, Agudo et al 1999)*. When the survey results were corrected for socio-economic factors, education was the socio-economic factor that had the biggest impact on (Chapter III, table 3.13, page 102) food choice.

Indices used to measure knowledge (Chapter II, 2.1d, page 75) were not typical of knowledge questions in other surveys. The knowledge questions were not validated. It is possible that a properly constructed knowledge questionnaire would have found a significant association between knowledge and food choice. Two of the individual knowledge questions were significantly related to food choice (Chapter III, table 3.20, page 113) even when adjusted for socio-economic factors. Women who knew that red meat or butter was high in fat were significantly more likely to have a low fat intake than other women were. The proportion of women who knew that butter was high in fat was 85%, compared with 53% who knew that margarine was high in fat. Knowing that margarine was high in fat may have been a better discriminator between knowledgeable and less knowledgeable women but it was not such a good indicator of low fat consumption. A properly validated questionnaire that discriminated between knowledgeable and less knowledgeable women may in fact have found less association between knowledge and food choice.

The fact that the fat intakes recorded by the DINE questionnaire were not corrected for low energy reporters would tend to reduce any association between knowledge and low fat intake. Some of the low fat respondents may not really have been low fat consumers, so their presence in the low fat group would weaken any association. If the problem with low energy reporters was great one might expect there to be more of a difference between the results for low fat intake and the results for fruit and vegetable consumption. The lack of a difference may be due to some other factor affecting the fruit and vegetable results and so does not necessarily indicate that low energy reporters were not important.

The European Health and Behaviour Survey *(Wardle & Steptoe 1991)* found few significant relationships between knowledge and health behaviour. Frequency of eating red meat was not reliably associated with awareness of the influence of animal fats on illness. The European Health & Behaviour Survey looked at both men and women; women were more likely to link high animal fat intake and heart disease than men were.

4.2d) **Confidence in cooking skills and fat and fruit and vegetable intake.**

Aim

- To assess whether the choice of a diet with a high fat, low fruit and vegetable content by a proportion of women aged 20-34 years could be partly accounted for by positive attitudes towards in cooking ability.

From the literature review we know that negative attitudes towards high fat foods are associated with lower fat intake *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler & Shepherd 1992, Stafleu et al 1994, Dittus et al 1995, Paisley 1995, Wise et al 1995)*. And that a positive attitude towards fruit and vegetables is associated with higher intake *(Dittus et al 1995, Hjartåker & Lund 1998, Havas et al 1998)* A summary of results from the Health and Lifestyle Survey shown in table 4.5 shows similar findings.

Table 4.5: Mean odds ratio & 95% CI for the influence of confidence in cooking on low fat and high fruit and vegetable intake, adjusted for socio-economic clusters.

Confidence in cooking skills	Low fat, OR (95%CI)	High fruit & vegetable, OR (95% CI)
Crude	**1.58 (1.14-2.20)**	**1.92 (1.41-2.59)**
Cluster 2	1.36 (0.93-1.97)	1.72 (1.22-2.44)
Cluster 1 *(reference)*	1	1

The results in table 4.5 suggest that women with positive attitudes towards cooking foods have an odds ratio of 1.58 to 1 of being low fat consumers and of 1.92 to 1 of having a high fruit and vegetable intake. When favourable socio-economic circumstances are taken into account the odds reduced to 1.36 (CI 0.93–1.97) and 1.72 (CI 1.22-2.44). When socio-economic variables are taken into account the relationship between attitudes and low fat intake is no longer significant. The literature review found more evidence in support of a relationship between attitudes and fat intake than between attitudes and fruit and vegetable consumption. This is because more studies have been done with fat intake, not because the relationship is stronger. The survey results suggest that the link is stronger with fruit and vegetable consumption. Many of the studies in the literature review have been done using young women this makes it easier to compare the results obtained from the young women in the health and lifestyle survey with studies in the literature. However the differences in the techniques used to measure attitudes means that the results have often measured different things.

The indices used to measure attitudes (Chapter 2, 2.1e, page 77) were not typical of those used in other surveys. The indices were not validated. It may be that a properly validated attitude questionnaire would have resulted in either a stronger or a weaker relationship between attitudes and food choice. The same problems with the failure of the DINE questionnaire to account for low energy reporters would apply to this section of results and the knowledge section. Both sections would also suffer from the difficulties with distinguishing between high and low fruit and vegetable consumers.

4.3) **Other factors and fat and fruit and vegetable intake.**

Aim

- To propose other factors that may account for the large unexplained variance in fat and fruit and vegetable intake.

This section of the discussion moves away from social influences of food choice to other influences. The premise that no amount of education, knowledge, money, or attempts to change attitudes will cause everyone to eat a healthy diet because at some level people are influenced by physiological is explored. The first part of the review looks at the development of food choice in the first years of life for clues to the way that adults make food choices. Nutrient regulation is considered together with other models of food selection in humans and other animals.

4.3a) **Development of food preferences**

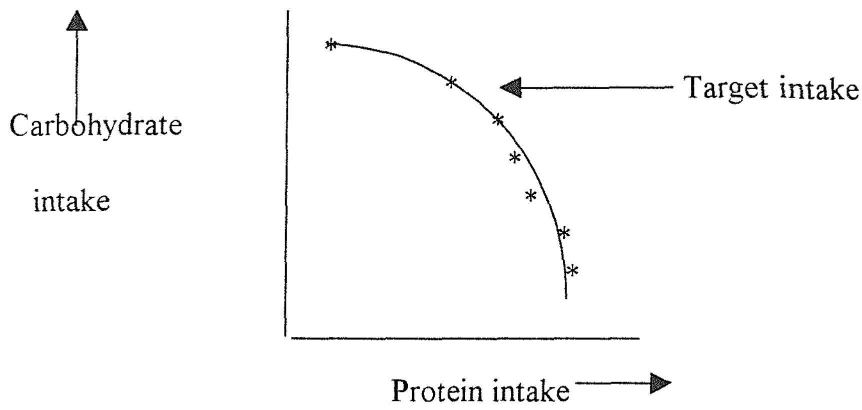
In a recent review of psychosocial research Westenhoefer *(2001)* reminds us of the early classic work of Clara Davis in which children self-selected a healthy diet without the influence of adults. Westenhoefer suggests that this points to the possibility that human infants possess a biological control system which enables nutritionally adequate food choice, at least when a variety of wholesome and natural foods is available. In a review article on the development of food preferences Birch *(1999)* suggests that genetic predispositions include reflex actions to basic tastes. The human infant shows preference for sweet tastes and rejects sour and bitter tastes. This predisposition is viewed as adaptive and may serve a protective function. In nature sweet tastes signal a source of energy and micronutrients as in milk and ripe fruits, whilst sour and bitter tastes often indicate the presence of toxins. The taste for salty food is not present at birth but appears at about four months. Infants are also predisposed to be neophobic about food. The fear of new foods is moderated by repeated exposure to the food especially when associated with positive experiences. Breast-fed infants showed greater acceptance of vegetables after being offered them than formula fed babies *(Sullivan & Birch 1994)*. Breast feeding infants have also been shown to respond to changes in the flavour of maternal milk by sucking for longer and spending more time attached to the breast *(Mennella et al 1991)*. Birch cites evidence that infants as young as six weeks can adjust their formula intake in response to changes in the energy density of the formula. Children aged 2-5yrs were shown by Birch to consume more in a self-selected second course after eating the energy dilute first course. Despite highly variable intake at individual meals, children's total energy intake was relatively constant due to energy regulation across successive meals.

Taste is an important factor in food selection in adults as well as children. The popular concept of taste generally includes the perception of smell and texture as well as taste. Fats are responsible for the characteristic aroma and texture of many foods, strongly influencing the overall palatability of the diet *(Drewnowski 1997)*.

4.3b) **Geometric modelling of nutrient intake**

Nutrition regulation *(Simpson S.J. & Raubenheimer D 1999)* can be expressed as a geometric model. The animal is depicted as existing within a multidimensional nutrient space, where each axis represents a nutrient. Within nutrient space lie regulatory targets. The intake target is the combination of nutrients whose ingestion provides the animal with nutrients to its tissues at the optimal rate and balance. An animal may reach its given target by selecting an optimal food if it exists or by mixing its intake from two or more suboptimal but nutritionally complementary foods. If the animal has only non-complimentary suboptimal foods available it will not be able to reach its target intake. The animal will have to compromise by eating some nutrients in excess and undereating others relative to its target intake. Locusts have been shown to minimise the sum of undereating one nutrient and over-eating another nutrient, irrespective of which of the two nutrients happens to be in excess or deficit. Other species of locust select food to provide the same sum of carbohydrate and protein as the target intake. Thereby ingesting a greater total amount of nutrients but incurring greater error with respect to the intake target. Simpson *(et al 1999)* suggested that species that feed on a wide variety of foods are more likely to be nutrient intake maximisers than species that experience a relatively narrow range of food nutrient compositions. Figures 4.6 and 4.7 illustrate this hypothesis.

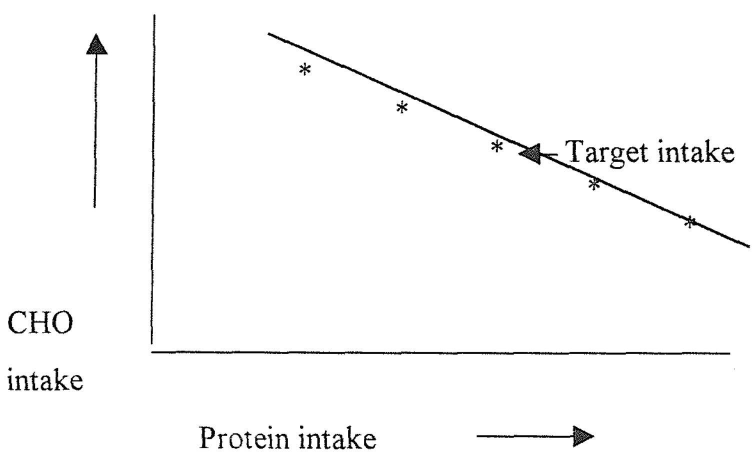
Figure 4.6: Food specialist follows the closest distance rule.



When forced to feed on a sub-optimal food the food specialist follows the closest distance rule, minimising error with respect to the unattainable intake. When presented with a single food source of defined protein/carbohydrate ratio, the specialist grass-eating locusts ate amounts of protein and carbohydrate illustrated by the stars on the arc, in an attempt to reach its target intake. The locust over-eats protein in its attempts to get enough carbohydrate, and overeats carbohydrate to try and meet its protein needs but only by a limited amount.

By contrast the food generalist, a species of locust with a broad intake of foods showed the pattern illustrated in figure 4.7

Fig 4.7: Food generalist chooses broad food intake.



The food generalist maximises intake ingesting a greater total amount of nutrients, but in doing so incurring greater error with respect to the target intake. The generalist substantially over eats protein in its attempts to eat enough carbohydrate when presented with a food that contains too little carbohydrate for its needs. Similarly it will eat too much carbohydrate whilst attempting to get enough protein if the food available contains too little protein.

Simpson *(et al 1999)* states that tracking the target intake requires two sources of information, the nutritional composition of the food and the nutritional state of the animal. Information regarding the nutritional state of the food is provided by taste, about which Simpson predicts:

- Gustatory sensitivity will have evolved to nutrients whose intake is specifically regulated.
- The taste system will show default dose-response characteristics that aid an animal in balancing its intake of such nutrients.
- These dose-responses will be subject to modulation through more current feed back mechanisms.

The first prediction is met by all organisms including mammals. The second prediction has led to the development of a mathematical model:

Figure 4.8: Calculation of ratio of protein to carbohydrate in diet.

$$\frac{p}{(p + c) \times 100}$$

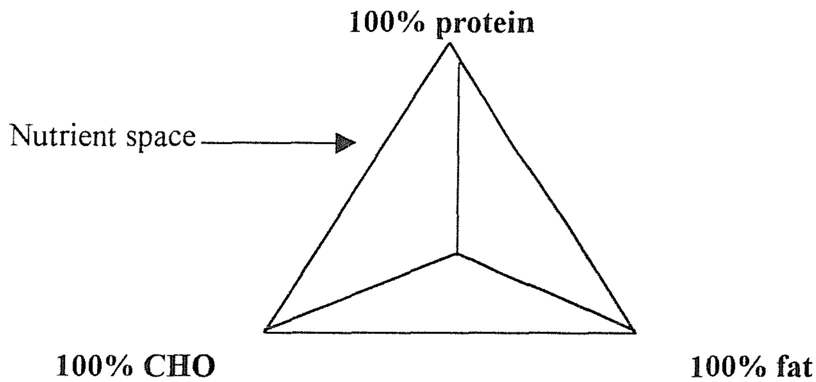
Where p and c are % dietary protein and digestible carbohydrate.

Simpson and Raubenheimer have used protein and carbohydrate as the experimental nutrients and looked in detail at nutrient choice by species of locusts. One particular species the desert locust, exists in a number of phenotypes. The expression of the phenotype depends on the population density. The solitary form exists when the population density is low, it is a food specialist. When the population becomes denser the solitary form changes over several generations to the gregarious form. This phenotype is a food generalist consuming a wide variety of vegetation *(Simpson et al 1999)*.

Optimal foraging models predict that foraging animals should aim to maximise their rate of intake of the nutrient most limiting to growth and/or reproduction. Intake rate maximisation is constrained by both the nutritional quality of available food items and by their abundance. The trade off between quality and quantity is a key factor in determining the diet which different herbivores select *(Duncan A.J. & Gordon I.J. 1999)*. Diet choice in man is determined by more complex factors than operate for insects or herbivores. The literature review has shown that; socio-economic factors, knowledge, and attitudes have some influence on food choice in women, but these factors are unable to account for food choice per se. By concentrating on complex social interactions in man, simple rules of food choice may have been overlooked. Man being a generalist species may follow the equal distance rule and over eat protein, carbohydrate or fat in order to maximise intake of other nutrients when they are present in suboptimal amounts. Nutrients are most likely to be suboptimal amongst people with low socio-economic status *(Smith & Baghurst 1993, Davey Smith 1997)*. The generalist rule would suggest that these groups of people might be over eating protein, carbohydrate or fat in order to meet a nutrient need. An inverse relationship between socio-economic status and body mass index (BMI) has been documented *(Jeffery & French 1996)*. Rogers *(et al 1998b)* found that mean pre-pregnancy weight increased significantly as women reported greater financial hardship ($P<0.001$). Data from the 1987-1988 Nation-wide Food Consumption Survey *(Murphy et al 1992)* indicated that only 1.9% of individuals reported a diet that contained no nutrients below 67% of the RDI and was also low in fat (<30% energy from fat). No correction was made for low energy reporters, the authors suggest that the analysis may overestimate the numbers of individuals with true intakes below the cut off point. The response rate for the survey was below 35% so the data were weighted to match the characteristics of the US population. The authors conclude that as the nutritional adequacy of the diet rises the percentage energy intake from fat also rises. Peterson *(et al 1999)* used data from the 1989,1990 & 1991 Continuing Survey of Food Intakes by Individuals (CSFII) to sort individuals into different categories depending on their adoption of various techniques to reduce fat intake. The micronutrient profile of those individuals who were not attempting to reduce their fat intake was worse than that of individuals who were choosing lean meat, skimmed milk or other low fat dairy foods. The authors suggested that people who choose to reduce their fat intake may be more concerned about a healthy diet then other people are.

Leibowitz *(1992)* developed a model for studying the effects of a variety of compounds on macronutrient choice in rodents. The animals are given access to sources of pure macronutrients as depicted in figure 4.9. The three dimensional equilateral triangle delineates a nutrient space that represents the percentage of protein, fat and carbohydrate. The rodent can select a diet represented by any point within this space.

Figure 4.9: Rodent studies of diet selection



Stubbs *(et al 1999)* adapted this model for human studies. Instead of using foods that were 100% fat, protein or carbohydrate, a choice of ten fat rich, ten protein rich and ten carbohydrate rich foods were chosen. A total of 30 foods were offered to 16 subjects during each day of the study. The subjects were each studied four times for 2-days. Each 2-day period involved 1 day of fixed diet followed by a fixed intake breakfast and midmorning drink followed by ad libitum access to the 30 foods. On each of the four occasions the subjects received either a high protein, high fat, high carbohydrate or mixed regime in the form of tuna lasagne plus a drink. Subjects also completed a number of questionnaires to assess their appetite, hunger, mood and degree of dietary restraint. There were no significant differences in the amount of food consumed following the different regimes. Analysis of the ad libitum intakes showed that there were no significant differences in the weight of food, energy or nutrient intakes. If the ad libitum period was broken into lunch and post-lunch intakes of food then subjects ate significantly more food, energy, protein and fat and to a lesser extent carbohydrate at lunchtime following the high fat morning than on the other days.

The range of acceptable fat intakes in adults is very wide, the lower limit, about 10% of energy intake, depends on the requirement to meet energy needs, the need for essential fatty acids and the need to absorb fat soluble vitamins. The upper limit of fat intake seen in Eskimo populations is about 50% of energy from fat *(Jéquier 1999)*. It is possible that this wide range of fat intakes enables different populations to adapt to different ranges of foods to meet requirements for energy, protein, vitamins and minerals.

Another modelling system employs the concept of fuzzy logic to evaluate nutrient intakes *(Wirsam et al 1997)*. This view of nutrient intake allows the diet to be considered as a whole. Each individual nutrient is given a fuzzy set based on five points, zero intake, safe minimum intake, optimal intake, safe upper intake and finally toxic level. A fuzzy set is created for each nutrient, then a 'Prerow' value is applied to measure how healthful a food is. Wirsam gives the example of a typical German diet calculated from a dietary survey. If more sausage is eaten and all the other foods held constant then the Prerow value deteriorates. If more vegetables are eaten the Prerow value increases. Thus the ideal dietary advise for an individual can be constructed. Following Wirsam's paper on fuzzy decision making in nutrition Gedrich *(et al 1999)* questioned the concept of an optimal diet pointing out that it was dependant on the conditions any optimisation was based on. In a study that compared low fat and high fat consumers *(Cooling et al 1998)* found that appetite control in the two groups was different. They suggest that physiological mechanisms, forming part of the basis for appetite control operate differently in the two groups. The authors proposed that emerging patterns of physiological and behavioural responses suggest that low and high fat consumers could be regarded as distinct phenotypes.

4.3g) **Summary**

Aim

- To investigate other factors in low fat, high fruit and vegetable intake and see if there is any evidence that food choice may be related to a specific requirement for nutrients.

The key findings are,

- Babies may be born with innate abilities to choose food that disappears in early childhood *(Birch 1999, Westenhoefer 2001)*
- Fat intake may be increased in diets that were low in nutrients *(Murphy et al 1992, Peterson et al 1999)*.

- Appetite control in low fat and high fat consumers may be different *(Cooling et al 1998)*
- Locusts may choose to over eat a particular food with respect to one nutrient in order to obtain sufficient quantity of a second nutrient *(Simpson et al 1999)*. The availability of nutrients influences the ability of successive generations of locusts to cope with excess and inadequacy of nutrients *(Simpson et al 1999b)*.
- It is important to question the concept of an optimal diet *(Gedrich et al 1999)*

4.4) **Summary**

The results from the survey data are generalisable to women in England aged 20-34 years, but are subject to selection bias and various confounding factors.

In addition to the socio-economic influences summarised in table 4.1 the analysis of results showed that certain variables were associated with being female, women were more likely than the general population to have some qualifications, be in non-manual employment and live in rented accommodation. Table 4.1 showed that having qualifications and being in non-manual employment were both associated with having a low fat intake and a high fruit and vegetable consumption. These two factors were confounders because they are associated with but not dependant on being female and their absence i.e. manual employment and lack of qualifications are risk factors for low fruit and vegetable intake and high fat intake. Living in rented accommodation is associated with being female, but women who are home owners are more likely to have low fat and high fruit and vegetable intakes, so living in rented accommodation was not a confounding factor. The confounding factors were controlled for in the analysis of results using logistic regression.

The use of fat intake and fruit and vegetable consumption as indicators of a healthy diet was probably not unreasonable given the large number of UK consumers who mentioned low fat and fruit and vegetables when asked to describe a healthy diet *(Margetts et al 1997)*. An indicator such as the USDA Healthy Eating Index might have given a more thorough assessment of respondents following a healthy diet but would not have been possible given the data set available.

Given that fat and fruit and vegetable intake were chosen, there were problems with the validity of the data. The fact that no adjustment for low energy reporters could be made affects the conclusions concerning fat intake. If it were correct to assume that a third of the respondents reported a lower fat intake than their actual fat intake and the majority of these respondents were of low socio-economic status then that would tend to strengthen any relationship between low fat intake and higher socio-economic status.

The original aim of the study was to assess whether the choice of a diet with a high fat, low fruit and vegetable content by a proportion of women aged 20-34 years could be partly accounted for by socio-economic variables, knowledge and confidence in cooking was met. Overall the factors investigated in this thesis accounted for 8.8%of the variance in fruit and vegetable intake and 2.2% of the variance in fat consumption. These leaves 91.2% the variance unexplained for fruit and vegetable intake and 97.8% for fat intake.

Measures of variance will be affected by the size of the study. A study with a small number of participants will tend to have a larger r^2 than a study with a larger number of participants. In order to establish whether the % variance explained by the variables was reasonable a comparison with other studies has been made.

In a paper reporting a lifecourse study that assessed the risk of cardiovascular disease measured by carotid intima-media thickness *(Lamont et al 2000)*, early life variables such as socio-economic position at birth, birth weight directly accounted for 2.0% of the total variance in carotid intima thickness in 193 women. A total of eight biological risk markers (systolic blood pressure, waist to hip ratio, serum low density lipoprotein cholesterol, serum high density lipoprotein cholesterol, serum triglycerides, plasma fibrinogen, 2 hour plasma glucose and fasting serum insulin) accounted for a further 4.9%of variance in women. A study investigating the effects of exercise, smoking, and calcium intake during adolescence and early adulthood on peak bone mass *(Valimaki et al 1994)*, was able to explain 38% of the variance in bone mineral density in women with three factors, weight, exercise and age. 153 women took part in this study. Macdiarmid et al *(1996)* found that age, smoking, alcohol consumption fat intake, protein intake and carbohydrate intake accounted for 15% of the variation in 523 women's BMI. An American study that looked at socio-economic status and weight control practices amongst 20-45 year old women found that income, demographic variables, dietary practices, exercise, weight concerns social support and weight loss practices combined accounted for 30% of the variation in BMI. A total of 998 women took part in the study *(Jeffery et al 1996)*. These results suggest that although the total variance accounted for by the factors considered in this study is small in comparison with other studies it is not of a different order of magnitude.

It would seem that education to 'A' level, combined with the use of a car and home ownership may act as a measure of socio-economic status and that this measure is associated with the choice of a low fat and/or high fruit and vegetable intake. Knowledge that red meat is high in fat is associated with both low fat intake and high fruit and vegetable consumption, whilst knowledge that chicken is high in fat more than doubles a young woman's likelihood of having a low fat diet. Knowing that butter is high in fat increases the chance of having a low fat diet by 1.7 times. Having confidence in ones general cooking ability doubles the chance of having a low fat diet and the chance of having a high fruit and vegetable intake. Confidence in ones ability to steam food and cook root vegetables was associated with double the chance of having a diet high in fruits and vegetables. Confidence in ones ability to cook fresh green vegetables was associated with being four times more likely to have a low fat diet. These results are generalisable to a wider section of the population than just young women. The influence of socio-economic variables on food choice could be applicable to other adult, but not elderly populations in Northern European countries, both male and female. Results regarding attitudes towards confidence in cooking are probably not generalisable to men.

Income was shown to affect expenditure on food and nutrient content of the diet. This result was obtained using data from the NFS, although the sample suffered from a poor response rate and was probably biased to wards people who were more able and willing to record food purchases, the information gained should be applicable to the general population. It was less clear what proportion of the variance in food choice was attributable to differences in income. It was difficult to compare results about expenditure with other studies because differences in time (year when the study was done) affect expenditure.

Differences in food choice may not be solely determined by sociological factors. It is beyond the scope of this thesis to review the vast literature on macronutrient metabolism. Work by Blundell *(1999)*, Cooling *(1998)* and others is suggestive of feedback mechanisms between appetite control and macronutrient intake. Work on animal nutrition *(Simpson et al 1999)* also indicates that nutrient intake influences not only immediate choice of foods but also programmes subsequent generations to deal with changes in availability of foods *(Simpson et al 1999b)*. The work of Westenhoefer *(2001)* and Birch *(1999)* on infants may be an indication that humans too have an innate mechanism that influences food choice.

The conclusions that can be drawn from the analysis of data and review of literature are presented in chapter V.

Chapter V: Conclusion

Introduction

This chapter presents the conclusions that have been drawn from the literature review and the results of the analysis in light of the discussion in chapter four. The aim of the chapter is to answer the original question.

Aim

To what extent do socio-economic status, knowledge, and confidence in cooking skills, account for young women's food choice. What other factors may influence food choice in this group?

5.1) Socio-economic variables and fat and fruit and vegetable intake

The socio-economic section of the Health and Lifestyle Survey was comprehensive. But difficulties remained in assessing socio-economic status accurately, as discussed previously. It would have been very helpful to have information on income from employment to supplement the data on occupation. All practical procedures were followed to increase the response rate and minimise response and interviewer bias.

The main source of bias was selection bias introduced by the respondents representing only 70% of the survey population. As there was no information on the non-responders it is only possible to guess that they may have been less interested in health than responders. The sample was weighted to ensure that it was representative of the general population in terms of the Registrar General's classification of social class, a sample that was biased in terms of its interest in health should not be biased in terms of its socio-economic distribution. If the population was biased in terms of interest in health it would tend to make any associations found between knowledge and attitudes towards cooking skills and low fat and high fruit and vegetable consumption occur more frequently in the sample than in the general population.

It was probably not possible in practical terms to improve on the socio-economic section of the survey.

Socio-economic factors were found to account for 45% of the variance in young women's choice of a diet high in fruit and vegetables and 8% of their choice of a low fat intake. These figures should be generalizable to other young women in England.

These findings broadly agree with the literature review that found that socio-economic factors were associated with fruit and vegetable consumption to a greater extent than fat consumption was. The literature review suggested that higher social class was associated with increased fruit and vegetable consumption *(Braddon 1988, Hulsof 1991, Bolton-Smith 1991, Roos 1996, Hjartåker & Lund 1998, Marmot 1991)*. It also found that greater number of years of education was associated with higher fruit and vegetable intake *(Braddon 1988, Hjartåker & Lund 1998, Agudo 1999)*.

It is not always appropriate to compare the young women in this study group with other study populations. Women are more likely than men to have a high intake of fruit and vegetables *(Bolton-Smith et al 1991, Järvinen 1994, Monneuse et al 1997, Johansson & Anderson 1998)*, and so should not be compared with population studies that have not been analysed with regard to gender. However the results of this study may be generalised to male populations because the factors that affect women's food choice may also affect men's food choice.

5.2) Income, expenditure and fat and fruit and vegetable intake

The literature review suggested that the choice of a diet with a low fruit and vegetable content by a proportion of women aged 20-34 years could be partly accounted for by levels of income and expenditure *(Subar et al 1992, Dowler & Calvert 1995b, MAFF 1998)*. There was much less information available on fat consumption and low income. Data from the NFS *(MAFF 1998)* indicated that low-income households tended to consume similar amounts of fat to high-income households. These results may be misleading because they do not take into account composition of the household.

Results from the Health and Lifestyle survey showed that young women in socio-economic circumstances suggestive of lower income, (e.g. manual employment, less well educated, living in rented accommodation and without the use of a car) were significantly more likely to have a low intake of fruits and vegetables than other young women. The results also suggested that these women were more likely to have a higher fat intake than other women were but not significantly so. The survey results were similar to the results of the literature review. Data from the NFS *(MAFF 1998)* confirmed that low-income households had different nutrient intakes to higher income households. These results are difficult to interpret because of differences in household composition.

5.3) **Knowledge and fat and fruit and vegetable intake.**

The literature review found two studies linking increased knowledge with lower fat intake and five studies that did not show a link. Two studies showed a link between fruit and vegetable intake and knowledge *(Piacentini et al 1995, Havas et al 1998)*. Very few studies have been done on knowledge and fruit and vegetable intake. The study by Havas is not generalizable to our study population because it was done on WIC participants.

Results from the analysis of the Health and Lifestyle survey suggested that there is no relationship between knowledge and fat intake or between knowledge and fruit and vegetable intake. The results from the analysis of the Health and Lifestyle survey agree with the results from the literature review and suggest that some other variable must influence the choice of a low fat or high fruit and vegetable intake. The questions that were used to indicate women's knowledge about food were not tested to see if they could distinguish between women who were knowledgeable and women who were not knowledgeable. Cronbach's alpha for test-retest reliability was not calculated. The knowledge questions cannot be said to be a reliable test instrument. The validity of the results obtained from the knowledge section of the questionnaire is doubtful. It is therefore hard to be confident about the results.

When good socio-economic circumstances were adjusted for the odds ratio for both low fat intake and high fruit and vegetable intake decreased (Results: table 3.29) suggesting that socio-economic circumstances influence the choice of a low fat and high fruit and vegetable diet. When knowledge was added to the socio-economic variables in a regression analysis (Results: table 3.42) it accounted for only 0.1% of the variation in fruit and vegetable consumption and did not account for any additional variation in the intake of low fat foods. The results of this study with regard to knowledge and food choice may be generalisable to a wider population. Selection bias makes it possible that people who had some interest in health were more likely to participate in the study than other people were. If knowledge about foods did not influence food choice in women who were possibly more interested in health than the general population it is possible that knowledge would influence food choice in other people who were less interested in health and may have been less knowledgeable to start with. If the questions used to measure knowledge were not able to distinguish sufficiently between the knowledgeable and the less knowledgeable then these results may not be generalisable to a less interested population. Odds ratios stratified for lower qualifications and higher qualifications on the influence of knowledge on fat and fruit and vegetables intake (Appendix, tables 6.34 & 6.35) showed that qualifications were not acting as effect modifiers on the influence of knowledge. I would expect these results to be generalisable to both adult men and women of different ages in Northern Europe.

In conclusion the knowledge section needed to ask a more clearly defined question. Two sets of five questions designed to test the following hypothesis may have been more appropriate.

- Women aged 20-34 with less knowledge about the health benefits of eating five portions of fruits and vegetables a day consume fewer portions of fruits and vegetables than young women who have greater knowledge.

Women aged 20-34 with less knowledge about the health benefits of low fat intake consume more portions of fatty foods than young women who have greater knowledge.

The knowledge questions should have been validated so that they distinguished between women with greater and lesser degrees of knowledge. They should also have been tested for test-retest reliability.

5.4) **Confidence in cooking ability and fat and fruit and vegetable intake**

There is a lot of evidence to suggest that negative attitudes towards high fat foods are associated with a lower fat intake *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler 1992, Stafleu 1994, Dittus 1995, Paisley 1995, Wise 1995*). There was very little work on the influence of attitudes on the consumption of fruit and vegetables, but positive attitudes were associated with increased fruit and vegetable consumption in three studies *(Dittus et al 1995, Hjartåker & Lund 1998, Havas et al 1998*) Being female is associated with more positive attitudes towards low fat intake *(Shepherd 1985, Shepherd 1988, Wardle & Steptoe 1991, Towler 1992, Lloyd 1993, Stafleu 1994, Barker 1995, Wise 1995*) and with having more positive attitudes towards fruit (*Dennison 1995*) than men have. This means that the results of some of the Health and Lifestyle survey analysis are not generalisable to men.

Questions from the Health and Lifestyle Survey about attitudes towards cooking resulted in a significant association between women who had positive attitudes towards their cooking ability and high fruit and vegetable intake, even when favourable socio-economic circumstances were accounted for (OR 1.72, CI 1.22-2.44). The association between attitudes and low fat consumption was no longer significant when socio-economic circumstances were taken into account (OR 1.36, CI 0.93-1.97). When confidence in cooking skills was added to knowledge and socio-economic factors it was found to account for a further 1.1% of the variance in the choice of a diet high in fruits and vegetables and 0.4% of the variance in the choice of a low fat intake.

The validity of these results would have been improved if the specific attitude in which the researcher was interested had been defined. The questions should then have been tested to see if they did in fact measure the defined attitude and distinguish between people with different attitudes. The test–retest reliability should also have been considered.

The results of this study with regard to the influence of positive attitudes towards cooking skills on food choice may be generalisable to a wider population than young women. It is possible that gender acts as a confounding factor in the relation ship between food choice and positive attitudes towards cooking skills. These results may be applicable to men.

5.5) **Other factors and fat and fruit and vegetable intake**

The effects of region of residence and not being a single parent were added into the regression analysis to look at the factors influencing fat and fruit and vegetable consumption. When combined with the four socio-economic factors and knowledge, confidence in cooking skills accounted for 5.7% of the variance in high fruit and vegetable intake and 1.2% of low fat consumption. Adding in being normal weight explained 8.5% of the variance for high fruit and vegetable intake and 1.3% for low fat intake. Including cigarette smoking history made no difference to explaining low fat intake or to the explanation of high fruit and vegetable consumption.

When all of the above factors were taken into consideration 91.2% of the variance in high fruit and vegetable intake remained unexplained and 97.8% of the variance in low fat intake. If other factors involved in food choice can be found it may be possible to improve public health by influencing those factors. In is beyond the scope of this thesis to explore those 'other factors' but Blundell *(& Stubbs 1999)* remind us, in a position statement on the role of behaviour and appetite in determining the limits of fat and carbohydrate intake that, 'the control of eating behaviour cannot be understood in the absence of an understanding of physiology.'

5.6) **Summary**

There is an assumption by public health nutritionists that socio-economic status, knowledge and positive attitudes can largely explain whether or not people choose to eat a diet low in fat and high in fruit and vegetables.

This thesis has contributed to our understanding of the influences on food choice by examining the extent to which socio-economic status, knowledge and positive attitudes towards cooking can predict the choice of a low fat or high fruit and vegetable intake in a specific section of the population. Many other studies have looked at some of these variables but this study has examined all those factors thought to be influential in food choice and looked at their relationship to each other as well as to food choice.

This study has found that there is a large unexplained variation in the choice of fruit and vegetables and in fat intake. The large unexplained variation in food choice suggests a need to look for other influences so that public health initiatives may be better tailored to influencing population food choice.

This study has suggested that different factors influence different aspects of food choice. For example confidence in cooking skills has more influence on the consumption of fruits and vegetables than on the consumption of fat. It is possible that this difference in influence may be due to the measures of fat and fruit and vegetable consumption being different. It was felt that the distinction between low and high fruit and vegetable consumption was less reliable than the distinction between low and high fat intake. If this was the case it would tend to make the distinction between variables affecting the groups more difficult for the fruit and vegetable consumers. The results have not shown this to be the fact.

This thesis has examined the extent to which socio-economic status, knowledge and positive attitudes towards cooking can predict the choice of a low fat or high fruit and vegetable intake in a specific section of the population and suggested that as well as these sociological influences on food choice there may also be other factors that in some way exert an influence on individual food intake.

The literature review has indicated that the association between socio-economic status and fat intake is unclear. The Whitehall II study *(Marmot et al 1991)* confirms the social class difference in morbidity found in the initial Whitehall study *(Reid et al 1974)*, the Black Report *(DHSS 1980)* and the Health Divide *(Whitehead 1992)*, but fails to find an explanation. Stallone *(et al 1997)* suggests that differences in vitamin C and potassium intake show associations with socio-economic status consistent with a dietary explanation for social inequalities in cardio-vascular disease. The literature review found an association between increased knowledge and lower fat intake *(Shepherd & Sims 1990, Shepherd & Towler 1992,)* in some studies but not in *(Shepherd & Stockley 1987, Anderson 1993, Larsson & Lissner 1996, Stafleu et al 1996, Koikkalainen et al 1999)* others. The link if there is one is far from fully understood.

The review of papers concerned with attitudes and food choice suggests that there is an association between attitudes towards fatty foods and choice of low or high fat foods *(Shepherd & Stockley 1985, Shepherd & Stockley 1986, Shepherd & Stockley 1987, Towler 1992, Stafleu 1994, Dittus 1995, Paisley 1995, Wise 1995)*. Behavioural models such as The Theory of Planned Behaviour describe the way in which attitudes influence behaviour but make no mention of knowledge. Ajzen himself *(1991)* indicated that the model might need further modification. 'The theory of planned behaviour is, in principal, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behaviour after the theories current variables have been taken into account.

Definitions of healthy food have been questioned. It may be inappropriate to define health in population terms and apply guidelines to large sections of the population. The elderly and young children have been recognised as having different nutrient needs from other people. To look to the future and protect people from the diseases of affluence may not be appropriate for those sectors of the population who have difficulty meeting their immediate health needs.

The aim and objectives of this study could have been met more completely by being much more precise about what was being investigated. Very specifically defined measures of knowledge and attitude needed to be validated. Energy intake should have been collected so that the fat intake data could have been properly validated. Fruit and vegetable intake needed to be better differentiated between the two groups and nearer the target of 5-a-day for the high intake group.

Despite the numerous problems with the quality of the data used in the analysis there is broad agreement between these results and those seen in the literature. The link between socio-economic factors and fruit and vegetable consumption was significant in the survey results and documented in the literature. The association between socio-economic factors and fat intake was more tenuous in the survey results and not proven in the literature. The link between income, expenditure and food choice was demonstrated in the literature review. The association between attitudes and food choice is stronger than any association between knowledge and food choice, both in the literature and in the survey results. This may be because changes in knowledge lead to changes in attitude, which in turn lead to changes in food choice.

Income was shown to affect expenditure on food and nutrient content of the diet. It was less clear what proportion of food choice was attributable to differences in income. When women who were in receipt of family credit were included in a regression analysis only an additional 0.1% of the variance in fat intake was accounted for. Including those women who felt that their choice of shop was influenced by 'prices being affordable' accounted for a further 0.8% of the variance in fat intake and 0.3% of the variance in fruit and vegetable intake.

Overall the factors investigated in this thesis accounted for 8.8% of the variance in fruit and vegetable intake and 2.2% of the variance in fat consumption. These leaves 91.2% the variance unexplained for fruit and vegetable intake and 97.8% for fat intake.

This thesis makes a contribution to public health by quantifying the influence of these sociological factors on food choice in young women.

Appendices

Appendix 1: The NACNE Report

In September 1983 the National Advisory Committee for Nutrition Education (NACNE) published a document entitled 'Proposals for Nutritional Guidelines for Health Education in Britain.' This report was the first to present a single set of quantified dietary goals for Britain. The report recommended that the composition of the average national diet should conform to the following proposals;

- Total fat intake should be reduced from the present 38% of total energy (including alcohol) to 34% of total energy in the 1980's and 30% of total energy in the long term.
- Sucrose should be reduced from the present 38 kg per head per year to 34 kg in the 1980's and to 20 kg in the long term, of which not more than half should be in drinks and snacks between meals.
- Dietary fibre should be increased from the present 20g per day to 25g in the 1980's and 30g in the long term; both cereal fibre and fruit and vegetable fibre should be increased.
- Alcohol should be reduced from 6% of total energy to 5% in the 1980's and 4% in the long term.
- Energy levels should be maintained because more exercise throughout the population was to be encouraged.

Table 6.1 NACNE recommendations.

	Present Intake	Recommendation for 1980's	Long Term Recommendation
Nutrient			
Total fat % total energy	38	34	30
Sucrose, k/head/year	38	34	20
Dietary fibre g/day	20	25	30
Alcohol % of total energy	6	5	4

Appendix 2: COMA 1994 Nutritional Aspects of Cardiovascular Disease.

This report concentrated on recommendations for fat and fatty acid intake. Fat intake should be reduced from 40% of dietary energy intake to 35% of dietary energy intake. Saturated fatty acid intake should decrease to 10% of dietary energy intake. The report made no specific recommendations for the ratio of polyunsaturated fatty acids to saturated fatty acids, the average intake of n-6 PUFAs, primarily linoleic acid from seed oils and polyunsaturated margarine was estimated to be 6% of dietary energy intake, it was recommended that this should not rise, it was also recommended that there should be no rise in the proportion of the population consuming more than 10% of their dietary energy intake from this source. Intake of n-3 PUFAs, eicoso-pentanoic acid and docosahexanoic acid should be increased from 0.1g/day to 0.2g/day. Two portions of fish a week were recommended at least one of which should be oily fish. The report recommended that dietary cholesterol and trans fatty acid intake should not rise from their current levels.

Table 6.2: Recommendations of COMA 1994

Nutrient	Present Intake	Recommendation
Total fat(% food energy)	40	35
Saturated. Fat (%food energy).	16	10
n-6 PUFA (% food energy)	6	6
n-3 PUFA (g/day)	0.1	0.2
Cholesterol (mg/day)	245	245
Trans fatty acid.(% food energy)	2	2

This was the first COMA report to give recommendations about the amount of food to eat.

Appendix 3: Socio-demographic characteristics of survey respondents

Aim

To illustrate the socio-demographic characteristics of young women in relation to the wider population.

Table 6.3 shows the gender distribution for all the Health and Lifestyle Survey respondents.

Table 6.3: Gender of respondents.

Gender	Percentage	Number
Male	49.6	2754
Female	50.4	2799

The HEA Health and Lifestyle survey was designed to reflect the make up of the English population, the final data was weighted to reduce any bias towards one gender. The population is therefore evenly split between males and females as shown in the above table.

Table 6.4 shows the number of respondents within each age group and the percentages of male and female respondents in each age group.

Table 6.4: Age of respondents.

Age years	16-19 (%)	20-24 (%)	25-34 (%)	35-44 (%)	45-54 (%)	55-64 (%)	65-74 (%)
Female	174 (48.6)	227 (49.0)	602 (50.0)	511 (49.8)	474 (49.8)	438 (54.0)	322 (50.7)
Male	184 (51.4)	288 (51.0)	602 (50.0)	516 (50.2)	478 (50.2)	373 (46.0)	313 (49.3)

Table 6.4 showed that men and women were evenly distributed within each age group across the survey population. There were equal numbers of men and women in the 25-34 year age group, but slightly more men in the 20-24 year age range.

The following tables present data for all the survey respondents together with data for women aged 20-34 years, this has been done so that data for the young women of specific interest can been seen in comparison with the general population. Confidence intervals (CI) are given to enable an estimate to be made of the range within which the variable is likely to lie. A narrow confidence interval indicates that the sample size was large and the data is likely to be precise. These results are calculated with a 95% confidence interval. The numbers of respondents are given with percentages in brackets. Table 6.5 presents the educational level of the respondents.

Table 6.5: Educational level of respondents

Education level	No formal qualification. (%)		Other qualification. (%)		'A' levels and higher (%)	
Female	913 (56.5)	CI 95% (54-59)	1149 (53.2)	CI 95% (51-55)	725 (41.5)	CI 95% (39-44)
Male	703 (43.5)		1010 (46.8)		1021 (58.5)	
Female 20-24 yrs	27 (24.1)	CI % (17-33)	146 (30.8)	CI % (27-35)	101 (35.1)	CI % (30-41)
Female 25-34 yrs	85 (75.9)		328 (69.2)		187 (64.9)	

This table showed that women in the general population are more likely to have no formal qualifications and less likely to have 'A' levels or higher qualification than men, although 53.2% of women have some other qualification compared to 46.8% of men. The 95% confidence intervals for these results are narrow because of the large sample size, indicating that the difference between the groups are unlikely to be due to chance alone, although there was some overlap between the confidence interval for women with no formal qualifications and other qualifications. Younger women were more likely than either men or women to have some qualifications. Younger women were also more likely to have A levels and higher qualifications than other women (26.0%), but not as likely as men (37.3%). The 95% confidence intervals for these results were much wider and show some overlap so they should not be regarded as showing such a strong association as the difference between the male /female results, but they do indicate a trend.

Table 6.6 shows the socio-economic group of the male and female respondents and of the young women, there is also a category for respondents who have never worked.

Table 6.6: Socio-economic group of respondents.

Socio-econo. Group	I (%)	II (%)	IIIa (%)	IIIb (%)	IIIm (%)	IV (%)	V (%)	Never worked (%)
Female	38 (17.5)	218 (29.4)	467 (66.5)	906 (77.9)	108 (17.4)	541 (57.4)	200 (64.5)	192 (63.2)
Male	179 (82.5)	523 (70.6)	235 (33.5)	257 (22.1)	856 (82.6)	401 (42.6)	110 (35.5)	112 (36.8)
♀ 20-24 yrs	2 (12.5)	11 (20.0)	41 (29.1)	107 (34.1)	15 (22.1)	53 (29.1)	6 (17.6)	37 (64.9)
♀ 25-34 yrs	14 (87.5	44 (80.0)	100 (70.9)	207 (65.9)	53 (77.9)	129 (70.9)	28 (82.4)	20 (35.1)

I Professional, II Employers and managers, IIIa Intermediate non-manual, IIIb Junior non-manual, IIIn Skilled manual and owners, IV Semi-skilled manual, V unskilled manual

Table 6.6 showed that women were more likely to be employed in intermediate non-manual and junior non-manual work than men. Men were more likely to be employed in professional occupations or as employers and managers than women were. Men were also more likely to be in skilled manual jobs than women were. Only 4.0% of women aged 20-24 years fell into this group, but the percentage rose to 7.4 amongst women aged 25-34 years, which was comparable to women generally (8.0%). Large numbers of women worked in semi-skilled manual jobs, 19.7% of the general female population and 21.7% of women aged 25-34 years. Some of the numbers in the different socio-economic groups are very small so table 6.7 amalgamates the categories into non-manual and manual groups.

Table 6.7: Manual and non-manual status of respondents.

	Non-manual (%)		Manual (%)		Never Worked (%)	
Female	1629 (57.7)	CI % (56-60)	921 (40.2)	CI % (38-42)	192 (63.2)	CI % (58-68)
Male	1193 (42.3)		1368 (59.8)		112 (36.8)	
Female 20-24 yrs	161 (30.6)	CI % (27-35)	74 (26.1)	CI % (21-31)	37 (64.9)	CI % (52-76)
Female 25-34 yrs	365 (69.4)		210 (73.9)		20 (35.1)	

Table 6.7 showed that the majority of people in non-manual employment were female (57.7%). Of those people who were in manual jobs the minority (40.2%) were female, whilst 63.2% of those who had never worked were female. The 95% confidence intervals for the non-manual and manual workers were narrow and did not overlap suggesting that these results were not chance happenings. Of the young women in employment the majority of non-manual and manual workers fell into the older (25-34 yrs.) age group, 30.6% of non-manual workers were younger compared with only 26.1% of manual workers. This may reflect the better education of the younger women but 95% confidence intervals overlap so results must be interpreted with care.

The following table's show other measures of standards of living so that a broader picture of the socio-economic status of the young women can be built up.

Table 6.8 shows total numbers and percentages of men and women and young women looking after the home, at school or in full time education, percentages do not add up to 100 because other categories of work status such as full time employment have not been presented. This table has been included to give some clues as to the occupation of the young women in the never worked section of table 6.7.

Table 6.8: Work status of respondents.

	Looking after home (%)		At school (%)		Other full-time education (%)	
Female	713 (97.4)	CI % (96-98)	44 (51.2)	CI % (41-61)	117 (49.4)	CI % (43-56)
Male	19 (2.6)		42 (48.8)		120 (50.6)	
♀ 20-24 years	58 (20.4)	CI % (16-25)	-		38 (84.4)	CI % (71-92)
♀ 25-34 years	227 (79.6)		-		7 (15.6)	

Table 6.8 showed that people looking after the home were more likely to be women (97.4%) than men. The percentages of men and women at school or in other full time education were similar. The number of 20-24 year old women who were still in full time education was similar to the number shown to have never worked in table 6.7. These are not necessarily the same women, as it is possible that women in full time education may undertake part-time employment, whilst studying or full time employment during holiday periods. Of those young women who were looking after the home the majority (79.6%) were in the older age group (25-34 yrs). Women aged 25-34 years old accounted for just under a third of the total number of women who were looking after the home.

Table 6.9 shows how many men and women are single parents and how many live in a household with two adults and children and how many receive family credit.

Table 6.9: Families with children.

	Single parent (%)	Two adults + children (%)	> Two adults + children (%)	Receiving family credit (%)
Female	115 (89.8)	665 (50.2)	295 (50.3)	59 (60.2)
CI	(83-94)	(47-53)	(46-54)	(50-69)
Male	13 (10.2)	661 (49.8)	291 (49.7)	39 (39.8)
♀ 20-24 years	18 (23.4)	48 (12.9)	32 (54.2)	9 (27.3)
CI	(15-34)	(10-17)	(42-66)	(15-44)
♀ 25-34 years	59 (76.6)	324 (87.1)	27 (45.8)	24 (72.7)

Table 6.9 showed that single parents were much more likely to be female (89.8%) than male. Young women who were single parents were more likely to be in the older age group (76.6%). Young women living in the traditional two parents with child or children families were also more likely to be in the older age group (87.1%). Of the young women living in households with more than two adults and children the majority (54.2%) were in the younger age group, it is possible that some of these young women were the children of older parents living in the family home together. In the general population the majority of those who received family credit were female (60.2%), amongst younger women receiving family credit the majority were in the older age group (72.7%).

Table 6.10 presents the number of respondents who own their own homes or live in rented accommodation. Information for both men and women is given so those young women can be compared with the general population

Table 6.10: Housing tenure of respondents.

Tenure	House owner (%)	Rented home (%)
Female	2080 (49.6)	657 (52.9)
CI	(48-51)	(50-56)
Male	2117 (50.4)	586 (47.1)
Female 20-24 years	172 (29.2)	97 (35.4)
CI	(26-33)	(30-41)
Female 25-34 years	417 (70.8)	177 (64.6)

Table 6.10 showed that homeowners were equally likely to be male or female, but people who lived in rented accommodation were more likely to be female (52.9%), this suggests that women were more likely to live in poorer housing than men. Amongst young women homeowners only 29.2% fell into the younger age group, this proportion was higher for those living in rented accommodation (35.4%), although the confidence intervals overlapped.

Table 6.11 shows the bedroom standard of properties. Bed standard is used to give an indication of the quality of the accommodation in a particular property in relation to the number of individuals living in the property. A home that meets the bed standard of a family will have more space for individual family members than one that is below the bed standard, but less than one that is above it.

Table 6.11: Bedroom standard of respondents.

Bed standard	Below (%)	Meets (%)	Above (%)
Female	104 (47.3)	704 (48.6)	1951 (51.0)
CI (%)	(41-54)	(46-51)	(49-53)
Male	116 (52.7)	745 (51.4)	1871 (49.0)
♀ 20-24 yrs	18 (41.9)	113 (35.8)	137 (27.4)
CI	(28-57)	(31-41)	(24-31)
♀ 25-34 yrs	25 (58.1)	203 (64.2)	363 (72.6)

Table 6.11 showed that people who lived in accommodation that failed to meet the bed standard were more likely to be male (52.7%), this was also true of people who lived in accommodation that met the bed standard (51.4%). As young women became older they were less likely to live in accommodation that failed to meet the bed standard. Only 27.4% of those young women living in accommodation above the bed standard were aged 20-24 years whilst 41.9% of those young women living in accommodation that failed to meet the bed standard were in this age group.

Table 6.12 shows the number and percentage of respondents that have the use of a car. Car use is a particularly important measure of socio-demographic status since the use of a car enables people to shop in larger out of town supermarkets that often have cheaper prices and more choice than local shops.

Table 6.12: Car use amongst respondents.

Use of car	Yes (%)	No (%)
Female	2114 (49.2)	680 (54.5)
CI	(48-51)	(52-57)
Male	2183 (50.8)	568 (45.5)
Female 20-24 years	185 (27.2)	90 (45.7)
CI	(24-31)	(39-53)
Female 25-34 years	494 (72.8)	107 (54.3)

Table 6.12 showed that the people who had the use of a car were almost equally divided into men and women. Of those people who did not have the use of a car 54.4% were female. The 95% confidence intervals are narrow and do not overlap indicating that not having the use of a car is more likely to affect women than men. Amongst young women the very young women (20-24 years) are much less likely to have the use of a car than older women.

Table 6.13 shows the marital status of men and women in the general population and compares this to the marital status of young women.

Table 6.13: Marital status of respondents.

Gender	Married (%)	Single (%)	Partner (%)	Separated (%)	Divorced (%)
Female	1750 (51.0)	508 (39.9)	168 (54.0)	50 (64.1)	148 (64.9)
CI	(47-50)	(37-43)	(48-59)	(53-74)	(59-71)
Male	1682 (49.0)	764 (60.1)	143 (46.0)	28 (35.9)	80 (35.1)
Female 20-24 yrs	60 (13.2)	172 (66.9)	40 (35.1)	3 (13.0)	3 (9.1)
CI	(10-17)	(61-72)	(27-44)	(5-32)	(3-24)
Female 25-34 yrs	393 (86.8)	85 (33.1)	74 (64.9)	20 (87.0)	30 (90.9)

Table 6.13 showed that single people were much less likely to be women (39.9%) than men (60.1%). People who regarded themselves as separated were also much more likely to be women (64.1%), as were people who were divorced (64.9%). Since equal numbers of men and women must be separated or divorced this suggested that men are more likely to remarry or live with a new partner

Aim

To examine the relationships between different socio-economic variables.

The relationship between qualifications and employment was assessed by looking to see how many women with different levels of qualifications fell into manual and non-manual groups. The results of this analysis are shown in table 6.14. Data were available on education and employment for a total of 863 women.

Table 6.14: Number of women with qualifications in manual and non-manual employment.

	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
Non-manual	36 (32)	287 (62)	202 (71)
Manual	61 (55)	162 (34)	58 (20)
Never worked	14 (13)	19 (4)	24 (9)

The results in table 6.14 showed that women with 'A' level or higher qualifications were more likely than other women to be employed in non-manual occupations. 71% of women with 'A' level qualifications or higher were employed in non-manual jobs compared with 62% of women with other qualifications and only 32% of women with no qualifications. These results suggest that there is a correlation between qualifications and employment.

A similar analysis was done to see if there was a correlation between levels of qualification and home ownership. The results of this analysis are shown in table 6.15. Data were available on qualifications and home ownership for 857 women.

Table 6.15: Number of women with qualifications, living in their own home or rented accommodation.

House owner	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
Yes	36 (32)	321 (69)	230 (82)
No	75 (68)	143 (31)	52 (18)

The results in table 6.15 show a clear association between home ownership and level of qualification. Only 32% of women with no formal qualifications own their own homes, this figure increased to 69% for women with some qualifications and rises to 82% for women with an 'A' level qualification or higher.

Table 6.16 shows the results obtained by looking at the relationship between levels of qualifications and the use of a car. Data were available on car use and qualifications for 871 women.

Table 6.16: Car use in women by level of qualifications.

Use of car	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
Yes	60 (54)	372 (79)	244 (85)
No	51 (46)	100 (21)	44 (15)

The results shown in table 6.16 show an association between having the use of a car and increasing level of qualifications. Women who have an 'A' level or higher qualification are most likely to have the use of a car (85%), women with other qualifications are less likely to have the use of a car (79%) and women with no qualifications are least likely (54%), to have the use of a car.

Table 6.17 shows the results obtained when women with various qualifications were divided into groups according to the region of England in which they live. A total of 873 women were included in the analysis.

Table 6.17: Women's level of qualification by the region in which they live.

Region	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
North	46 (41)	130 (24)	66 (20)
Midlands	30 (27)	100 (18)	48 (15)
South	35 (32)	316 (58)	214 (65)

The results shown in table 6.17 indicate that 65% of women with an 'A' level qualification or higher live in the South of England. A total of 32% of women with no formal qualifications also live in the South of England.

The results in table 6.18 were obtained by dividing women into groups according to their level of qualifications and the presence of a partner in the household. Information was available for 874 women.

Table 6.18: Number of women with qualifications who have a partner present.

Presence of partner	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
Yes	79 (71)	313 (66)	164 (57)
No	33 (29)	161 (34)	124 (43)

The results shown in table 6.18 suggest that women with an 'A' level qualification (57%) are less likely to live with a partner than women with fewer (66%) or no qualifications are (71%). There is an association between level of qualification and presence of a partner.

Table 6.19 shows the numbers of women receiving family credit and their level of qualification. Data were available for 877 women.

Table 6.19: Number of women with qualifications who receive family credit.

Receiving family credit	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
Yes	8 (7)	23 (5)	3 (1)
No	105 (93)	451 (95)	287 (99)

There is a small increase in the percentage of women who receive family credit as the level of qualification reduces. Only 1% of women who have an 'A' level qualification receives family credit, but 7% of women with no qualifications are in receipt of family credit.
The relationship between qualifications and BMI is explored in table 6.20, 800 women are included in the analysis.

Table 6.20: Women's Body Mass Index and qualifications.

BMI kg/m^2	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
<20	34(28)	59 (13)	11 (4)
20-25	49 (40)	239 (54)	177 (73)
26-30	32 (26)	102 (23)	41 (17)
>30	7 (6)	43 (10)	16 (6)

The results in table 6.20 show that BMI is related to level of qualification. Of women with an 'A' level 73% are normal body weight and 17% overweight. 23% of women with fewer qualifications are overweight and 26% of women with no formal qualification. There is no relationship between obesity and qualifications, although this may be due to the number of women being too small to make meaningful comparisons.
The relationship between qualifications and smoking cigarettes is explored in table 6.21, 870 women are included in the analysis.

Table 6.21: Cigarette smoking and qualifications.

Cigarette smoking	No formal qualification. (%)	Other qualification (%)	'A' levels or higher (%)
Current smoker	53 (48)	174 (41)	67 (23)
Ex-smoker	26 (24)	118 (28)	90 (32)
Never smoked	31 (28)	128 (30)	128 (45)

The results in table 6.21 show that cigarette smoking is related to level of qualification. Of women with an 'A' level only 23% are current smokers, compared with 41% of women with other qualifications and 48% of women with no formal qualification.

The relationship between socio-economic group and tenure is explored in table 6.22, 851 women are included in the analysis.

Table 6.22: Socio-economic group of women living in their own home or rented accommodation.

House owner	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
Yes	395 (77)	157 (56)	27 (47)
No	121 (23)	121 (44)	30 (53)

The results in table 6.22 show a clear association between home ownership and type of employment. Only 47% of women who have never worked own their own homes, this figure increased to 56% for women in manual employment and rises to 77% for women in non-manual employment.

Table 6.23 shows the results obtained by looking at the relationship between type of employment and the use of a car. Data were available on car use and employment for 866 women.

Table 6.23: Car use in women by socio-economic group.

Use of car	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
Yes	446 (85)	194 (68)	31 (54)
No	79 (15)	90 (32)	26 (46)

The results shown in table 6.23 show an association between having the use of a car and socio-economic group. Women who are in non-manual employment are more likely to have the use of a car (85%), than women who were in manual employment (68%) or women who had never worked (54%) were.

Table 6.24 shows the results obtained when women in different socio-economic groups were divided according to the Region of England in which they live. A total of 887 women were included in the analysis.

Table 6.24: Women's socio-economic group and the region in which they live.

Region	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
North	130 (25)	90 (31)	15 (20)
Midlands	91 (17)	70 (25)	15 (19)
South	303 (58)	124 (44)	47 (61)

The results shown in table 6.24 indicate that 58% of women in non-manual employment live in the South of England. A total of 61% of women who have never worked also live in the South of England, as do 44% of those women in manual employment. There is no relationship between type of employment and region in which the women live.

The results in table 6.25 were obtained by dividing women into socio-economic groups according the presence of a partner in the household. Information was available for 867 women.

Table 6.25: Socio-economic group of women who have a partner present.

Presence of partner	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
Yes	349 (66)	185 (65)	19 (33)
No	178 (34)	98 (35)	38 (67)

The results shown in table 6.25 suggest that women with non-manual employment were as likely as women in manual employment (66%) were to live with a partner. Women who had never worked were less likely to have a partner present (33%).

Table 6.26 shows the numbers of women receiving family credit and their socio-economic group. Data were available for 868 women.

Table 6.26: Socio-economic group of women who receive family credit.

Receiving family credit	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
Yes	14 (3)	18 (6)	1 (0)
No	513 (97)	266 (94)	56 (99)

Table 6.26 shows that there is no relationship between socio-economic group and the receipt of family credit in this group of women.

The relationship between socio-economic group and BMI is explored in table 6.27, 805 women are included in the analysis.

Table 6.27: Women's Body Mass Index and socio-economic group.

BMI kg/m^2	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
<20	62 (13)	30 (12)	11 (21)
20-25	286 (58)	144 (55)	31 (58)
26-30	105 (21)	61 (23)	8 (15)
>30	39 (8)	25 (10)	3 (6)

The results in table 6.27 show that BMI is not related to socio-economic group in this sample of women.

The relationship between socio-economic group and smoking cigarettes is explored in table 6.28, 862 women are included in the analysis.

Table 6.28: Cigarette smoking and women's socio-economic group.

Cigarette smoking	Non-manual employment. (%)	Manual employment (%)	Never worked (%)
Current smoker	145 (28)	131 (47)	18 (31)
Ex-smoker	161 (31)	60 (21)	10 (17)
Never smoked	216 (41)	91 (32)	30 (52)

The results in table 6.28 suggest that women in manual employment were more likely to be current smokers than other women were. Women in manual employment were also less likely to have never smoked than other women were.

Appendix 4: Knowledge and fat and fruit and vegetable intake.

Table 6.29: Fruit and vegetable intake of young women by ability to explain 'polyunsaturated fat' and 'saturated fat' with 95% confidence intervals.

Ability to explain terms	Confident (%)	Not Confident (%)
'polyunsaturated fat'?		
Fruit & vegetable intake		
Low	211 (47.3)	226 (52.8)
High	235 (52.7, CI 56-65)	202 (47.2, CI 43-52)
Fat intake		
Low	133 (31.4, CI 27-36)	98 (24.7, CI 21-29)
High	291 (68.6)	298 (75.3)
'saturated fat?'		
Fruit & vegetable intake		
Low	269 (50.8)	169 (49.0)
High	261 (49.2, CI 45-53)	176 (51.0, CI 46-56)
Fat intake		
Low	153 (30.7, CI 27-35)	78 (24.2, CI 20-29)
High	345 (69.3)	244 (75.8)

Table 6.30: Fruit and vegetable and fat intake of young women by knowledge about reducing chances of heart disease with 95% confidence intervals.

Knowledge	No (%)	Yes (%)
Controlling body weight?		
Fruit & vegetable intake		
Low	139 (57.0)	299 (47.3)
High	105 (43.0, C I 37-49)	333 (52.7, CI 49-57)
Fat intake		
Low	56 (24.1, CI 19-30)	174 (29.6, CI 26-33)
High	176 (75.9)	413 (70.4)
Reducing fat intake?		
Fruit & vegetable intake		
Low	85 (56.7)	352 (48.6)
High	65 (43.3, CI 36-51)	372 (51.4, CI 48-55)
Fat intake		
Low	31 (22.3, CI 16-30)	199 (29.2, CI 26-33)
High	108 (77.7)	482 (70.8)
Fresh fruit & veg?		
Fruit & vegetable intake		
Low	232 (54.5)	205 (45.7)
High	194 (45.5, CI 41-50)	244 (54.3, CI 50-59)
Fat intake		
Low	111 (27.7, CI 24-32)	120 (28.6, CI)
High	290 (72.3)	299 (71.4)

Table 6.31: Fruit and vegetable and fat intake of young women by knowledge that foods are high in fat with 95% confidence intervals.

Food high in fat?	No (%)	Yes (%)
Red meat		
Fruit & vegetable intake		
Low	233 (52.5)	205 (47.5)
High	211 (47.5, CI 43-52)	227 (52.5, CI 48-57)
Fat intake		
Low	95 (23.3, CI 19-28)	135 (32.8, CI 28-37)
High	313 (76.7)	277 (67.2)
Pies etc. high in fat?		
Fruit & vegetable intake		
Low	199 (54.1)	238 (46.9)
High	169 (45.9, CI 41-51)	269 (53.1,CI 49-57)
Fat intake		
Low	89 (25.8, CI 21-31)	142 (29.9, CI 26-34)
High	256 (74.2)	333 (70.1)
Whole milk		
Fruit & vegetable intake		
Low	146 (55.1)	292 (47.8)
High	119 (44.9, CI 39-51)	319 (52.2, CI 48-56)
Fat intake		
Low	61 (24.7, C|I 20-30)	170 (29.7, CI 26-34)
High	186 (75.3)	403 (70.3)

Table 6.32: Fruit and vegetable and fat intake of young women by knowledge that soft margarine is high in fat with 95% confidence intervals.

Knowledge	No (%)	Yes (%0
Soft margarine high in fat?		
Fruit & vegetable intake		
Low	222 (54.5)	215 (46.0)
High	185 (45.5, CI 41-50)	252 (54.0, CI 49-58)
Fat intake		
Low	92 (24.1, CI 20-29)	139 (31.7, CI 28-36)
High	290 (75.9)	299 (68.3)
Butter high in fat?		
Fruit & vegetable intake		
Low	69 (53.5)	368 (49.3)
High	60 (46.5, CI 38-55)	378 (50.7, CI 47-54)
Fat intake		
Low	23 (19.0, CI 13-27)	208 (29.8, CI 26-33)
High	98 (81.0)	491 (70.2)

Table 6.33: Fruit and vegetable and fat intake of young women by knowledge about a healthy diet with 95% confidence intervals.

Knowledge	No (%)	Yes (%)
Well balanced?		
Fruit & vegetable intake		
Low	386 (52.6)	51 (36.2)
High	348 (47.4, CI 44-51)	90 (63.8, CI 56-71)
Fat intake		
Low	190 (27.3, CI 24-31)	41 (33.1, CI 25-42)
High	506 (72.7)	83 (66.9)
Fresh fruit?		
Fruit & vegetable intake		
Low	95 (53.4)	343 (49.1)
High	83 (46.6, CI 39-54)	355 (50.9, CI 47-55)
Fat intake		
Low	48 (28.6, CI 22-36)	183 (28.1, CI 25-32)
High	120 (71.4)	469 (71.9)

Table 6.34: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for education and lack of education on the influence of knowledge on low fat intake in young women using logistic regression analysis.

Knowledge	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI) stratified for lower qualification	Low fat OR (95%CI) stratified for higher qualification
Knowledge of the fat content of;			
Red meat	1.61 (1.18-2.19)	1.35 (0.88-2.07)	1.62 (0.97-2.73)
Pies, pasties and quiches	1.23 (0.90-1.68)	1.08 (0.70-1.66)	0.97 (0.58-1.64)
Whole milk	1.28 (0.91-1.80)	1.15 (0.72-1.83)	1.23 (0.64-2.35)
Soft margarine	1.48 (1.08-2.01)	1.16 (0.76-1.78)	2.01 (1.17-3.45)
Butter	1.85 (1.14-3.00)	1.30 (0.67-2.50)	7.07 (1.82-27.53)
Knowledge about a healthy diet;			
Should be well balanced	1.31 (0.87-1.97)	1.73 (0.98-3.02)	0.80 (0.42-1.51)
Did not know (reference)	1	1	1

Table 6.35: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for education and lack of education on the influence of knowledge on high fruit and vegetable intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for high fruit & veg. Intake	High fruit & veg. OR (95% CI) stratified for lower qualification	OR (95% CI) stratified for higher qualification
Knowledge of the fat content of;			
Red meat	1.22 (0.94-1.59)	0.98 (0.68-1.41)	1.33 (0.83-2.14)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.11 (0.77-1.61)	1.64 (1.01-2.67)
Whole milk	1.35 (1.01-1.80)	0.97 (0.65-1.43)	1.20 (0.67-2.17)
Soft margarine	1.40 (1.07-1.83)	1.36 (0.95-1.96)	1.08 (0.67-1.74)
Butter	1.19 (0.82-1.73)	1.02 (0.60-1.73)	1.29 (0.62-2.66)
Knowledge about a healthy diet,			
Should be well balanced	1.96 (1.35-2.84)	1.85 (1.11-3.09)	1.49 (0.83-2.68)
Did not know (reference)	1	1	1

Table 6.36: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for manual and non-manual employment on the influence of knowledge on low fat intake in young women using logistic regression analysis.

Knowledge	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI) stratified for manual employment	Low fat OR (95%CI) Stratified for non-manual employment
Knowledge of the fat content of;			
Red meat	1.61 (1.18-2.19)	1.22 01.69-2.16)	1.93 (1.29-2.87)
Pies, pasties and quiches	1.23 (0.90-1.68)	1.20 (0.67-2.13)	1.22 (0.82-1.83)
Whole milk	1.28 (0.91-1.80)	1.44 (0.80-2.62)	1.10 (0.70-1.75)
Soft margarine	1.48 (1.08-2.01)	1.00 (0.56-1.78)	1.66 (1.10-2.48)
Butter	1.85 (1.14-3.00)	1.37 (0.61-3.05)	2.41 (1.17-4.95)
Knowledge about a healthy diet;			
Should be well balanced	1.31 (0.87-1.97)	1.56 (0.66-3.72)	1.01 (0.61-1.67)
Did not know (reference)	1	1	1

Table 6.37: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for manual and non-manual employment on the influence of knowledge on high fruit and vegetable intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for high fruit & veg. Intake	High fruit & vegetable OR (95% CI) stratified for manual employment	High fruit & vegetable OR (95% CI) stratified for non-manual employment
Knowledge of the fat content of;			
Red meat	1.22 (0.94-1.59)	1.12 (0.69-1.81)	1.17 (0.83-1.66)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.19 (0.74-1.93)	1.39 (0.98-1.97)
Whole milk	1.35 (1.01-1.80)	1.08 (0.67-1.77)	1.23 (0.82-1.84)
Soft margarine	1.40 (1.07-1.83)	1.42 (0.88-2.29)	1.29 (0.91-1.83)
Butter	1.19 (0.82-1.73)	1.06 (0.56-2.00)	1.02 (0.60-1.73)
Knowledge about a healthy diet;			
Should be well balanced	1.96 (1.35-2.84)	1.25 (0.59-2.65)	1.86 (1.17-2.96)
Did not know (reference)	1	1	1

Table 6.38: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for homeownership and rented accommodation on the influence of knowledge on low fat intake in young women using logistic regression analysis.

Knowledge	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI) stratified for rented accommodation	Low fat OR (95%CI) stratified for homeownership
Knowledge of the fat content of;			
Red meat	1.61 (1.18-2.19)	1.77 (1.00-3.14)	1.57 (1.08-2.28)
Pies, pasties and quiches	1.23 (0.90-1.68)	1.21 (0.68-2.14)	1.13 (0.77-1.65)
Whole milk	1.28 (0.91-1.80)	1.49 (0.80-2.75)	1.14 (0.75-1.73)
Soft margarine	1.48 (1.08-2.01)	1.69 (0.95-3.00)	1.29 (0.89-1.87)
Butter	1.85 (1.14-3.00)	1.47 (0.65-3.31)	1.94 (1.05-3.57)
Knowledge about a healthy diet;			
Should be well balanced	1.31 (0.87-1.97)	2.72 (1.16-6.34)	1.00 (0.62-1.62)
Did not know (reference)	1	1	1

Table 6.39: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for tenure on the influence of knowledge on high fruit and vegetable intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for high fruit & veg. Intake	OR (95% CI) for high fruit & veg stratified for rented accommodation	OR (95% CI) for high fruit & veg. Stratified for homeownership
Knowledge of the fat content of;			
Red meat	1.22 (0.94-1.59)	1.56 (0.95-2.55)	1.02 (0.74-1.42)
Pies, pasties and quiches	1.33 (1.02-1.74)	0.90 (0.55-1.47)	1.40 (1.00-1.96)
Whole milk	1.35 (1.01-1.80)	1.30 (0.97-1.75)	1.40 (0.96-1.98)
Soft margarine	1.40 (1.07-1.83)	1.32 (0.81-2.16)	1.33 (0.96-1.84)
Butter	1.19 (0.82-1.73)	1.10 (0.53-2.12)	1.11 (0.69-1.79)
Knowledge about a healthy diet;			
Should be well balanced	1.96 (1.35-2.84)	1.45 (0.65-3.23)	1.89 (1.22-2.92)
Did not know (reference)	1	1	1

Table 6.40: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for car use and lack of car on the influence of knowledge on low fat intake in young women using logistic regression analysis.

Knowledge	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI) stratified for no car	Low fat OR (95%CI) stratified for use of car
Knowledge of the fat content of;			
Red meat	1.61 (1.18-2.19)	1.85 (0.92-3.74)	1.55 (1.10-2.19)
Pies, pasties and quiches	1.23 (0.90-1.68)	1.35 (0.64-2.71)	1.18 (0.83-1.68)
Whole milk	1.28 (0.91-1.80)	1.85 (0.88-3.89)	1.11 (0.76-1.64)
Soft margarine	1.48 (1.08-2.01)	1.65 (0.82-3.29)	1.41 (1.00-2.00)
Butter	1.85 (1.14-3.00)	1.64 (0.62-4.38)	1.85 (1.06-3.24)
Knowledge about a healthy diet;			
Should be well balanced	1.31 (0.87-1.97)	1.40 (0.48-4.08)	1.24 (0.79-1.93)
Did not know (reference)	1	1	1

Table 6.41: Stratified odds ratios (OR) with their respective 95% confidence intervals (95%CI) for car use and lack of a car on the influence of knowledge on high fruit and vegetable intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for high fruit & vegetable intake	OR (95% CI) stratified for lack of car	High fruit & veg. OR (95% CI) stratified for car use
Knowledge of the fat content of;			
Red meat	1.22 (0.94-1.59)	1.41 (0.79-2.51)	1.20 (0.89-1.62)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.00 (0.56-1.78)	1.44 (1.06-1.96)
Whole milk	1.35 (1.01-1.80)	1.34 (0.74-2.43)	1.28 (0.91-1.79)
Soft margarine	1.40 (1.07-1.83)	1.58 (0.88-2.81)	1.35 (1.00-1.83)
Butter	1.19 (0.82-1.73)	2.85 (1.20-6.77)	0.91 (0.58-1.41)
Knowledge about a healthy diet;			
Should be well balanced	1.96 (1.35-2.84)	2.36 (0.94-5.94)	1.80 (1.19-2.71)
Did not know *(reference)*	1	1	1

Table 6.42: Stratified odds ratios (OR) with their respective 95% confidence intervals (95%CI) for current cigarette smoking, past cigarette smoking and never smoked on the influence of knowledge on low fat intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for low fat intake	Low fat OR (95% CI) stratified for current smoker	Low fat OR (95% CI) stratified for ex smoker	Low fat OR (95% CI) stratified for never smoked
Knowledge of the fat content of;				
Red meat	1.22 (0.94-1.59)	1.35 (0.79-2.31)	1.73 (0.94-3.17)	1.75 (1.07-2.85)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.35 (0.78-2.35)	0.91 (0.50-1.66)	1.37 (0.84-2.23)
Whole milk	1.35 (1.01-1.80)	1.57 (0.89-2.80)	0.99 (0.49-2.03)	1.18 (0.69-2.02)
Soft margarine	1.40 (1.07-1.83)	1.44 (0.84-2.47)	1.67 (0.90-3.10)	1.33 (0.81-2.16)
Butter	1.19 (0.82-1.73)	0.94 (0.50-1.92)	2.06 (0.74-5.72)	3.65 (1.43-9.37)
Knowledge about a healthy diet;				
Should be well balanced	1.96 (1.35-2.84)	2.15 (1.04-4.44)	0.85 (0.37-1.94)	1.15 (0.61-2.16)
Did not know (reference)	1	1		1

Table 6.43: Stratified odds ratios (OR) with their respective 95% confidence intervals (95%CI) for current cigarette smoking, past cigarette smoking and never smoked on the influence of knowledge on high fruit and vegetable intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for high fruit & vegetable intake	High fruit & veg. OR (95% CI) stratified for current smoker	High fruit & veg. OR (95% CI) stratified for ex smoker	High fruit & veg. OR (95% CI) stratified for never smoked
Knowledge of the fat content of;				
Red meat	1.22 (0.94-1.59)	0.99 (0.62-1.58)	1.41 (0.83-2.28)	1.24 (0.81-1.90)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.24 (0.77-2.01)	1.40 (0.82-2.39)	1.41 (0.92-2.16)
Whole milk	1.35 (1.01-1.80)	0.96 (0.59-1.56)	1.47 (0.78-2.78)	1.39 (0.88-2.20)
Soft margarine	1.40 (1.07-1.83)	1.28 (0.80-2.05)	2.13 (1.25-3.64)	1.03 (0.67-1.57)
Butter	1.19 (0.82-1.73)	1.01 (0.54-1.90)	4.25 (1.79-10.10)	0.68 (0.37-1.24)
Knowledge about a healthy diet;				
Should be well balanced	1.96 (1.35-2.84)	1.41 (0.72-2.76)	2.48 (1.13-5.41)	2.11 (1.18-3.78)
Did not know (reference)	1	1		1

Table 6.44: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for BMI on the influence of knowledge on low fat intake in young women using logistic regression analysis.

Knowledge	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI) stratified for BMI <20 kg/m^2	Low fat OR (95%CI) stratified for BMI 20-25 kg/m^2	Low fat OR (95%CI) stratified for BMI 26-30 kg/m^2	Low fat OR (95%CI) stratified for BMI >30 kg/m^2
Knowledge of the fat content of;					
Red meat	1.61 (1.18-2.19)	1.54 (0.57-4.11)	1.47 (0.98-2.23)	2.24 (1.13-4.46)	1.37 (0.45-4.14)
Pies, pasties and quiches	1.23 (0.90-1.68)	0.71 (0.27-1.87)	1.26 (0.83-1.91)	1.90 (0.93-3.73)	0.81 (0.25-2.67)
Whole milk	1.28 (0.91-1.80)	0.87 (0.34-2.77)	1.22 (0.77-1.91)	1.58 (0.74-3.36)	1.74 (0.40-7.64)
Soft margarine	1.48 (1.08-2.01)	0.75 (0.28-2.01)	1.53 (1.01-2.32)	1.45 (0.73-2.88)	2.91 (0.84-10.08)
Butter	1.85 (1.14-3.00)	0.87 (0.23-3.32)	2.25 (1.16-4.37)	1.93 (0.62-6.04)	1.41 (0.25-7.79)
Knowledge about a healthy diet;					
Should be well balanced	1.31 (0.87-1.97)	0.60 (0.16-2.30)	1.53 (0.91-2.58)	0.89 (0.31-2.58)	3.41 (0.73-15.83)
Did not know (reference)	1	1			1

Table 6.45: Stratified odds ratios (OR) with their respective 95% confidence intervals (95%CI) for BMI on the influence of knowledge on high fruit and vegetable intake in young women using logistic regression analysis.

Knowledge	Crude OR (95% CI) for high fruit & vegetable intake	High fruit & veg. OR (95% CI) stratified for BMI <20 kg/m^2	High fruit & veg. OR (95% CI) stratified for BMI 20-25 kg/m^2	High fruit & veg. OR (95% CI) stratified for BMI 26-30 kg/m^2	High fruit & veg. OR (95% CI) stratified for BMI >30 kg/m^2
Knowledge of the fat content of;					
Red meat	1.22 (0.94-1.59)	1.50 (0.69-3.23)	0.92 (0.64-1.32)	1.45 (0.82-2.73)	3.26 (1.20-8.87)
Pies, pasties and quiches	1.33 (1.02-1.74)	1.21 (0.56-2.62)	1.36 (0.94-1.96)	1.86 (1.00-3.48)	0.80 (0.23-2.28)
Whole milk	1.35 (1.01-1.80)	1.06 (0.46-2.42)	1.92 (1.29-2.86)	0.69 (0.36-1.31)	2.24 (0.65-7.65)
Soft margarine	1.40 (1.07-1.83)	0.88 (0.41-1.90)	1.47 (1.02-2.11)	1.42 (0.77-2.60)	2.45 (0.89-6.72)
Butter	1.19 (0.82-1.73)	0.93 (0.31-2.83)	1.21 (0.73-2.00)	1.10 (0.46-2.66)	1.85 (0.43-8.05)
Knowledge about a healthy diet;					
Should be well balanced	1.96 (1.35-2.84)	2.56 (0.93-7.03)	1.87 (1.15-3.04)	1.78 (0.69-4.57)	2.18 (0.54-8.87)
Did not know (reference)	1	1	1	1	1

Appendix 5: Attitudes towards cooking methods and fat and fruit and vegetable intake.

Table 6.46: Fat and fruit and vegetable intake with 95% confidence intervals of women who had positive attitudes towards cooking methods.

Attitude	Negative (%)	Positive (%)
Boiling food		
Fruit & vegetable intake		
Low	28 (57.1)	409 (49.5)
High	21 (42.9, CI 30-57)	417 (50.5, CI 47-54)
Fat intake		
Low	14 (29.8, CI 19-44)	216 (27.9, CI 25-31)
High	33 (70.2)	557 (72.1)
Steaming food?		
Fruit & vegetable intake		
Low	223 (63.0)	214 (41.1)
High	131 (37.0, CI 32-42)	307 (58.9, CI 55-63)
Fat intake		
CI	(19-27)	(27-35)
Low	78 (23.7)	153 (31.1)
High	251 (76.3)	339 (68.9)
Shallow frying food?		
Fruit & vegetable intake		
Low	104 (55.0	333 (48.6)
High	85 (45.0, CI 38-52)	352 (51.4, CI 48-55)
Fat intake		
Low	75 (29.4, CI 25-38)	178 (27.7, CI 24-31)
High	125 (70.6)	464 (72.3)

Table 6.47: Fat and fruit and vegetable intake, with 95% confidence intervals of women who had positive attitudes towards cooking certain foods.

Attitude	Negative (%)	Positive (%)
Deep frying food?		
Fruit & vegetable intake		
Low	126 (47.4)	312 (51.2)
High	140 (52.6, CI 47-59)	297 (48.8, CI 45-53)
Fat intake		
Low	75 (29.9, CI 25-39)	156 (27.4, CI 24-31)
High	176 (70.1)	414 (72.6)
Grilling food?		
Fruit & vegetable intake		
Low	24 (55.8)	413 (49.7)
High	19 (44.2, CI 30-59)	418 (50.3, CI 47-54)
Fat intake		
Low	13 (31.0, CI 19-46)	218 (28.0, CI 25-31)
High	29 (69.0)	561 (72.0)

Table 6.48: Fat and fruit and vegetable intake, with 95% confidence intervals of women who had positive attitudes towards cooking certain foods.

Attitude	Negative (%)	Positive (%)
Cooking red meat?		
Fruit & vegetable intake		
Low	74 (44.6)	364 (51.3)
High	92 (55.4, CI 48-63)	346 (48.7, CI 45-52)
Fat intake		
Low	42 (26.6, CI 20-34)	188 (28.4, CI 25-32)
High	116 (73.4)	474 (71.6)
Cooking chicken?		
Fruit & vegetable intake		
Low	47 (50.0)	390 (49.9)
High	47 (50.0, CI 40-60)	391 (50.1, CI 47-54)
Fat intake		
Low	27 (29.3, CI 21-39)	204 (28.0, CI 25-31)
High	65 (70.7)	524 (72.0)
Cooking white fish?		
Fruit & vegetable intake		
Low	140 (57.4)	297 (47.1)
High	104 (42.6, CI 37-48)	333 (52.9, CI 49-57)
Fat intake		
Low	62 (27.0, CI 22-33)	168 (28.5, CI 25-32)

Table 6.49: Fat and fruit and vegetable intake with 95% confidence intervals of women who had positive attitudes towards cooking specific foods.

Attitudes	Negative (%)	Positive (%)
Cooking oily fish?		
Fruit & vegetable intake		
Low	277 (55.5)	160 (42.6)
High	222 (44.5, CI 40-49)	216 (57.4, CI 52-62)
Fat intake		
Low	118 (25.4, CI 22-30)	113 (31.7, CI 27-37)
High	347 (74.6)	243 (68.3)
Cooking pulses?		
Fruit & vegetable intake		
Low	238 (56.0)	200 (44.3)
High	187 (44.0, CI 39-49)	251 (55.7, CI 51-61)
Fat intake		
Low	92 (23.3, CI 19-28)	139 (32.6, CI 28-37)
High	303 (76.7)	287 (67.4)
Cooking pasta?		
Fruit & vegetable intake		
Low	73 (65.8)	364 (47.6)
High	38 (34.2, CI 26-43)	400 (52.4, CI 49-56)
Fat intake		
Low	21 (19.8, CI 13-28)	210 (29.4, CI 26-33)
High	85 (80.2)	505 (70.6)

Table 6.50: Fat and fruit and vegetable intake with 95% confidence intervals of women who had positive attitudes towards cooking rice and potatoes (not chips).

Attitudes	Negative (%)	Positive (%)
Cooking rice?		
Fruit & vegetable intake		
Low	71 (69.6)	366 (47.3)
High	31 (30.4, CI 22-40)	407 (52.7, CI 49-56)
Fat intake		
Low	17 (17.3, CI 11-26)	214 (29.6, CI 26-33)
High	81 (82.7)	509 (70.4)
Cooking potatoes?		
Fruit & vegetable intake		
Low	16 (57.1)	422 (49.8)
High	12 (42.9, CI 27-61)	426 (50.2, CI 54-57)
Fat intake		
Low	7 (25.9, CI 13-45)	224 (28.2, CI 25-31)
High	20 (47.1)	569 (71.8)

Table 6.51: Fat and fruit and vegetable intake with 95% confidence intervals of women who had positive attitudes towards cooking vegetables.

Attitude	Negative (%)	Positive (%)
Cook fresh greens		
Fruit & vegetable intake		
Low	42 (67.7)	396 (48.6)
High	20 (32.3, CI 22-45)	418 (51.4, CI 48-55)
Fat intake		
Low	6 (10.5, CI 5-21)	225 (29.5, CI 26-33)
High	51 (89.5)	538 (70.5)
Cooking root vegetables?		
Fruit & vegetable intake		
Low	97 (69.8)	438 (47.5)
High	42 (30.2, CI 23-38)	472 (52.5, CI 49-55)
Fat intake		
Low	17 (18.7, CI 12-28)	213 (29.2, CI 26-33)
High	74 (81.3)	516 (70.8)

Table 6.52: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for higher and lower levels of education on the influence of positive attitudes towards cooking ability on high fruit and vegetable intake and low fat intake in young women using logistic regression analysis.

	Crude OR (95% CI) for high fruit & veg. Intake	High fruit & veg OR (95% CI) stratified for lower qualification	High fruit & veg OR (95% CI) stratified for higher qualification
Steam food	2.44 (1.85-3.22)	1.84 (1.27-2.67)	2.91 (1.75-4.85)
Cook oily fish	1.68 (1.28-2.20)	1.67 (1.15-2.41)	1.48 (0.92- 2.39)
Cook pulses	1.60 (1.23-2.09)	1.61 (1.12-2.32)	1.15 (0.71-1.86)
Cook pasta	2.11 (1.39-3.20)	1.31 (0.78-2.20)	3.18 (1.04-9.78)
Cook rice	2.60 (1.66-4.06)	1.57 (0.85-2.88)	3.62 (1.47-8.93)
Cook fresh green veg.	2.26 (1.30-3.93)	2.77 (1.16-6.60)	1.42 (0.56-3.61)
Cook root vegetables	2.56 (1.62-4.05)	1.73 (0.88-3.84)	4.13 (1.97-8.67)
	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI)	Low fat OR (95%CI)
Steam food	1.45 (1.06-2.00)	1.26 (0.82-1.94)	1.31 (0.76-2.28)
Cook oily fish	1.37 (1.01-1.86)	1.36 (0.89-2.09)	1.11 (0.67-1.84)
Cook pulses	1.60 (1.18-2.19)	1.61 (1.05-2.46)	1.44 (0.85-2.43)
Cook pasta	1.72 (1.03-2.85)	1.33 (0.70-2.50)	1.32 (0.37-4.71)
Cook rice	2.04 (1.18-3.54)	1.28 (0.62-2.64)	3.14 (0.94-10.47)
Cook fresh greens	3.53(1.50-8.35)	4.12 (1.06-16.04)	4.05 (0.88-18.71)
Cook root vegetables	1.75 (1.01-3.02)	1.44 (0.63-3.29)	1.75 (0.78-3.94)
Not confident *(reference)*	1	1	1

Table 6.53: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for non-manual and manual employment on the influence of positive attitudes towards cooking ability on high fruit and vegetable intake and low fat intake in young women using logistic regression analysis.

	Crude OR (95% CI) for high fruit & veg. Intake	High fruit & vegetable OR (95%CI) stratified for manual employment	High fruit & vegetable OR (95%CI) Stratified for non-manual employment
Steam food	2.44 (1.85-3.22)	2.10 (1.28-3.45)	2.58 (1.80-3.70)
Cook oily fish	1.68 (1.28-2.20)	1.81 (1.11-2.96)	1.61 (1.14-2.29)
Cook pulses	1.60 (1.23-2.09)	1.51 (0.93-2.44)	1.65 (1.17-2.33)
Cook pasta	2.11 (1.39-3.20)	2.31 (1.15-4.64)	1.82 (1.02-3.28)
Cook rice	2.60 (1.66-4.06)	2.07 (1.03-4.16)	2.39 (1.26-4.52)
Cook fresh greens	2.26 (1.30-3.93)	3.49 (1.04-11.68)	1.88 (0.90-3.93)
Cook root vegetables	2.56 (1.62-4.05)	2.70 (1.10-6.60)	3.07 (1.63-5.81)
	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI)	Low fat OR (95%CI)
Steam food	1.45 (1.06-2.00)	1.92 (1.05-3.50)	1.23 (0.82-1.84)
Shallow fry food	0.91 (0.63-1.32)	1.55 (0.75-3.22)	0.63 (0.40-1.00)
Cook oily fish	1.37 (1.01-1.86)	1.17 (0.66-2.09)	1.35 (0.91-1.98)
Cook pulses	1.60 (1.18-2.19)	1.23 (0.70-2.19)	1.85 (1.24-2.75)
Cook pasta	1.72 (1.03-2.85)	2.07 (0.88-4.89)	1.47 (0.72-3.00)
Cook rice	2.04 (1.18-3.54)	1.92 (0.80-4.60)	2.18 (0.97-4.90)
Cook fresh green veg.	3.53(1.50-8.35)	2.18 (0.55-8.64)	3.17 (1.03-9.76)
Cook root vegetables	1.75 (1.01-3.02)	1.42 (0.53-3.82)	1.69 (0.81-3.54)
Not confident (reference)	1	1	1

Table 6.54: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for car use and lack of a car on the influence of positive attitudes towards cooking ability on high fruit and vegetable intake and low fat intake in young women using logistic regression analysis.

	Crude OR (95% CI) for high fruit & veg. Intake	High fruit & veg OR (95% CI) stratified for lack of car	High fruit & veg. OR (95% CI) stratified for car use
Steam food	2.44 (1.85-3.22)	2.28 (1.26-4.13)	2.43 (1.77-3.34)
Cook oily fish	1.68 (1.28-2.20)	2.40 (1.29- 4.46)	1.46 (1.08- 1.97)
Cook pulses	1.60 (1.23-2.09)	2.12 (1.18-3.81)	1.46 (1.08-1.98)
Cook pasta	2.11 (1.39-3.20)	1.45 (0.70-3.02)	2.37 (1.41-3.98)
Cook rice	2.60 (1.66-4.06)	2.74 (1.20-6.25)	2.30 (1.34-3.96)
Cook fresh greens	2.26 (1.30-3.93)	2.45 (0.88-6.79)	1.89 (0.96-3.73)
Cook root vegetables	2.56 (1.62-4.05)	1.86 (0.83-4.18)	2.71 (1.55-4.76)
	Crude OR (95%CI) for low fat intake	Low fat OR (95% CI)	Low fat OR (95% CI)
Steam food	1.45 (1.06-2.00)	2.73 (1.31-5.68)	1.19 (0.83-1.70)
Cook oily fish	1.37 (1.01-1.86)	1.25 (0.60-2.58)	1.32 (0.94-1.86)
Cook pulses	1.60 (1.18-2.19)	1.32 (0.67-2.63)	1.65 (1.17-2.34)
Cook pasta	1.72 (1.03-2.85)	1.65 (0.66-4.12)	1.60 (0.86-2.96)
Cook rice	2.04 (1.18-3.54)	1.75 (0.67-4.58)	2.05 (1.04-4.05)
Cook fresh green veg.	3.53(1.50-8.35)	2.42 (0.62-9.34)	3.98(1.29-12.25)
Cook root vegetables	1.75 (1.01-3.02)	1.91 (0.68-5.38)	1.58 (0.83-3.03)
Not confident (reference)	1	1	1

Table 6.55: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for home ownership and rented accommodation to show the influence of positive attitudes towards cooking ability on high fruit and vegetable intake and low fat intake in young women using logistic regression analysis.

	Crude OR (95% CI) for high fruit & veg. Intake	OR (95% CI) for high fruit & veg stratified for rented accommodation	OR (95% CI) for high fruit & veg. Stratified for homeownership
Steam food	2.44 (1.85-3.22)	1.89 (1.13-3.13)	2.74 (1.95-3.86)
Cook oily fish	1.68 (1.28-2.20)	1.73 (1.04- 2.89)	1.54 (1.10- 2.13)
Cook pulses	1.60 (1.23-2.09)	1.78 (1.09-2.92)	1.47 (1.06-2.05)
Cook pasta	2.11 (1.39-3.20)	1.60 (0.81-3.17)	2.29 (1.34-3.93)
Cook rice	2.60 (1.66-4.06)	1.84 (0.92-3.67)	2.84 (1.56-5.19)
Cook fresh greens	2.26 (1.30-3.93)	4.02 (1.20-13.43)	1.60 (0.82-3.15)
Cook root vegetables	2.56 (1.62-4.05)	1.50 (0.68-3.27)	3.31 (1.86-5.92)
	Crude OR (95%CI) for low fat intake	Low fat OR (95% CI)	Low fat OR (95% CI)
Steam food	1.45 (1.06-2.00)	2.68 (1.43-5.01)	1.08 (0.74-1.58)
Cook oily fish	1.37 (1.01-1.86)	1.46 (0.82-2.62)	1.23 (0.85-1.77)
Cook pulses	1.60 (1.18-2.19)	2.06 (1.15-3.69)	1.46 (1.01-2.12)
Cook pasta	1.72 (1.03-2.85)	3.30 (1.22-8.94)	1.21 (0.66-2.24)
Cook rice	2.04 (1.18-3.54)	3.77 (1.31-10.82)	1.41 (0.72-2.76)
Cook fresh green veg.	3.53(1.50-8.35)	10.39(0.96-111.95)	2.35(1.35-12.31)
Cook root vegetables	1.75 (1.01-3.02)	1.39 (0.54-3.55)	2.07 (1.02-4.20)
Not confident (reference)	1	1	1

Table 6.56 Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for current cigarette smoking, past cigarette smoking and never smoked to show the influence of positive attitudes towards cooking ability on high fruit and vegetable intake and low fat intake in young women using logistic regression analysis.

	Crude OR (95% CI) for high fruit & veg. Intake	OR (95% CI) for high fruit & veg stratified for current smoker	OR (95% CI) for high fruit & veg stratified for ex smoker	OR (95% CI) for high fruit & veg. Stratified for never smoked
Steam food	2.44 (1.85-3.22)	1.77 (1.09-2.87)	2.98 (1.72-5.18)	2.73 (1.75-4.25)
Oily fish	1.68 (1.28-2.20)	1.41 (0.88-2.27)	1.75 (1.03-2.98)	1.75 (1.13-2.70)
Pulses	1.60 (1.23-2.09)	1.43 (0.89-2.28)	2.06 (1.21-3.51)	1.48 (0.97-2.27)
Pasta	2.11 (1.39-3.20)	2.23 (1.07-4.67)	3.56 (1.32-9.56)	1.44 (0.78-2.67)
Rice	2.60 (1.66-4.06)	2.77 (1.33-5.77)	3.43 (1.25-9.39)	1.66 (0.81-3.38)
Greens	2.26 (1.30-3.93)	2.59 (0.94-7.10)	3.67 (1.11-12.13)	1.45 (0.63-3.37)
Root veg.	2.56 (1.62-4.05)	2.75 (1.18-6.40)	3.25 (1.26-8.38)	2.05 (1.03-4.07)
	Crude OR (95%CI) for low fat intake	Low fat OR (95% CI)	Low fat OR (95% CI)	Low fat OR (95% CI)
Steam food	1.45 (1.06-2.00)	2.18 (1.23-3.85)	1.00 (0.54-1.85)	1.30 (0.79-2.13)
Oily fish	1.37 (1.01-1.86)	1.93 (1.12-3.32)	1.08 (0.60-1.94)	1.20 (0.74 1.94)
Pulses	1.60 (1.18-2.19)	1.14 (0.67-1.95)	2.64 (1.41-4.95)	1.48 (0.91-2.40)
Pasta	1.72 (1.03-2.85)	2.57 (1.01-6.57)	1.90 (0.56-6.43)	1.21 (0.59-2.47)
Rice	2.04 (1.18-3.54)	4.52 (1.55-13.23)	2.23 (0.61-8.20)	0.97 (0.44-2.13)
Greens	3.53(1.50-8.35)	4.07 (.86-19.17)	1.65 (0.39-6.86)	5.73 (1.19-27.64)
Root veg.	1.75 (1.01-3.02)	2.50 (0.89-7.02)	0.89 (0.32-2.45)	2.03 (0.86-4.80)
Not confident (reference)	1	1		1

Table 6.57: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for BMI on the influence of positive attitudes towards cooking ability on high fruit and vegetable intake in young women using logistic regression analysis.

	Crude OR (95% CI) for high fruit & vegetable intake	High fruit & veg. OR (95% CI) stratified for BMI <20 kg/m^2	High fruit & veg. OR (95% CI) stratified for BMI 20-25 kg/m^2	High fruit & veg. OR (95% CI) stratified for BMI 26-30 kg/m^2	High fruit & veg. OR (95% CI) stratified for BMI >30 kg/m^2
Steam food	2.44 (1.85-3.22)	3.03 (1.36-6.79)	2.49 (1.71-3.64)	2.81 (1.45-5.42)	2.04 (0.75-5.57)
Cook oily fish	1.68 (1.28-2.20)	2.22 (1.00-4.91)	1.29 (0.89-1.87)	2.27 (1.23-4.19)	2.17 (0.82-5.77)
Cook pulses	1.60 (1.23-2.09)	1.92 (0.88-4.18)	1.44 (1.00-2.07)	1.61 (0.88-2.95)	1.98 (0.75-5.22)
Cook pasta	2.11 (1.39-3.20)	2.18 (0.78-6.08)	1.79 (1.00-3.18)	3.37 (1.15-9.80)	3.09 (0.54-17.57)
Cook rice	2.60 (1.66-4.06)	1.89 (0.65-5.52)	3.13 (1.63-6.01)	3.30 (1.12-9.68)	3.42 (0.27-43.92)
Fresh green vegatables	2.26 (1.30-3.93)	3.15 (0.68-14.64)	1.64 (0.81-3.34)	2.18 (0.61-7.82)	N/A
Root vegetables	2.56 (1.62-4.05)	3.21 (0.96-10.72)	2.70 (1.48-4.89)	2.14 (0.73-6.31)	0.81 (7.75-83.64)
Not confident (reference)	1	1	1	1	1

Table 6.58: Odds ratios (OR) with their respective 95% confidence intervals (95%CI) stratified for BMI on the influence of positive attitudes towards cooking ability on low fat intake in young women using logistic regression analysis.

	Crude OR (95%CI) for low fat intake	Low fat OR (95%CI) stratified for BMI <20 kg/m^2	Low fat OR (95%CI) stratified for BMI 20-25 kg/m^2	Low fat OR (95%CI) stratified for BMI 26-30 kg/m^2	Low fat OR (95%CI) stratified for BMI >30 kg/m^2
Steam food	1.45 (1.06-2.00)	1.00 (0.38-2.68)	1.21 (0.79-1.84)	2.66 (1.25-5.66)	0.98 (0.32-3.01)
Cook oily fish	1.37 (1.01-1.86)	1.14 (0.43-3.04)	1.30 (0.86-1.97)	1.85 (0.95-3.63)	1.54 (0.51-4.66)
Cook pulses	1.60 (1.18-2.19)	1.10 (0.42-2.92)	1.48 (0.98-2.23)	2.56 (1.26-5.19)	2.17 (0.70-6.68)
Cook pasta	1.72 (1.03-2.85)	1.44 (0.38-5.48)	2.02 (0.96-4.28)	1.20 (0.44-3.23)	2.23 (0.30-16.34)
Cook rice	2.04 (1.18-3.54)	1.11 (0.28-4.34)	1.38 (0.68-2.79)	6.79 (1.33-34.70)	1.56 (0.12-20.33)
Cook fresh greens	3.53 (1.50-8.35)	2.07 (0.24-17.69)	2.91 (1.03-8.22)	7.74 (0.70-85.00)	N/A
Cook root vegetables	1.75 (1.01-3.02)	1.26 (0.29-5.38	2.27 (1.03-4.77)	1.16 (0.37-3.60)	N/A
Not confident (reference)	1	1	1	1	1

Appendix 6: Income and food choice National Food Survey data

Table 6.59 has been reprinted from the National Food Survey to show differences in nutrient intakes between income groups. Information in table B11from the NFS on the nutritional value of old age pensioners household food has been omitted as it was not felt to be relevant to this thesis.

Table 6.59: Nutritional value of household food by income group (MAFF 1998.)

		Income groups						
		Gross weekly income of head of household						
		Households with one or more earner				Households without an earner		
		£640 and over	£330 and under £640	£160 and under £330	Under £160	£160 and over	Under £160	O
		A	B	C	D	E1	E2	
		(i) intake per person per day						
Energy	(kcal)	1720	1640	1690	1610	2100	1800	2(
	(MJ)	7.2	6.9	7.1	6.7	8.8	7.6	
Total protein	(g)	64.5	61.7	63.1	57.7	77.6	65.3	
Animal protein	(g)	39.4	37.5	38.7	34.8	48.0	39.5	
Fat	(g)	74	70	74	68	90	76	
Fatty acids:								
saturated	(g)	29.6	27.7	28.4	26.9	36.3	29.4	
monounsaturated	(g)	26.1	25.0	26.5	24.0	31.6	27.0	
polyunsaturated	(g)	13.2	12.7	13.7	11.9	15.8	13.7	
Cholesterol	(mg)	225	207	218	204	280	232	
Carbohydrate,	(g)	211	202	206	203	260	228	
Of which:								
total sugars	(g)	87	79	79	83	116	91	
non-milk extrinsic sugars	(g)	45	42	44	49	64	54	
starch	(g)	124	123	127	121	144	137	
Fibre [a]	(g)	12.9	11.7	11.5	10.5	15.6	12.3	
Calcium	(mg)	800	770	770	750	980	840	
Iron	(mg)	10.1	9.4	9.5	8.6	12.1	10.0	
Zinc	(mg)	7.6	7.2	7.4	6.7	9.2	7.7	
Magnesium	(mg)	232	214	212	199	283	224	
Sodium	(g)	2.44	2.45	2.49	2.31	2.96	2.55	
Potassium	(g)	2.65	2.46	2.47	2.34	3.28	2.59	
Thiamin	(mg)	1.41	1.32	1.30	1.22	1.67	1.39	
Riboflavin	(mg)	1.71	1.59	1.61	1.53	2.08	1.76	
Niacin equivalent	(mg)	26.7	25.2	25.6	23.0	31.9	25.9	
Vitamin B6	(mg)	2.0	1.8	1.9	1.8	2.4	2.0	
Vitamin B12	(µg)	6.7	6.5	6.5	6.2	8.6	6.9	
Folate	(µg)	254	229	228	213	307	246	
Vitamin C	(mg)	78	60	52	48	81	52	
Vitamin A:								
retinol	(µg)	490	450	490	370	660	470	
β-carotene	(µg)	1900	1710	1600	1500	2250	1490	1
total (retinol equivalent)	(µg)	800	740	750	620	1030	720	1
Vitamin D	(µg)	3.01	3.13	3.10	2.67	4.22	3.39	
Vitamin E	(mg)	9.55	9.36	9.90	8.50	11.69	9.87	
		(ii) as a percentage of Reference Nutrient Intake [b]						
Energy [c]		86	81	81	77	94	87	
Protein		154	144	141	130	150	147	
Calcium		123	117	113	108	131	122	
Iron		99	91	90	81	123	96	
Zinc		101	93	93	85	106	96	
Magnesium		95	85	81	76	95	86	
Sodium		177	174	170	156	177	172	
Potassium		91	83	79	75	90	83	
Thiamin		176	163	155	147	185	167	
Riboflavin		160	146	143	135	165	155	
Niacin equivalent		201	187	185	167	216	189	
Vitamin B6		170	158	155	145	173	165	
Vitamin B12		524	497	480	451	547	505	
Folate		145	128	123	115	146	131	
Vitamin C		216	164	136	126	192	133	
Vitamin A (retinol equivalent)		138	124	123	101	151	115	
		(iii) as a percentage of food energy						
Fat		38.9	38.7	39.3	38.0	38.7	37.9	
Of which:								
saturated fatty acids		15.5	15.2	15.1	15.1	15.6	14.7	
Carbohydrates		46.1	46.3	45.8	47.6	46.5	47.6	
		(iv) contribution to selected nutrients from soft and alcoholic drinks and confectioner						
Energy	(kcal)	130	120	110	80	130	90	
	(MJ)	0.6	0.5	0.5	0.4	0.5	0.4	
Fat	(g)	2	2	2	1	2	1	
Carbohydrate	(g)	17	19	18	16	17	17	
Alcohol	(g)	8.0	4.3	2.9	1.6	6.0	1.8	

(a) as non-starch polysaccharides
(b) Department of Health, *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*, HMSO, 1991
(c) as a percentage of Estimated Average Requirement

Table 6.59 showed that low-income households (category D, head of the household earning less than £160/week) met RNI's for all nutrients except, iron, zinc, magnesium, and potassium. Low income households also failed to meet the EAR for energy intake. Intakes were converted to % RNI using food consumption tables *(MAFF 1998)*. Trends in other nutrient intakes across the income brackets have been highlighted in table 6.60

Table 6.60: Nutrient intake as percentage of RNI per person per day.

	Gross weekly income of Head of household			
Nutrient, % of RNI	£640 and over	£330-£640	£160-£330	£160 and under
Calcium (mg)	123	117	113	108
Thiamin (mg)	176	163	155	147
Riboflavin (mg)	160	146	143	135
Niacin equivalent (mg)	201	187	185	167
Vitamin B6 (mg)	170	158	155	145
Vitamin B12 (μg)	524	497	480	451
Folate (μg)	145	128	123	115
Vitamin C (mg)	216	164	136	126
Vitamin A (retinol equivalent, μg)	138	124	123	101

Table 6.60 shows that although RNI for the nine nutrients are met by all the income groups there is a trend for intake to decrease as income levels are reduced. These trends do not take into account the differences in amount spent on eating away from the home between the income groups. Those households whose head was earning less than £160 per week spent £ 2.41 per person per week away from the home, and those households whose head was earning £640 and over per week spent on average £10.23 per person per week on food and drink. Table 6.61 shows the nutritional value of the extra food purchased by each income group.

Table 6.61: Nutritional value of food and drink (/person/day) eaten out by income group by head of household (MAFF 1998).

	Gross weekly income of Head of household			
Nutrient	£640 and over	£330-£640	£160-£330	£160 and under
Energy (Kcals)	375	330	270	200
Fat (g)	17	15	12	9
Protein (g)	12.4	9.8	7.9	5.6
Iron (mg)	1.8	1.5	1.2	0.8
Zinc (mg)	1.4	1.1	0.9	0.7
Magnesium (mg)	46	40	31	23
Potassium (g)	0.49	0.43	0.34	0.25
Calcium (mg)	109	98	77	59
Thiamin (mg)	0.22	0.20	0.16	0.12
Riboflavin (mg)	0.21	0.18	0.14	0.10
Niacin equivalent (mg)	6.0	4.9	3.9	2.6
Vitamin B6 (mg)	0.4	0.3	0.3	0.2
Vitamin B12 (µg)	0.9	0.7	0.5	0.3
Folate (µg)	42	37	29	21
Vitamin C (mg)	13	11	9	6
Vitamin A (retinol equivalent, µg)	95	85	59	29

The results in table 6.61 indicate that there is a trend towards an increasing consumption of nutrients obtained from food purchased outside the home as the gross weekly income of the head of household increases. This trend would increase the difference in daily nutrient consumption between low and high-income households.

Further data has been taken from the NFS *(MAFF 1998)* to find out which foods contribute to the differences in nutrient intake between income groups. Table 6.62 shows expenditure on selected food groups in pence/person/week according to the gross weekly income of the head of the household in 1988. Total expenditure is not the sum of the columns because only selected food groups are included.

Table 6.62: Expenditure on food groups, (pence/person/week) by income group 1998.

*Household income	Group A ≥ £910	Group D ≤ £160
Food group		
Total carcass meat	138.5	79.6
Total meat & meat products	532.8	296.7
Total bread	88.2	62.6
Total cereals	368.8	215.7
Cheese	68.5	36.8
Fats	40.5	32.2
Fruit	258.0	84.0
Vegetables	253.4	97.4
Total food & drink	£28.55	£12.73

*(Gross weekly income of head of household, in households with one or more earner)

The food groups that provide iron and zinc are meat and meat products, and cereals. High-income households, with a gross weekly income of £910 and over, spend £1.39 per person per week on total carcass meat and £5.33 on meat products and 88 pence on bread. Income group D spends 79.6 pence on carcass meat per person and £2.97 on meat products and 62 pence on bread. Table 6.62 shows that the average low-income household spends less than half the amount of money that an average high-income household spends on food and drink.

Households with incomes of less then £160 per week have low intakes of iron, zinc, magnesium and potassium. The tables suggest that individuals from families in this income group fail to meet the RNI's for these nutrients, but these figure are representative of population trends and cannot be equated to individual requirements. Table 6.63 highlights the difference found in table 6.62 in nutrient intake amongst the high and low-income households. These differences would be increased by the inclusion of data from food consumed outside the home.

Table 6.63: Nutrient intake of households (/person/day).

Nutrient	Group A ≥ £640	Group D ≤ £160
Energy (% of EAR)	86	77
Fat (% of food energy)	38.9	38
Iron (% of RNI)	99	81
Zinc (% of RNI)	101	85
Potassium (% of RNI)	91	75
Magnesium (% of RNI)	95	76

Appendix 7

Income and food choice, sensitivity analysis

The following set of tables shows cost sensitivity analysis for energy, fat, iron zinc, magnesium and potassium. The tables were based on food purchases (by households with one or more earner) where the head of household had a gross weekly income of under £160 per week *(MAFF 1998)*.

Table 6.64: Cheapest sources of energy.

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
ENERGY								
CEREALS	Flour (12)	35	9.60	8.0	13.1	4.8	4.6	3.3
FATS	Vegetable & salad oils	50	8.80	23.4	0.0	0.0	0.0	0.0
FATS	Margarine	23	5.90	15.8	0.5	0.0	0.0	0.0
SUGAR & PRESERVES	Sugar	157	5.70	0.0	0.0	0.0	0.0	0.0
FATS	Other fats	18	5.10	13.4	0.5	0.0	0.0	0.0
CEREALS	White bread, standard loaves	383	4.40	0.8	6.4	3.8	4.1	1.5
CEREALS	Wholegrain bread	66	3.20	1.0	7.4	7.5	11.7	9.8
CEREALS	Softgrain and premium loaves (32)	150	3.10	0.8	12.3	0.0	7.0	2.4
SOFT DRINKS	Concentrated (888)	91	3.10	0.0	1.4	0.0	0.0	0.9
CEREALS	Brown bread	53	2.70	0.7	6.0	4.8	7.6	2.1
FATS	Butter	38	2.50	6.5	0.2	0.3	0.5	0.0
VEGETABLES	Potatoes Fresh (640)	799	2.10	0.1	1.6	1.2	3.3	7.2
FATS	Low fat and dairy spreads	51	2.00	5.3	0.0	0.0	0.0	0.0
CEREALS	Biscuits (62)	130	1.90	2.0	1.6	0.6	1.0	0.4
CEREALS	Rolls (41)	64	1.90	1.1	3.4	2.9	4.6	1.2
CEREALS	Cakes (81)	108	1.70	2.3	1.0	0.5	0.3	0.1
SUGAR & PRESERVES	Honey, preserves, syrup and treacle	29	1.60	0.0	0.5	0.0	0.1	0.0
MILK & CREAM	Liquid whole milk, full price	744	1.40	2.0	0.3	1.9	2.2	2.8
CEREALS	Breakfast cereals (48)	109	1.30	0.2	0.5	0.2	0.4	0.1
CEREALS	Other bread (43)	50	1.30	0.8	1.6	1.0	1.0	0.2
VEGETABLES	Processed potatoes (647)	205	1.30	2.0	0.9	0.4	1.0	1.9
MILK & CREAM	Cream (whipping)	11	1.20	2.9	0.2	0.0	0.0	0.1
MISCELLANEOUS	Ice-cream and other frozen dairy food (108)	92	1.20	1.4	0.5	0.7	0.7	0.8
MEAT	Bacon and Ham uncooked (232)	75	1.10	2.2	0.8	1.8	0.3	0.5
CHEESE	Natural (Cheddar)	72	1.00	1.9	0.2	2.4	0.5	0.1
MILK & CREAM	Other milks and dairy desserts (milk pudding)	96	1.00	0.8	0.2	0.0	1.0	1.0
ALCOHOLIC DRINKS	Others (919)	55	0.90	0.0	0.0	0.0	0.0	0.0

Table 6.64: Cheapest sources of energy (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
BEVERAGES	Cocoa and drinking chocolate (868)	3	0.90	1.5	5.9	4.7	12.4	3.7
CONFECTIONARY	Chocolate confectionery (857)	34	0.90	1.3	0.6	0.1	0.8	0.5
CONFECTIONARY	Mints and boiled sweets (865)	9	0.90	0.1	0.1	0.0	0.0	0.0
EGGS	Eggs	87	0.90	1.5	2.3	2.2	0.6	0.5
MEAT	Other meats and meat products (413)	297	0.90	1.7	0.9	1.2	0.4	0.3
BEVERAGES	Branded food drinks (874)	4	0.80	0.4	0.7	0.5	0.7	1.1
CONFECTIONARY	Other (866)	2	0.80	0.8	0.6	0.0	0.4	0.2
MEAT	Beef and veal (Roast 245)	101	0.80	1.6	0.9	3.0	0.3	0.3
MEAT	Mutton and lamb (275)	33	0.80	1.5	0.9	1.8	0.4	0.4
MEAT	Pork (309)	59	0.80	1.4	0.8	2.1	0.5	0.7
SOFT DRINKS	Ready to drink (878)	474	0.80	0.0	0.0	0.0	0.2	0.0
CHEESE	Processed	8	0.70	1.3	0.3	1.7	0.4	0.0
MILK & CREAM	Skimmed milks	1018	0.70	0.1	0.3	1.9	2.2	2.7
CEREALS	Other cereals (20)	231	0.50	0.1	0.2	0.4	0.1	0.0
FISH	Frozen, including fish products (544)	51	0.50	0.7	0.6	0.2	0.4	0.4
FISH	Prepared, including fish products (546)	44	0.50	0.6	0.3	0.2	0.3	0.3
FRUIT	Juice (775)	235	0.50	0.0	0.9	0.7	1.4	2.1
MEAT	Bacon and Ham cooked (217)	37	0.50	0.9	0.5	1.2	0.3	0.1
MEAT	Poultry Uncooked	171	0.50	0.5	0.6	1.1	0.9	1.0
MILK & CREAM	Yoghurt/Fromage Fraise	95	0.50	0.2	0.3	0.8	0.7	0.8
FRUIT	Fresh (675)	505	0.40	0.0	0.6	0.2	0.4	0.8
FRUIT	Other including fruit products (693)	47	0.40	0.1	0.4	0.2	1.6	1.3
MEAT	Poultry cooked (324)	31	0.40	0.4	0.5	1.1	0.4	0.4
MISCELLANEOUS	Other foods (27)	122	0.40	0.1	0.3	0.0	0.3	0.0
MISCELLANEOUS	Soups, canned, dehydrated and powdered (938)	61	0.40	0.7	0.6	0.8	0.3	0.1
VEGETABLES	Processed other vegetables (623)	327	0.40	0.1	2.4	1.5	1.6	0.8
CEREALS	Oatmeal and oat products (18)	3	0.30	0.2	0.8	0.5	0.8	0.1
ALCOHOL. DRINKS	Lager and Beer (896)	133	0.20	0.0	0.0	0.0	0.3	0.0
ALCOHOL. DRINKS	Wine (904)	39	0.20	0.0	0.4	0.0	0.2	0.1

Table 6.64: Cheapest sources of energy (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
BEVERAGES	Tea	34	0.20	0.1	5.4	1.3	2.7	3.3
FISH	Fresh (440)	17	0.20	0.1	0.2	0.2	0.3	0.3
FISH	Processed and shell (523)	10	0.20	0.1	0.5	0.6	0.7	0.3
VEGETABLES	Other fresh (588)	355	0.20	0.0	0.8	0.7	0.5	0.5
BEVERAGES	Coffee (872)	17	0.10	0.0	0.7	0.1	2.6	2.6
VEGETABLES	Greens Fresh (658)	181	0.10	0.0	2.4	0.9	0.7	0.8
MISCELLANEOUS	Mineral water	56	0.00	0.0	0.0	0.0	0.6	0.0
SOFT DRINKS	Low calorie, ready to drink	184	0.00	0.0	0.0	0.0	0.2	0.0
SOFT DRINKS	Low calorie, concentrated	32	0.00	0.0	1.4	0.0	0.6	0.9

The results of the sensitivity analysis for energy shows that flour, vegetable oil, margarine, sugar and white bread are the five cheapest sources of energy in the low-income households diet.

Table 6.65: Cheapest sources of fat.

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
FAT								
FATS	Vegetable & salad Oils	50	8.80	23.4	0.0	0.0	0.0	0.0
FATS	Margarine	23	5.90	15.8	0.5	0.0	0.0	0.0
FATS	Other fats	18	5.10	13.4	0.5	0.0	0.0	0.0
CEREALS	Flour (12)	35	9.60	8.0	13.1	4.8	4.6	3.3
FATS	Butter	38	2.50	6.5	0.2	0.3	0.5	0.0
FATS	Low fat and dairy spreads	51	2.00	5.3	0.0	0.0	0.0	0.0
MILK & CREAM	Cream (whipping)	11	1.20	2.9	0.2	0.0	0.0	0.1
CEREALS	Cakes (81)	108	1.70	2.3	1.0	0.5	0.3	0.1
MEAT	Bacon and Ham uncooked (232)	75	1.10	2.2	0.8	1.8	0.3	0.5
CEREALS	Biscuits (62)	130	1.90	2.0	1.6	0.6	1.0	0.4
MILK & CREAM	Liquid whole milk, full price	744	1.40	2.0	0.3	1.9	2.2	2.8
VEGETABLES	Processed potatoes (647)	205	1.30	2.0	0.9	0.4	1.0	1.9
CHEESE	Natural (Cheddar)	72	1.00	1.9	0.2	2.4	0.5	0.1
MEAT	Other meats and meat products (413)	297	0.90	1.7	0.9	1.2	0.4	0.3
MEAT	Beef and veal (Roast 245)	101	0.80	1.6	0.9	3.0	0.3	0.3
BEVERAGES	Cocoa and drinking chocolate (868)	3	0.90	1.5	5.9	4.7	12.4	3.7
EGGS	Eggs	87	0.90	1.5	2.3	2.2	0.6	0.5
MEAT	Mutton and lamb (275)	33	0.80	1.5	0.9	1.8	0.4	0.4
MEAT	Pork (309)	59	0.80	1.4	0.8	2.1	0.5	0.7
MISCELLANEOUS	Ice-cream and other frozen dairy food (108)	92	1.20	1.4	0.5	0.7	0.7	0.8
CHEESE	Processed	8	0.70	1.3	0.3	1.7	0.4	0.0
CONFECTIONARY	Chocolate confectionery (857)	34	0.90	1.3	0.6	0.1	0.8	0.5
CEREALS	Rolls (41)	64	1.90	1.1	3.4	2.9	4.6	1.2
CEREALS	Wholegrain bread	66	3.20	1.0	7.4	7.5	11.7	9.8
MEAT	Bacon and Ham cooked (217)	37	0.50	0.9	0.5	1.2	0.3	0.1
CEREALS	Other bread (43)	50	1.30	0.8	1.6	1.0	1.0	0.2
CEREALS	Softgrain and premium loaves (32)	150	3.10	0.8	12.3	0.0	7.0	2.4
CEREALS	White bread, standard loaves	383	4.40	0.8	6.4	3.8	4.1	1.5
CONFECTIONARY	Other (866)	2	0.80	0.8	0.6	0.0	0.4	0.2

Table 6.65: Cheapest sources of fat (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
MILK & CREAM	Other milks and dairy desserts (milk pudding)	96	1.00	0.8	0.2	0.0	1.0	1.0
CEREALS	Brown bread	53	2.70	0.7	6.0	4.8	7.6	2.1
FISH	Frozen, including fish products (544)	51	0.50	0.7	0.6	0.2	0.4	0.4
MISCELLANEOUS	Soups, canned, dehydrated and powdered (938)	61	0.40	0.7	0.6	0.8	0.3	0.1
FISH	Prepared, including fish products (546)	44	0.50	0.6	0.3	0.2	0.3	0.3
MEAT	Poultry Uncooked	171	0.50	0.5	0.6	1.1	0.9	1.0
BEVERAGES	Branded food drinks (874)	4	0.80	0.4	0.7	0.5	0.7	1.1
MEAT	Poultry cooked (324)	31	0.40	0.4	0.5	1.1	0.4	0.4
CEREALS	Breakfast cereals (48)	109	1.30	0.2	0.5	0.2	0.4	0.1
CEREALS	Oatmeal and oat products (18)	3	0.30	0.2	0.8	0.5	0.8	0.1
MILK & CREAM	Yogurt/Fromage Fraise	95	0.50	0.2	0.3	0.8	0.7	0.8
BEVERAGES	Tea	34	0.20	0.1	5.4	1.3	2.7	3.3
CEREALS	Other cereals (20)	231	0.50	0.1	0.2	0.4	0.1	0.0
CONFECTIONARY	Mints and boiled sweets (865)	9	0.90	0.1	0.1	0.0	0.0	0.0
FISH	Fresh (440)	17	0.20	0.1	0.2	0.2	0.3	0.3
FISH	Processed and shell (523)	10	0.20	0.1	0.5	0.6	0.7	0.3
FRUIT	Other including fruit products (693)	47	0.40	0.1	0.4	0.2	1.6	1.3
MILK & CREAM	Skimmed milks	1018	0.70	0.1	0.3	1.9	2.2	2.7
MISCELLANEOUS	Other foods (27)	122	0.40	0.1	0.3	0.0	0.3	0.0
VEGETABLES	Potatoes Fresh (640)	799	2.10	0.1	1.6	1.2	3.3	7.2
VEGETABLES	Processed other vegetables (623)	327	0.40	0.1	2.4	1.5	1.6	0.8
ALCOHOLIC DRINKS	Lager and Beer (896)	133	0.20	0.0	0.0	0.0	0.3	0.0
ALCOHOLIC DRINKS	Others (919)	55	0.90	0.0	0.0	0.0	0.0	0.0
ALCOHOLIC DRINKS	Wine (904)	39	0.20	0.0	0.4	0.0	0.2	0.1
BEVERAGES	Coffee (872)	17	0.10	0.0	0.7	0.1	2.6	2.6
FRUIT	Fresh (675)	505	0.40	0.0	0.6	0.2	0.4	0.8
FRUIT	Juice (775)	235	0.50	0.0	0.9	0.7	1.4	2.1

Table 6.65: Cheapest sources of fat (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
MISCELLANEOUS	Mineral water	56	0.00	0.0	0.0	0.0	0.6	0.0
SOFT DRINKS	Concentrated (888)	91	3.10	0.0	1.4	0.0	0.0	0.9
SOFT DRINKS	Low calorie, ready to drink	184	0.00	0.0	0.0	0.0	0.2	0.0
SOFT DRINKS	Low calorie, concentrated	32	0.00	0.0	1.4	0.0	0.6	0.9
SOFT DRINKS	Ready to drink (878)	474	0.80	0.0	0.0	0.0	0.2	0.0
SUGAR & PRESERVES	Honey, preserves, syrup and treacle	29	1.60	0.0	0.5	0.0	0.1	0.0
SUGAR & PRESERVES	Sugar	157	5.70	0.0	0.0	0.0	0.0	0.0
VEGETABLES	Greens Fresh (658)	181	0.10	0.0	2.4	0.9	0.7	0.8
VEGETABLES	Other fresh (588)	355	0.20	0.0	0.8	0.7	0.5	0.5

Table 6.66: Cheapest sources of iron.

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
IRON (Fe)								
CEREALS	Flour (12)	35	9.60	8.0	13.1	4.8	4.6	3.3
CEREALS	Softgrain and premium loaves (32)	150	3.10	0.8	12.3	0.0	7.0	2.4
CEREALS	Wholegrain bread	66	3.20	1.0	7.4	7.5	11.7	9.8
CEREALS	White bread, standard loaves	383	4.40	0.8	6.4	3.8	4.1	1.5
CEREALS	Brown bread	53	2.70	0.7	6.0	4.8	7.6	2.1
BEVERAGES	Cocoa and drinking chocolate (868)	3	0.90	1.5	5.9	4.7	12.4	3.7
BEVERAGES	Tea	34	0.20	0.1	5.4	1.3	2.7	3.3
CEREALS	Rolls (41)	64	1.90	1.1	3.4	2.9	4.6	1.2
VEGETABLES	Greens Fresh (658)	181	0.10	0.0	2.4	0.9	0.7	0.8
VEGETABLES	Processed other vegetables (623)	327	0.40	0.1	2.4	1.5	1.6	0.8
EGGS	Eggs	87	0.90	1.5	2.3	2.2	0.6	0.5
CEREALS	Biscuits (62)	130	1.90	2.0	1.6	0.6	1.0	0.4
CEREALS	Other bread (43)	50	1.30	0.8	1.6	1.0	1.0	0.2
VEGETABLES	Potatoes Fresh (640)	799	2.10	0.1	1.6	1.2	3.3	7.2
SOFT DRINKS	Concentrated (888)	91	3.10	0.0	1.4	0.0	0.0	0.9
SOFT DRINKS	Low calorie, concentrated	32	0.00	0.0	1.4	0.0	0.6	0.9
CEREALS	Cakes (81)	108	1.70	2.3	1.0	0.5	0.3	0.1
FRUIT	Juice (775)	235	0.50	0.0	0.9	0.7	1.4	2.1
MEAT	Beef and veal (Roast 245)	101	0.80	1.6	0.9	3.0	0.3	0.3
MEAT	Mutton and lamb (275)	33	0.80	1.5	0.9	1.8	0.4	0.4
MEAT	Other meats and meat products (413)	297	0.90	1.7	0.9	1.2	0.4	0.3
VEGETABLES	Processed potatoes (647)	205	1.30	2.0	0.9	0.4	1.0	1.9
CEREALS	Oatmeal and oat products (18)	3	0.30	0.2	0.8	0.5	0.8	0.1
MEAT	Bacon and Ham uncooked (232)	75	1.10	2.2	0.8	1.8	0.3	0.5
MEAT	Pork (309)	59	0.80	1.4	0.8	2.1	0.5	0.7
VEGETABLES	Other fresh (588)	355	0.20	0.0	0.8	0.7	0.5	0.5
BEVERAGES	Branded food drinks (874)	4	0.80	0.4	0.7	0.5	0.7	1.1
BEVERAGES	Coffee (872)	17	0.10	0.0	0.7	0.1	2.6	2.6
CONFECTIONARY	Chocolate confectionery (857)	34	0.90	1.3	0.6	0.1	0.8	0.5
CONFECTIONARY	Other (866)	2	0.80	0.8	0.6	0.0	0.4	0.2

Table 6.66: Cheapest sources of iron (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
FISH	Frozen, including fish products (544)	51	0.50	0.7	0.6	0.2	0.4	0.4
FRUIT	Fresh (675)	505	0.40	0.0	0.6	0.2	0.4	0.8
MEAT	Poultry Uncooked	171	0.50	0.5	0.6	1.1	0.9	1.0
MISCELLANEOUS	Soups, canned, dehydrated and powdered (938)	61	0.40	0.7	0.6	0.8	0.3	0.1
CEREALS	Breakfast cereals (48)	109	1.30	0.2	0.5	0.2	0.4	0.1
FATS	Marg	23	5.90	15.8	0.5	0.0	0.0	0.0
FATS	Other fats	18	5.10	13.4	0.5	0.0	0.0	0.0
FISH	Processed and shell (523)	10	0.20	0.1	0.5	0.6	0.7	0.3
MEAT	Bacon and Ham cooked (217)	37	0.50	0.9	0.5	1.2	0.3	0.1
MEAT	Poultry cooked (324)	31	0.40	0.4	0.5	1.1	0.4	0.4
MISCELLANEOUS	Ice-cream and other frozen dairy food (108)	92	1.20	1.4	0.5	0.7	0.7	0.8
SUGAR & PRESERVES	Honey, preserves, syrup and treacle	29	1.60	0.0	0.5	0.0	0.1	0.0
ALCOHOLIC DRINKS	Wine (904)	39	0.20	0.0	0.4	0.0	0.2	0.1
FRUIT	Other including fruit products (693)	47	0.40	0.1	0.4	0.2	1.6	1.3
CHEESE	Processed	8	0.70	1.3	0.3	1.7	0.4	0.0
FISH	Prepared, including fish products (546)	44	0.50	0.6	0.3	0.2	0.3	0.3
MILK & CREAM	Liquid whole milk, full price	744	1.40	2.0	0.3	1.9	2.2	2.8
MILK & CREAM	Skimmed milks	1018	0.70	0.1	0.3	1.9	2.2	2.7
MILK & CREAM	Yoghurt/Fromage Fraise	95	0.50	0.2	0.3	0.8	0.7	0.8
MISCELLANEOUS	Other foods (27)	122	0.40	0.1	0.3	0.0	0.3	0.0
CEREALS	Other cereals (20)	231	0.50	0.1	0.2	0.4	0.1	0.0
CHEESE	Natural (Cheddar)	72	1.00	1.9	0.2	2.4	0.5	0.1
FATS	Butter	38	2.50	6.5	0.2	0.3	0.5	0.0
FISH	Fresh (440)	17	0.20	0.1	0.2	0.2	0.3	0.3
MILK & CREAM	Cream (whipping)	11	1.20	2.9	0.2	0.0	0.0	0.1
MILK & CREAM	Other milks and dairy desserts (milk pudding)	96	1.00	0.8	0.2	0.0	1.0	1.0
CONFECTIONARY	Mints and boiled sweets (865)	9	0.90	0.1	0.1	0.0	0.0	0.0

Table 6.66: Cheapest sources of iron (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
ALCOHOLIC DRINKS	Lager and Beer (896)	133	0.20	0.0	0.0	0.0	0.3	0.0
ALCOHOLIC DRINKS	Others (919)	55	0.90	0.0	0.0	0.0	0.0	0.0
FATS	Low fat and dairy spreads	51	2.00	5.3	0.0	0.0	0.0	0.0
FATS	Vegetable & salad oils	50	8.80	23.4	0.0	0.0	0.0	0.0
MISCELLANEOUS	Mineral water	56	0.00	0.0	0.0	0.0	0.6	0.0
SOFT DRINKS	Low calorie, ready to drink	184	0.00	0.0	0.0	0.0	0.2	0.0
SOFT DRINKS	Ready to drink (878)	474	0.80	0.0	0.0	0.0	0.2	0.0
SUGAR & PRESERVES	Sugar	157	5.70	0.0	0.0	0.0	0.0	0.0

Table 6.67: Cheapest sources of zinc.

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
Zinc (Zn)								
CEREALS	Wholegrain bread	66	3.20	1.0	7.4	7.5	11.7	9.8
CEREALS	Brown bread	53	2.70	0.7	6.0	4.8	7.6	2.1
CEREALS	Flour (12)	35	9.60	8.0	13.1	4.8	4.6	3.3
BEVERAGES	Cocoa and drinking chocolate (868)	3	0.90	1.5	5.9	4.7	12.4	3.7
CEREALS	White bread, standard loaves	383	4.40	0.8	6.4	3.8	4.1	1.5
MEAT	Beef and veal (Roast 245)	101	0.80	1.6	0.9	3.0	0.3	0.3
CEREALS	Rolls (41)	64	1.90	1.1	3.4	2.9	4.6	1.2
CHEESE	Natural (Cheddar)	72	1.00	1.9	0.2	2.4	0.5	0.1
EGGS	Eggs	87	0.90	1.5	2.3	2.2	0.6	0.5
MEAT	Pork (309)	59	0.80	1.4	0.8	2.1	0.5	0.7
MILK & CREAM	Liquid whole milk, full price	744	1.40	2.0	0.3	1.9	2.2	2.8
MILK & CREAM	Skimmed milks	1018	0.70	0.1	0.3	1.9	2.2	2.7
MEAT	Bacon and Ham uncooked (232)	75	1.10	2.2	0.8	1.8	0.3	0.5
MEAT	Mutton and lamb (275)	33	0.80	1.5	0.9	1.8	0.4	0.4
CHEESE	Processed	8	0.70	1.3	0.3	1.7	0.4	0.0
VEGETABLES	Processed other vegetables (623)	327	0.40	0.1	2.4	1.5	1.6	0.8
BEVERAGES	Tea	34	0.20	0.1	5.4	1.3	2.7	3.3
MEAT	Bacon and Ham cooked (217)	37	0.50	0.9	0.5	1.2	0.3	0.1
MEAT	Other meats and meat products (413)	297	0.90	1.7	0.9	1.2	0.4	0.3
VEGETABLES	Potatoes Fresh (640)	799	2.10	0.1	1.6	1.2	3.3	7.2
MEAT	Poultry cooked (324)	31	0.40	0.4	0.5	1.1	0.4	0.4
MEAT	Poultry Uncooked	171	0.50	0.5	0.6	1.1	0.9	1.0
CEREALS	Other bread (43)	50	1.30	0.8	1.6	1.0	1.0	0.2
VEGETABLES	Greens Fresh (658)	181	0.10	0.0	2.4	0.9	0.7	0.8
MILK & CREAM	Yoghurt/Fromage Fraise	95	0.50	0.2	0.3	0.8	0.7	0.8
MISCELLANEOUS	Soups, canned, dehydrated and powdered (938)	61	0.40	0.7	0.6	0.8	0.3	0.1
FRUIT	Juice (775)	235	0.50	0.0	0.9	0.7	1.4	2.1
MISCELLANEOUS	Ice-cream and other frozen dairy food (108)	92	1.20	1.4	0.5	0.7	0.7	0.8
VEGETABLES	Other fresh (588)	355	0.20	0.0	0.8	0.7	0.5	0.5
CEREALS	Biscuits (62)	130	1.90	2.0	1.6	0.6	1.0	0.4

Table 6.67: Cheapest sources of zinc (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
FISH	Processed and shell (523)	10	0.20	0.1	0.5	0.6	0.7	0.3
BEVERAGES	Branded food drinks (874)	4	0.80	0.4	0.7	0.5	0.7	1.1
CEREALS	Cakes (81)	108	1.70	2.3	1.0	0.5	0.3	0.1
CEREALS	Oatmeal and oat products (18)	3	0.30	0.2	0.8	0.5	0.8	0.1
CEREALS	Other cereals (20)	231	0.50	0.1	0.2	0.4	0.1	0.0
VEGETABLES	Processed potatoes (647)	205	1.30	2.0	0.9	0.4	1.0	1.9
FATS	Butter	38	2.50	6.5	0.2	0.3	0.5	0.0
CEREALS	Breakfast cereals (48)	109	1.30	0.2	0.5	0.2	0.4	0.1
FISH	Fresh (440)	17	0.20	0.1	0.2	0.2	0.3	0.3
FISH	Frozen, including fish products (544)	51	0.50	0.7	0.6	0.2	0.4	0.4
FISH	Prepared, including fish products (546)	44	0.50	0.6	0.3	0.2	0.3	0.3
FRUIT	Fresh (675)	505	0.40	0.0	0.6	0.2	0.4	0.8
FRUIT	Other including fruit products (693)	47	0.40	0.1	0.4	0.2	1.6	1.3
BEVERAGES	Coffee (872)	17	0.10	0.0	0.7	0.1	2.6	2.6
CONFECTIONARY	Chocolate confectionery (857)	34	0.90	1.3	0.6	0.1	0.8	0.5
ALCOHOLIC DRINKS	Lager and Beer (896)	133	0.20	0.0	0.0	0.0	0.3	0.0
ALCOHOLIC DRINKS	Others (919)	55	0.90	0.0	0.0	0.0	0.0	0.0
ALCOHOLIC DRINKS	Wine (904)	39	0.20	0.0	0.4	0.0	0.2	0.1
CEREALS	Softgrain and premium loaves (32)	150	3.10	0.8	12.3	0.0	7.0	2.4
CONFECTIONARY	Mints and boiled sweets (865)	9	0.90	0.1	0.1	0.0	0.0	0.0
CONFECTIONARY	Other (866)	2	0.80	0.8	0.6	0.0	0.4	0.2
FATS	Low fat and dairy spreads	51	2.00	5.3	0.0	0.0	0.0	0.0
FATS	Margarine	23	5.90	15.8	0.5	0.0	0.0	0.0
FATS	Other fats	18	5.10	13.4	0.5	0.0	0.0	0.0
FATS	Vegetable & salad oils	50	8.80	23.4	0.0	0.0	0.0	0.0
MILK & CREAM	Cream (whipping)	11	1.20	2.9	0.2	0.0	0.0	0.1
MILK & CREAM	Other milks and dairy desserts (milk pudding)	96	1.00	0.8	0.2	0.0	1.0	1.0

Table 6.67: Cheapest sources of zinc (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
MISCELLANEOUS	Mineral water	56	0.00	0.0	0.0	0.0	0.6	0.0
MISCELLANEOUS	Other foods (27)	122	0.40	0.1	0.3	0.0	0.3	0.0
SOFT DRINKS	Concentrated (888)	91	3.10	0.0	1.4	0.0	0.0	0.9
SOFT DRINKS	Low calorie, ready to drink	184	0.00	0.0	0.0	0.0	0.2	0.0
SOFT DRINKS	Low calorie, concentrated	32	0.00	0.0	1.4	0.0	0.6	0.9
SOFT DRINKS	Ready to drink (878)	474	0.80	0.0	0.0	0.0	0.2	0.0
SUGAR & PRESERVES	Honey, preserves, syrup and treacle	29	1.60	0.0	0.5	0.0	0.1	0.0
SUGAR & PRESERVES	Sugar	157	5.70	0.0	0.0	0.0	0.0	0.0

Table 6.68: Cheapest sources of magnesium.

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
Magnesium (Mg)								
BEVERAGES	Cocoa and drinking chocolate (868)	3	0.90	1.5	5.9	4.7	12.4	3.7
CEREALS	Wholegrain bread	66	3.20	1.0	7.4	7.5	11.7	9.8
CEREALS	Brown bread	53	2.70	0.7	6.0	4.8	7.6	2.1
CEREALS	Softgrain and premium loaves (32)	150	3.10	0.8	12.3	0.0	7.0	2.4
CEREALS	Flour (12)	35	9.60	8.0	13.1	4.8	4.6	3.3
CEREALS	Rolls (41)	64	1.90	1.1	3.4	2.9	4.6	1.2
CEREALS	White bread, standard loaves	383	4.40	0.8	6.4	3.8	4.1	1.5
VEGETABLES	Potatoes Fresh (640)	799	2.10	0.1	1.6	1.2	3.3	7.2
BEVERAGES	Tea	34	0.20	0.1	5.4	1.3	2.7	3.3
BEVERAGES	Coffee (872)	17	0.10	0.0	0.7	0.1	2.6	2.6
MILK & CREAM	Liquid whole milk, full price	744	1.40	2.0	0.3	1.9	2.2	2.8
MILK & CREAM	Skimmed milks	1018	0.70	0.1	0.3	1.9	2.2	2.7
FRUIT	Other including fruit products (693)	47	0.40	0.1	0.4	0.2	1.6	1.3
VEGETABLES	Processed other vegetables (623)	327	0.40	0.1	2.4	1.5	1.6	0.8
FRUIT	Juice (775)	235	0.50	0.0	0.9	0.7	1.4	2.1
CEREALS	Biscuits (62)	130	1.90	2.0	1.6	0.6	1.0	0.4
CEREALS	Other bread (43)	50	1.30	0.8	1.6	1.0	1.0	0.2
MILK & CREAM	Other milks and dairy desserts (milk pudding)	96	1.00	0.8	0.2	0.0	1.0	1.0
VEGETABLES	Processed potatoes (647)	205	1.30	2.0	0.9	0.4	1.0	1.9
MEAT	Poultry Uncooked	171	0.50	0.5	0.6	1.1	0.9	1.0
CEREALS	Oatmeal and oat products (18)	3	0.30	0.2	0.8	0.5	0.8	0.1
CONFECTIONARY	Chocolate confectionery (857)	34	0.90	1.3	0.6	0.1	0.8	0.5
BEVERAGES	Branded food drinks (874)	4	0.80	0.4	0.7	0.5	0.7	1.1
FISH	Processed and shell (523)	10	0.20	0.1	0.5	0.6	0.7	0.3
MILK & CREAM	Yoghurt/Fromage Fraise	95	0.50	0.2	0.3	0.8	0.7	0.8
MISCELLANEOUS	Ice-cream. and other frozen dairy food (108)	92	1.20	1.4	0.5	0.7	0.7	0.8
VEGETABLES	Greens Fresh (658)	181	0.10	0.0	2.4	0.9	0.7	0.8
EGGS	Eggs	87	0.90	1.5	2.3	2.2	0.6	0.5
MISCELLANEOUS	Mineral water	56	0.00	0.0	0.0	0.0	0.6	0.0

Table 6.68: Cheapest sources of magnesium (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
SOFT DRINKS	Low calorie, concentrated	32	0.00	0.0	1.4	0.0	0.6	0.9
CHEESE	Natural (Cheddar)	72	1.00	1.9	0.2	2.4	0.5	0.1
FATS	Butter	38	2.50	6.5	0.2	0.3	0.5	0.0
MEAT	Pork (309)	59	0.80	1.4	0.8	2.1	0.5	0.7
VEGETABLES	Other fresh (588)	355	0.20	0.0	0.8	0.7	0.5	0.5
CEREALS	Breakfast cereals (48)	109	1.30	0.2	0.5	0.2	0.4	0.1
CHEESE	Processed	8	0.70	1.3	0.3	1.7	0.4	0.0
CONFECTIONARY	Other (866)	2	0.80	0.8	0.6	0.0	0.4	0.2
FISH	Frozen, including fish products (544)	51	0.50	0.7	0.6	0.2	0.4	0.4
FRUIT	Fresh (675)	505	0.40	0.0	0.6	0.2	0.4	0.8
MEAT	Mutton and lamb (275)	33	0.80	1.5	0.9	1.8	0.4	0.4
MEAT	Other meats and meat products (413)	297	0.90	1.7	0.9	1.2	0.4	0.3
MEAT	Poultry cooked (324)	31	0.40	0.4	0.5	1.1	0.4	0.4
ALCOHOL DRINKS	Lager and Beer (896)	133	0.20	0.0	0.0	0.0	0.3	0.0
CEREALS	Cakes (81)	108	1.70	2.3	1.0	0.5	0.3	0.1
FISH	Fresh (440)	17	0.20	0.1	0.2	0.2	0.3	0.3
FISH	Prepared, including fish products (546)	44	0.50	0.6	0.3	0.2	0.3	0.3
MEAT	Bacon and Ham cooked (217)	37	0.50	0.9	0.5	1.2	0.3	0.1
MEAT	Bacon and Ham uncooked (232)	75	1.10	2.2	0.8	1.8	0.3	0.5
MEAT	Beef and veal (Roast 245)	101	0.80	1.6	0.9	3.0	0.3	0.3
MISCELLANEOUS	Other foods (27)	122	0.40	0.1	0.3	0.0	0.3	0.0
MISCELLANEOUS	Soups, canned, dehydrated and powdered (938)	61	0.40	0.7	0.6	0.8	0.3	0.1
ALCOHOL, DRINKS	Wine (904)	39	0.20	0.0	0.4	0.0	0.2	0.1
SOFT DRINKS	Low calorie, ready to drink	184	0.00	0.0	0.0	0.0	0.2	0.0
SOFT DRINKS	Ready to drink (878)	474	0.80	0.0	0.0	0.0	0.2	0.0
CEREALS	Other cereals (20)	231	0.50	0.1	0.2	0.4	0.1	0.0
SUGAR & PRESERVES	Honey, preserves, syrup and treacle	29	1.60	0.0	0.5	0.0	0.1	0.0
ALCOHOL, DRINKS	Others (919)	55	0.90	0.0	0.0	0.0	0.0	0.0
CONFECTIONARY	Mints and boiled sweets (865)	9	0.90	0.1	0.1	0.0	0.0	0.0
FATS	Low fat and dairy spreads	51	2.00	5.3	0.0	0.0	0.0	0.0

Table 6.68: Cheapest sources of magnesium (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
FATS	Margarine	23	5.90	15.8	0.5	0.0	0.0	0.0
FATS	Other fats	18	5.10	13.4	0.5	0.0	0.0	0.0
FATS	Vegetable & salad oils	50	8.80	23.4	0.0	0.0	0.0	0.0
MILK & CREAM	Cream (whipping)	11	1.20	2.9	0.2	0.0	0.0	0.1
SOFT DRINKS	Concentrated (888)	91	3.10	0.0	1.4	0.0	0.0	0.9
SUGAR & PRESERVES	Sugar	157	5.70	0.0	0.0	0.0	0.0	0.0

Table 6.69: Cheapest sources of potassium.

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
Potassium (K)								
CEREALS	Wholegrain bread	66	3.20	1.0	7.4	7.5	11.7	9.8
VEGETABLES	Potatoes Fresh (640)	799	2.10	0.1	1.6	1.2	3.3	7.2
BEVERAGES	Cocoa and drinking chocolate (868)	3	0.90	1.5	5.9	4.7	12.4	3.7
BEVERAGES	Tea	34	0.20	0.1	5.4	1.3	2.7	3.3
CEREALS	Flour (12)	35	9.60	8.0	13.1	4.8	4.6	3.3
MILK & CREAM	Liquid whole milk, full price	744	1.40	2.0	0.3	1.9	2.2	2.8
MILK & CREAM	Skimmed milks	1018	0.70	0.1	0.3	1.9	2.2	2.7
BEVERAGES	Coffee (872)	17	0.10	0.0	0.7	0.1	2.6	2.6
CEREALS	Softgrain and premium loaves (32)	150	3.10	0.8	12.3	0.0	7.0	2.4
CEREALS	Brown bread	53	2.70	0.7	6.0	4.8	7.6	2.1
FRUIT	Juice (775)	235	0.50	0.0	0.9	0.7	1.4	2.1
VEGETABLES	Processed potatoes (647)	205	1.30	2.0	0.9	0.4	1.0	1.9
CEREALS	White bread, standard loaves	383	4.40	0.8	6.4	3.8	4.1	1.5
FRUIT	Other including fruit products (693)	47	0.40	0.1	0.4	0.2	1.6	1.3
CEREALS	Rolls (41)	64	1.90	1.1	3.4	2.9	4.6	1.2
BEVERAGES	Branded food drinks (874)	4	0.80	0.4	0.7	0.5	0.7	1.1
MEAT	Poultry Uncooked	171	0.50	0.5	0.6	1.1	0.9	1.0
MILK & CREAM	Other milks and dairy desserts (milk pudding)	96	1.00	0.8	0.2	0.0	1.0	1.0
SOFT DRINKS	Concentrated (888)	91	3.10	0.0	1.4	0.0	0.0	0.9
SOFT DRINKS	Low calorie, concentrated	32	0.00	0.0	1.4	0.0	0.6	0.9
FRUIT	Fresh (675)	505	0.40	0.0	0.6	0.2	0.4	0.8
MILK & CREAM	Yoghurt/Fromage Fraise	95	0.50	0.2	0.3	0.8	0.7	0.8
MISCELLANEOUS	Ice-cream and other frozen dairy food (108)	92	1.20	1.4	0.5	0.7	0.7	0.8
VEGETABLES	Greens Fresh (658)	181	0.10	0.0	2.4	0.9	0.7	0.8
VEGETABLES	Processed other vegetables (623)	327	0.40	0.1	2.4	1.5	1.6	0.8
MEAT	Pork (309)	59	0.80	1.4	0.8	2.1	0.5	0.7
CONFECTIONARY	Chocolate confectionery (857)	34	0.90	1.3	0.6	0.1	0.8	0.5
EGGS	Eggs	87	0.90	1.5	2.3	2.2	0.6	0.5
MEAT	Bacon and Ham uncooked (232)	75	1.10	2.2	0.8	1.8	0.3	0.5

Table 6.69: Cheapest sources of potassium (cont).

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
VEGETABLES	Other fresh (588)	355	0.20	0.0	0.8	0.7	0.5	0.5
CEREALS	Biscuits (62)	130	1.90	2.0	1.6	0.6	1.0	0.4
FISH	Frozen, including fish products (544)	51	0.50	0.7	0.6	0.2	0.4	0.4
MEAT	Mutton and lamb (275)	33	0.80	1.5	0.9	1.8	0.4	0.4
MEAT	Poultry cooked (324)	31	0.40	0.4	0.5	1.1	0.4	0.4
FISH	Fresh (440)	17	0.20	0.1	0.2	0.2	0.3	0.3
FISH	Prepared, including fish products (546)	44	0.50	0.6	0.3	0.2	0.3	0.3
FISH	Processed and shell (523)	10	0.20	0.1	0.5	0.6	0.7	0.3
MEAT	Beef and veal (Roast 245)	101	0.80	1.6	0.9	3.0	0.3	0.3
MEAT	Other meats and meat products (413)	297	0.90	1.7	0.9	1.2	0.4	0.3
CEREALS	Other bread (43)	50	1.30	0.8	1.6	1.0	1.0	0.2
CONFECTIONARY	Other (866)	2	0.80	0.8	0.6	0.0	0.4	0.2
ALCOHOLIC DRINKS	Wine (904)	39	0.20	0.0	0.4	0.0	0.2	0.1
CEREALS	Breakfast cereals (48)	109	1.30	0.2	0.5	0.2	0.4	0.1
CEREALS	Cakes (81)	108	1.70	2.3	1.0	0.5	0.3	0.1
CEREALS	Oatmeal and oat products (18)	3	0.30	0.2	0.8	0.5	0.8	0.1
CHEESE	Natural (Cheddar)	72	1.00	1.9	0.2	2.4	0.5	0.1
MEAT	Bacon and Ham cooked (217)	37	0.50	0.9	0.5	1.2	0.3	0.1
MILK & CREAM	Cream (whipping)	11	1.20	2.9	0.2	0.0	0.0	0.1
MISCELLANEOUS	Soups, canned, dehydrated and powdered (938)	61	0.40	0.7	0.6	0.8	0.3	0.1
ALCOHOLIC DRINKS	Lager and Beer (896)	133	0.20	0.0	0.0	0.0	0.3	0.0
ALCOHOLIC DRINKS	Others (919)	55	0.90	0.0	0.0	0.0	0.0	0.0
CEREALS	Other cereals (20)	231	0.50	0.1	0.2	0.4	0.1	0.0
CHEESE	Processed	8	0.70	1.3	0.3	1.7	0.4	0.0
CONFECTIONARY	Mints and boiled sweets (865)	9	0.90	0.1	0.1	0.0	0.0	0.0
FATS	Butter	38	2.50	6.5	0.2	0.3	0.5	0.0
FATS	Low fat and dairy spreads	51	2.00	5.3	0.0	0.0	0.0	0.0
FATS	Margarine	23	5.90	15.8	0.5	0.0	0.0	0.0

Table 6.69: Cheapest sources of potassium (cont.)

Food group, food.		g	Energy	Fat	Fe	Zn	Mg	K
FATS	Other fats	18	5.10	13.4	0.5	0.0	0.0	0.0
FATS	Vegetable & salad oils	50	8.80	23.4	0.0	0.0	0.0	0.0
MISCELLANEOUS	Mineral water	56	0.00	0.0	0.0	0.0	0.6	0.0
MISCELLANEOUS	Other foods (27)	122	0.40	0.1	0.3	0.0	0.3	0.0
SOFT DRINKS	Low calorie, ready to drink	184	0.00	0.0	0.0	0.0	0.2	0.0
SOFT DRINKS	Ready to drink (878)	474	0.80	0.0	0.0	0.0	0.2	0.0
SUGAR & PRESERVES	Honey, preserves, syrup and treacle	29	1.60	0.0	0.5	0.0	0.1	0.0
SUGAR & PRESERVES	Sugar	157	5.70	0.0	0.0	0.0	0.0	0.0

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