Do socio-demographic and psychological factors predict dietary pattern?

Griffiths, Julie E

Swansea University
Prifysgol Abertawe

"DO SOCIO-DEMOGRAPHIC AND PSYCHOLOGICAL FACTORS PREDICT DIETARY PATTERN?"

Julie E. Griffiths

Submitted to the University of Wales in fulfilment for the degree of „Master of Philosophy"

2010

Declaration/Statements

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed . .. (candidate)

Date ....

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s).

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed .. (candidate)

Date .....

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

Signed . . (candidate)

Date ....

Abstract

Despite governmental strategies to curb chronic disease, obesity and mental health problems, these continue largely unabated. Yet interventions and health education are expensive and would be more cost effective if targeted at high risk groups. The purpose of the thesis was to establish predictors of healthy and unhealthy dietary patterns and thus identify sections of the population to which more effective interventions can be focused.

The 'Western' diet has been characterized by higher consumption of refined cereals, processed and red meats, eggs, desserts and high-fat dairy products while the 'Prudent' diet is distinguished by more fruit, vegetables, whole grains, legumes, fish and poultry. The 'Western' diet has been linked with higher incidence of chronic disease. A food frequency questionnaire of a representative sample of the adult U.K. population was reduced using factor analysis to ten dietary patterns, seven of which were consistent with either the Western or Prudent type diet. These dietary styles were related to demographic variables and found to differ depending on gender, education, age and socio-economic background. The present study is unusual in that it considered the influence of a wide range of factors on dietary choice. Women ate more whole-foods while men ate more processed foods; older people preferred sweet foods; the lesser educated ate more savoury foods; the better educated ate more rice, pasta nuts, fruits and salad; higher socio-economic status was associated with eating more whole foods.

In particular it was recommended that nutrition education should be targeted at more extraverted young males with less education, from a lower socio-economic background. A more general message is that one should not consider demographic variables in isolation as there are interactions that make simple generalizations misleading.

TABLE of CONTENTS

Chapter 1: Introduction 1

Chapter 2: Literature Review 6

Chapter 3: Introduction to the HALS 1 15

Chapter 4: Can we identify Western and Prudent dietary patterns in a representative sample of the U.K. population? 19

Chapter 5: Is there a relationship between UK socio-demographic variables and Prudent and Western dietary styles? 29

Chapter 6: Can psychological variables predict dietary patterns? 48

Chapter 7: Conclusion 65

Bibliography 68

Appendix A 92

Appendix B 104

Appendix C 106

Chapter 1. Introduction

Healthy behaviours such as appropriate dietary choices can contribute significantly to improved public health (WHO, 2003).

The purpose of this paper is to investigate possible predictors of healthy and unhealthy dietary patterns in order to make recommendations for more effective social policy that improves overall national health. Should health education be focused on particular sections of the population?

According to the WHO (2003), obesity is a major contributor to the global burden of chronic disease and disability. Obesity is now considered a disease in its own right. It is estimated that more than one billion adults are overweight of whom 300 million are classified as clinically obese. They concluded that these statistics reflect profound changes in society and behavioural patterns. The aim of this thesis is to explore the nature of some of these behavioural patterns to facilitate the targeting of public health education.

The extent to which the obesity issue has reached critical mass is reflected in a recent Letter to the Editor of The Lancet (Edwards, 2008) in which two experts estimated that the obese population of the world consumes 18% more food energy than those people of normal weight. This, in the face of increasing worries about food supply (Editorial, The Lancet 2008), highlights the need for research into the circumstances which have lead to the global obesity problem in order to reduce this effect.

Evidence on obesity rates in the UK is just as alarming. Foresight, a research group set up by the Science and Technology Ministry (2007), reported that the percentage of obese people had climbed steadily three fold since 1980. The National Audit Office estimated that obesity costs England alone 18 million sick days and 30,000 excess deaths. Long term projections forecast that in 2050, sixty per cent of males and fifty per cent of females will be obese.

Obesity is not the only issue requiring urgent attention. Commenting in The Lancet recently McMahon (2008) stated in terms of global-health politics, that cardiovascular disease is a massive problem that few want to acknowledge and few want to tackle. He pointed to a new global study by Lawes et al. (2008) which highlights the yearly 8 million deaths attributable to high blood pressure and that its victims are disproportionately in the lower to middle income groups. Diet is one risk factor for heart disease.

Mental health is another area which requires attention. The 2004 WHO World Mental Health Survey (WHO, 2004), using newly developed cross-national criteria based on the DSM IV, revealed the high prevalence of mental disorders in a cross-section of developed and developing countries, exceeding that of any single chronic disease. This was striking in light of research documenting that mental disorders have greater effects on functioning in society than many chronic diseases. Again there are suggestions that diet may influence psychiatric disease. There is strong evidence that improving nutrition and development in socio-economically disadvantaged children can lead to healthy cognitive development, improved educational outcomes and reduced risk for mental ill-health, especially for those at risk or who are living in impoverished communities (WHO, 2004).

Despite international and national governmental strategies to drastically curb chronic disease, obesity and mental health problems, all these continue unabated. In recent years, there has been increasing interest in the identification of dietary patterns as consumed by populations. It has been suggested that such analyses could shed light on the complex relationships between diet and chronic disease (Schwerin 1982; Randall 1990). We do not consume specific nutrients but rather we have dietary style.

In support of the argument for a shift away from the traditional approach of analysing only individual nutrients, Pryer (2000) writes: "Empirical dietary surveys frequently examine the food intake of a population in terms of nutrient intake. This approach provides valuable information on nutrient adequacy and deficiency/excess and allows the testing of a priori hypotheses on the association between nutrients and disease. However the approach does not allow the complexities of the dietary intake of individuals, or groups of individuals, to be considered in terms of their overall dietary pattern".

Increasingly, dietary patterns or overall diet are regarded as important determinants of chronic disease. Research from the Health Professionals Follow-up Study and the Nurse Health Study cohorts suggest that dietary patterns associated with high consumption of fruit, vegetables, whole grains, legumes and poultry, known as the 'Prudent' pattern, have been associated with a lower risk of coronary heart (Hu, 2000; Fung, 2001), obesity, type 2 diabetes and metabolic syndrome (Giugliano, 2008). A pattern known as the 'Western' pattern, characterized by high consumption of refined cereals, processed and red meats, eggs, potatoes, desserts and high-fat dairy products has been associated with an increased risk of coronary heart disease (Brunner, 2008; Iqbal, 2008; Hu, 2000) as well as colon cancer (Fung, 2003), breast cancer, (Sieri, 2004), type 2 diabetes (van Dam, 2002; Brunner, 2008), obesity (Fung, 2001) and chronic disease (Esposito, 2008).

Dietary patterns can vary according to age, sex, ethnicity and culture (Lin, 2003; Park, 2005; Mishra, 1995). Most research on dietary patterns has been conducted in the United States (Mishra, 2007) with very little carried out in the United Kingdom (Fraser, 2000; Pryer, 2001). Studies of other populations have identified varied dietary patterns (Balder, 2003; Maskarinec, 2000). An objective of the present study is to examine dietary patterns in a large British sample.

What influences eating behaviour? Genetic factors do play a role in eating behaviour. Large studies of twins attest to genes accounting for, on average, 50% of the variance (Keskitalo, 2008; Van den Bree, 1999). This leaves, however, considerable variability attributable to other factors. Yet there is a gene-environment interaction with diet being an important factor in those with a genetic predisposition.

Healthy behaviours such as healthy diets contribute to the improvement of public health (WHO, 2003). Given the substantial epidemiologic and experimental evidence that disease risks are affected by food choices, health professionals need to understand the patterns of food consumption in the population. Higher risk groups can then be identified which may become the target of special interventions. With evidence suggesting a relationship between disease and diet, it would be of significant scientific interest to identify significant dietary patterns in a large sample population and then to elucidate the driving forces behind these dietary patterns. The effective targeting of nutrition education programs requires not only knowledge of the current dietary patterns, beliefs and concerns of the target population but also understanding the factors which may be a barrier to choosing a healthy diet or factors underlying the need to consume unhealthy foods.

The present study therefore explores whether relatively homogenous groups reporting similar patterns of diet can be identified in a representative sample of British men and women over 18 years of age and whether socio-demographic, physiological and psychological can be associated with each dietary pattern and nutrient choice. The Health and Lifestyle Survey, conducted in 1986-87 presents an excellent opportunity to investigate this in a large randomly selected population of 9003 UK adult residents. The survey provides information on dietary intake, socio-demographic factors, health and psychological measures.

We aim to answer the following questions:

1. Can we identify Western and Prudent type dietary patterns in a representative sample of the U.K. population?
2. Can we relate these patterns to groups with similar socio-demographic variables, e.g. socio-economic status, education, age and gender?
3. Can we relate these patterns to psychological factors, specifically personality?

By referring to questions contained in the survey, we identified certain dietary patterns similar to the Western and Prudent diets that were associated with homogenous population groups in terms of: socio-demographic and psychological factors.

It was concluded that dietary patterns analgous to either the Western or Prudent diets could be identified in this sample of the British population and that the consumers of these diets could be classified according to socio-demographic and psychological factors.

These homogenous groups can now be subject of more targeted public health campaigns to promote healthier lifestyle.

Chapter 2: Literature Review

When discussing the relationship between diet and socio-demographic and psychological factors, it is clearly necessary to assess dietary intake. There is no easy, practical or even economical way to evaluate this over a long period of time. We will discuss the merits of the various dietary assessment tools. Then the socio-demographic and psychological factors as they relate to diet will be reviewed.

Dietary Assessments:

EuroFIR (European Food Information Resource Network, 2009), a European Commission funded partnership between 47 universities, research institutes and small-to-medium sized enterprises from 25 European countries evaluated the merits of various dietary assessments. Food Frequency Questionnaires (FFQs) are usually self-administered and are therefore designed to be easy to complete by the study subjects. FFQs usually comprise a list of foods or food groups, and a corresponding frequency response section (e.g. never, once per week, twice per week etc). FFQs often rely on assumptions regarding portion size, and are limited by the amount of detail that it is feasible to include in the questionnaire. FFQs are often designed to gain information about specific aspects of diet, such as dietary fats or particular vitamins or minerals, and other aspects may be less well characterised. It is possible for the questionnaires to be semi-quantitative where subjects are asked to estimate usual portion sizes.

Further, according to EuroFIR, the structured design of the questionnaire means that data can be easily processed and computerised. Furthermore, the relative ease of administration and affordability makes FFQs appropriate for use in large scale studies and they are frequently used in cohort studies. An important advantage of this method of dietary assessment is the low burden on the study subjects, compared to recording methods. However, accuracy of measurement of absolute intakes is lower than for other methods (Gibson, 1998). FFQs are mainly used in epidemiology for ranking individuals into broad categories, e.g. high, moderate and low consumers of vegetables.

All dietary assessment methods involve measurement error. Random measurement error refers to the precision of methods, whereby increasing the number of measurements will reduce random error and improve precision. Systematic measurement error cannot be minimised by extending the number of measurements. This type of error is important because it can introduce bias e.g. where respondents to a questionnaire may overestimate consumption of 'good' foods, such as fruit and vegetables.

Errors arise from assessment of the frequency of consumption of foods, portion size, daily variation, failure to report usual diet (either due to changing habits whilst taking part in a study or misreporting foods consumed), and the use of food composition data (Nelson and Bingham, 1997).

EuroFIR further comments that FFQs are frequently associated with errors due to overestimation of consumption, possibly resulting from the use of lists. Participants using the FFQ may have difficulty in choosing a frequency category so that over-estimation tends to occur. The estimation of portion size rather than direct weighing is associated with imprecision at the individual level and to differing degrees for different foods. This is a greater issue for measuring intake of foods rather than nutrients. Daily variation in intake is one of the main factors introducing imprecision to diet records and 24 hour recall methods of dietary assessment. A 7 day record is probably sufficient to rank the distribution of energy and macronutrients in a population, but longer periods are necessary for investigating alcohol, vitamins and minerals.

Problems of under reporting have been demonstrated by studies that have compared dietary assessment methods of food intake with biological measures (biomarkers); under reporting in obese individuals is now well recognised (Mendez et al., 2005; Rennie et al., 2004).

Many study objectives relate to the effects of food components, e.g. vitamins or phytochemicals, on disease outcomes. Food composition data are required to convert the information from dietary assessment methods to intake data on nutrients and other food components. Errors can be introduced at this stage because of an assumption that all subjects eat foods with the same standard composition and portion size. In reality, food composition varies widely depending on soil (in the case of plants), harvesting conditions, storage, processing and preparation of foods. Unless portion sizes are directly assessed, non-standard portion sizes may also lead to bias. Furthermore, food composition tables can be incomplete, for instance, in respect of phytochemicals or fatty acids. Incomplete food lists are also problematic, especially for some countries where indigenous foods are not analysed and their composition recorded, or where analyses on new food products or recently modified foods (e.g. lower in fat) are not available.

Frequent Food Questionnaires have been shown to provide a valid estimate of dietary macro- and micro-nutrients (Brunner, 2001; Daures, 2000; Katsouyanni, 1997).

- In summing up the strengths and weaknesses of select diet assessment methods, Barrett-Connor (1991) expressed the view that food frequency questionnaires were considered to provide better estimates of usual diet but are less quantitative and subject to problems of recall and seasonality. No method is universally the best.

Dietary patterns:

Nutritional epidemiology has typically examined diseases in relation to a single or a few nutrients or foods. However people do not eat isolated nutrients. Instead, they eat meals consisting of a variety of foods with complex combinations of nutrients. The single nutrient approach may be inadequate for taking into account complicated interactions among nutrients in studies of free-living people (National Research Council, 1989). To overcome these limitations, dietary patterns are being increasingly used to identify eating patterns.

In one of the earliest attempts to derive food patterns and correlate them with health conditions, Schwerin et al. (1982) analysed dietary assessments from three American studies: the Ten State Nutritional Survey (USDHEW), the first National Health and Nutritional Examination Survey (HANES 1) and the Nationwide Food Consumption Survey (USDA). Seven dietary patterns were identified through factor analysis, several of which, the authors found, were associated with better nutritional health as measured by the percentage of symptom-free individuals who followed them.

Using a large numbers of food variables, Gex-Fabry et al. (1988) conducted a dietary survey on 939 randomly selected Swiss adults. A factor analysis, using average weekly intakes for 33 food variables revealed three principal components of the diet. These were: satiating capacity, healthfulness, and culinary complex.

In 1990, Barker et al. collected a 7 day weighed record of all food and drink consumed by a randomly selected group of 592 people in Northern Ireland as well as details of their social, personal and anthropometric details. Using principal components analysis, they were able to deduce four distinct dietary patterns: traditional, cosmopolitan, convenience and a 'meat and two vegetables' diet. Through correlation, they were able to establish that identifiable population groups had different dietary behaviours.

In a huge complement of 60,000 Swedish women, Khani et al. (2004) were able to identify 3 dietary patterns: 'healthy' (high in vegetables, fruit, fish, poultry tomato, cereal, and low-fat dairy products), 'Western' (processed meat, meat, refined grains, sweets and fried potatoes) and 'drinker' diet (beer, wine, liquor and snacks) through two separate FFQs and diet records. Within their own study, they were also able to reproduce and validate dietary patterns through factorial analysis.

Analyzing the same Health and Lifestyle Survey 1 (UK), Whichelow et al. (1996) identified discrete dietary patterns. Principal component analysis was used to identify four main dietary patterns, and analysis of variance employed to examine the characteristics associated with them. The four components derived were frequent fruit and salad vegetable; high-starch foods, most vegetables and meat; high-fat foods and sweets, biscuits and cakes, respectively, 10.2, 7.3, 5.1 and 4.9% of the total dietary variation. They were able to relate each pattern with health status. For example, the first group fruits and vegetable reported better health while the third group, high fat foods, was associated with many illness symptoms.

Hu & Willett et al. in their much cited 1999 study of a small subset (n=127) of the American-based Health Professionals Follow-up Study compared two food frequency questionnaires, one year apart, with one week weighed diet records, against plasma blood biomarkers. Using factor analysis, they identified 2 major eating patterns, which were qualitatively similar across the 2 FFQs and the diet records. The first factor, the prudent dietary pattern, was characterized by a high intake of vegetables, fruit, legumes, whole grains, and fish and other seafood, whereas the second factor, the Western pattern, was characterized by a high intake of processed meat, red meat, butter, high-fat dairy products, eggs, and refined grains. The reliability correlations for the factor scores between the 2 FFQs were 0.70 for the prudent pattern and 0.67 for the Western pattern. The correlations (corrected for week-to-week variation in diet records) between the 2 FFQs and diet records ranged from 0.45 to 0.74 for the 2 patterns. In addition, the correlations between the factor scores and nutrient intakes and plasma concentrations of biomarkers were in the expected direction. It was concluded that their data indicated reasonable reproducibility and validity of the major dietary patterns defined by factor analysis with data from an FFQ.

Further studies have reproduced and validated this method successfully. In 2001, Fung enlisted a subset of 69,017 participants from the ongoing American Nurse's Health Study, where dietary patterns were derived from a FFQ by factor analysis. Similar to the Hu & Willett study, here also, two patterns were identified, a 'Prudent' and a 'Western' diet. They were able to associate risk of cardiovascular mortality with dietary pattern.

And a final word on the subject. Kant (2004) conducted a systematic review of the literature on dietary patterns in relation to nutrient adequacy, lifestyle, demographic variables and health outcomes. In general, an inverse association was found between healthful dietary patterns and all-cause mortality.

- The generating of dietary patterns through the use of factor analysis has gained in popularity in recent years as it is thought this method of assessing diet better reflects the complex nature of dietary exposure.

Socio-demographic:

Aside from the Health and Lifestyle Survey (HALS), two smaller large-scale national U.K population surveys have also collected detailed data on nutrition and lifestyle. 'The National 1946 Birth Cohort' is an ongoing survey, analyzed for this purpose in 1982 while 'The Dietary and Nutritional Survey of British Adults (DNSBA)' was carried out in 1986-7, concurrent with HALS.

Participants of the U.K. 1946 Birth Cohort were asked to fill out a 7 day weighed food diary in 1982. Braddon et al. analysed the results of 2424 completed diaries. With the exception of calcium, mean intakes of all nutrients were significantly higher in men than women. Using job descriptions, those gainfully employed were allocated to a Registrar General's social group (Classification of Social Classes, 1980). The non-manual group showed a greater tendency to consume fibre, calcium, iron and Vitamin C than those in manual occupations. Women with higher educational achievements had significantly higher energy intakes than other women. Higher Vitamin C intake was seen in both men and women of higher educational attainment.

The (DSBNA) Dietary and Nutritional Survey of British Adults (Gregory et al., 1990) commissioned by the British government and conducted in 1986-7 revealed the following patterns. Energy intake was lower for unemployed men than for other men. For women, there was a trend towards lower energy intake in the lower socio-economic groups but there was no consistent trend with social group in men. Among both sexes, intakes of sugars and fibre tended to be higher in socio-economic groups I/ II than those in IV/V.

Men generally consumed larger quantities of foods. A larger proportion of women consumed wholemeal bread, reduced fat milks, salad vegetables, fresh fruit and confectionary. Conversely men were more likely to eat fried white fish, sausages, meat pies and chips. Older informants were more likely to eat potatoes, milk puddings, butter, preserves and fresh fruit and vegetables. Younger adults more commonly ate savoury snacks and takeaway items, such as meat pies, burgers and kebabs.

Various food patterns in the DSBNA were identified through cluster analysis by Pryer et al. (2001). Four diet groups in men and a further four different groups were found for women that varied in terms of nutrients and socio-demographic features. Amongst men, the most prevalent group was 'beer and convenience food' (34%), second was the 'traditional British diet' (18%), third was 'healthier but sweet' (17.5%) and the fourth was 'healthier diet' (17%). Among women, the most common food pattern was the 'traditional British diet' (32%), second was the 'healthy cosmopolitan diet' (25%), third was the 'convenience food diet' (21%) and finally the 'healthier but sweet diet' (15%).The 'traditional British' and 'beer and convenience' diets were consumed mostly by the manual socio-economic groups. In contrast, the 'healthier', the 'mixed but sweet' and 'healthy sweet' diets found most of their adherents in the non-manual social-economic groups. Those on a 'beer and convenience' diet were on average younger.

Billson et al. (1999) examined fruit and vegetable consumption in the DNSBA with particular reference to low and high intake in terms of age, gender and social-economic

group. Major findings showed that men consumed more portions of fruit and vegetable weekly and that younger adults between the ages of 16-24 consumed twice as much than in the oldest group. The manual socio-economic group ate least of this food group.

- In general, it has been shown that dietary patterns could be derived from people's individual food and drink intake and that these varied according to age, gender, education and socio-economic status. Although there has been little attempt to identify the diet of sub-groups rather than a more global consideration of demographic factors.

Psychological:

In terms of personality dimensions, Revelle (1980) writes that introversion/extraversion is one of the few personality dimensions that can be reliably identified from study to study and investigator to investigator. The importance of this dimension within personality theory is due both to the stability of the trait and the influential theory of Eysenck. The basic assumption of Eysenck's theory of introversion/extraversion is that the personality differences between introverts and extraverts reflect some basic differences in the resting level of cortical arousal or activation. It implies that moderate increases in stress should increase the performance of extroverts who are said to be underaroused. However, the same moderate increase in stress might disrupt the performance of the more highly aroused introverts. Eysenck (1991) describes the basic concepts of extraversion as representing sociability, liveliness and surgency.

A review of the literature does suggest a physiological basis to extraversion. Reproducing Rees (1960) findings that extroverts tended to have 'broader physique', Segraves (1970) explored this further and found a significant correlation between extraversion and body build indices i.e., weight, stature and chest diameter. In the same study, extraversion was positively correlated to the ratio of 17-oxogenic steroids to 17-oxosteroids in the urine. High levels of this trait were also found to be associated with higher plasma cortisol levels (Leblanc, 2005) while lower levels were characterized by a blunted cortisol response (Oswald et al, 2006). In a study of 52 normal people, a positive correlation was shown between CSF 5-HIAA (the main metabolite of serotonin, plasma tryptophan) and higher extraversion scores (Moller et al., 1996). Certain disease states have been linked with higher extraversion; breast and lung cancer and myocardial infraction (Eysenck, 1965) and irritable bowel syndrome in women (Farnam, 2008). And most recently, Kakizaki (2008) found that extraversion was positively related to being overweight. As such, a knowledge of the dietary style associated with extraversion becomes relevant.

An increasing body of evidence has pointed to a neurobiological basis of personality. A highly significant correlation has emerged between extraversion and perfusion of the basal ganglia, thalamus, inferior frontal gyrus and cerebellum areas (O'Gorman, 2006).

In terms of lifestyle, extraversion has been associated with exercising (Arai, 1998), self-reported physical activity (Sale, 2000), smoking frequency (Kikuchi, 1998; Dinn, 2004), alcohol use (Sale, 2000) and gambling (Roy, 2008).

Person-related factors in food choice models have traditionally been considered in terms of sensory, attitudinal and physiological factors (Yeo, 1997) neglecting the direct effects of individual differences in personality.

In 1993, the Eysenckian personality factors of psychoticism, extraversion and neuroticism were examined in a randomly selected population based Australian study (Falconer, 1993) of the relationship between personality and nutrients densities. Sex and nutrient specific correlations were found. In men, neuroticism correlated negatively with fibre density but positively with cholesterol density; psychoticism correlated negatively with complex carbohydrate density. In women, psychoticism correlated negatively with both protein and sodium density but positively with refined sugar density; extraversion correlated positively with sodium intake. Regression analysis showed that these personality factors explained more of the variance (15-30%) than the socio-demographic variables (6-17%). However, a later study of Australian twin pairs (Yeo, 1996) failed to reproduce these findings.

Japanese researchers have reported distinctive eating patterns in extroverts. Kikuchi (1998) studied 942 Japanese college students and found that extroverts ate more meat and legumes. A further but separate study of 470 college students by the same author (Kikuchi, 1999) showed those scoring high on the extroversion scales preferred salty foods, oily dishes, fish and had breakfast only once a week. Studies carried out in the UK showed an association between extraversion and alcohol consumption (Sale, 2000).

Summing up, extraversion has been found to be associated with physiological and neurobiological indices as well as lifestyle, in addition to being associated with different health outcomes, i.e. cancer and overweight. There was also some evidence demonstrating that extraverted people have definite dietary preferences.

Having established from the scientific literature, that socio-demographic and psychological factors can be related to diet, we will now turn our attention to examining these relationships in a large representative British population.

Chapter 3: Introduction to the Health and Lifestyle Survey 1 (HALS 1)

Survey aims:

The Health and Lifestyle Survey, funded by the Health Promotion Trust, was conducted under the auspices of the Regius Professor of Physics, Cambridge University School of Clinical Medicine from 1984-1985 in the UK.

The principal objective of the study was:

1. To investigate, in a representative national sample, the four habits or behaviours most often implicated in studies of ill health, smoking, alcohol consumption, diet and physical exercise.

2. To consider the association of these and other components of lifestyles, both singly and in combination with various aspects of health in the individual.

3. To investigate whether health behaviour in these four areas of life reflected the individuals' beliefs about, attitudes towards, and experience of health.

4. To examine the distribution of a number of simple measures of physiological status, and look for associations between these measures and lifestyles and reported health.

5. To examine the distribution of measures of cognitive function, personality and psychiatric status, and consider associations between these and lifestyles and reported health.

The data consisted of:

1. An interview, carried out in the respondent's home and lasting approximately one hour, on the topics of (a) basic socio-economic, education, family and housing data, (b) self-reported health, (c) health attitudes and beliefs, (d) dietary habits, (e) leisure, work and exercise, (f) smoking and (g) alcohol consumption.

2. A separate home visit by a nurse for a series of physiological measures, height, girth and hips, blood pressure, pulse rate, respiratory function, environmental and exhaled carbon monoxide, and ambient room temperature. At the same visit, simple tests of cognitive function (reaction time, memory and reasoning) were also carried out by the nurse.

3. A self-completion questionnaire, introduced by the nurse and returned by mail assessing four measures of personality and psychiatric status.

Survey Method

The fieldwork was carried out by the Social and Community Planning Research (SCPR). The process of interviewing was carried out in three phases, Autumn 1983, Winter-Spring 1985 and Summer 1985. Each region of the country was represented in at least two of these time periods and most in all three to ensure that different times of the year were represented.

Interviewers provided potential respondents with an introductory letter. At the close of each interview they introduced the second part of the study, the visit by a nurse, and passed to the nurses the names and addresses of all interviewed subjects who were willing to be further involved. The nurse visit, also accompanied by an introductory letter, was made a week or so later. At the end of the nurses' visit, the self-completion booklet was given to the respondent together with a reply-paid envelope, and the method of completing it was explained.

The Social and Community Planning Research (SCPR) provided coded data on magnetic tape for each of the three parts of the study. To this team members added the coding of the many open-ended or "verbatim" questions which were a particular feature of the survey method, and as far as possible dealt with answers which the interviewers had been unable to code in pre-coded questions. Consistency and word code checks were performed and the data rigorously "cleaned".

Sample

The population was defined as individuals of eighteen and over living in private households, in England, Wales and Scotland. To obtain a sample of required size, a total of 12,672 addresses were randomly selected from English, Welsh and Scottish Electoral registers using a three-stage design. Parliamentary constituencies were allocated with Standard Regions to one of three population density bands, and 198 constituencies were then selected with the probability proportional to the size of the electorate. Two wards were selected from each of the sampled constituencies, again with probability proportional to the electorate. Each of the addresses was visited, and 12,254 were found that could be included in the study. In each household, the interviewers selected one person aged eighteen and over from all those residents, applying a pre-determined method to ensure random selection of an individual.

This procedure was necessary because Electoral Registers were not usually sufficiently up to date to provide a reliable list of individuals. There were 418 addresses (3.3%) which were excluded on the basis they were: unoccupied, demolished, business or industrial sites, institutions, untraced or lacking occupants 18 years or over.

Response Rate

The 12,254 addresses produced interviews with 9003 individuals which was a response rate of 73%. Reasons for non-response were due to refusals, failure to establish contact, incapacitation due to senility and ill health and miscellaneous. Of these, 82.2% (7,414) agreed to further visits from a study nurse and measurements were carried out. Of those sent who received self-completion booklets from the nurse, 88.6% were returned. Reasons for non-return included visit not attempted by nurse, refusals, failure to establish contact and other reasons. The highest response rates were achieved in Scotland, Wales and Northern England whereas the lowest were in Greater London.

Representativeness of Sample

The study population was compared with data from the 1981 census. The study population showed slightly more women and demonstrated some differences from the Census population at the extreme end of the age spectrum with a slight underrepresentation of single persons. These were probably due to differences in availability for interviews. Older women, but not men, were particularly under-represented in the measured and self-completion samples. Employment status was however well represented with 60.6% of the study population "economically active" by census definitions, compared with 61.6% in census 1981 and 34.4% of the study population "economically inactive" compared with 38.3%.

Available data on ethnic differences was difficult to compare, since the Census question was concerned with "country of birth" and did not differentiate native-born white and non-white, whereas the survey interviewers were asked to judge the ethnic group from their own observations.

Nevertheless, taking these differences in the definition of ethnicity into account, the sample appeared to represent ethnic minorities well.

Characteristics of the Sample

"Marital Status" included those who were also co-habiting. "Working status" was defined in terms of: employed full-time/part-time, unemployed, permanently sick, retired, full-time student and household duties. The term 'household duties' included only participants under 60 years of age in the case of females or, in a few cases, 65 years in the case of males. All those of retirement age and over who were economically inactive were categorized as "retired". Social-economic grouping were classified according to the U.K. Registrar General's classification of occupations.

Chapter 4: Can we identify Western and Prudent dietary patterns in a representative sample of the U.K. population?

The 'Western' diet has been linked to higher incidence of chronic disease; the 'Prudent' to a far lesser degree. The 'Western' diet has been characterized by higher consumption of refined cereals, processed and red meats, eggs, desserts and high-fat dairy products while the 'Prudent' diet is distinguished by more fruit, vegetables, whole grains, legumes, fish and poultry. One of the aims of the present study was to explore whether relatively homogenous groups reporting 'Western' or 'Prudent' diets could be identified in a representative sample of British men and women over 18 years of age. As a first step, the question was asked, 'Can we identify Western and Prudent type dietary patterns in a representative sample of the U.K. population?'

Methods:

Dietary intake in a large UK sample of 9003 participants was assessed with a Frequent Food Questionnaire (FFQ), which previously has been shown to provide a valid estimate of food and drink consumption (Brunner, 2001; Daures, 2000; Hu, 1999; Katsouyanni, 1997) over short time periods. The FFQ was used to derive dietary patterns using principal components analysis.

The foods and drinks found in the main questionnaire (see Table 4.1) were recoded to reflect the common unit of how much consumed a day. For example, portions consumed daily were given a score of 7. Thus, we transformed the raw data as follows: Never=0, Less than once a week=.75, Once or twice a week=1.5, Most days (3-6) = 4.5, Once a day=7, More than once a day= 14.

In addition to the main food and drink questionnaire, variables were created for bread, tea, coffee and milk based on separate questions. They were recoded as follows:

Bread: A value for bread consumption was created by combining the responses of two questions: *39 (a) How many slices of bread or crisp bread do you usually eat each day, including toast and sandwiches?* (Respondents choose number of slices between 0-98) and_*39 (b) In addition, how many rolls or similar types of bread do you usually eat each day?* (Respondents chose number of rolls between 0-98.) Thus, one slice of bread =1 and one roll, which contained slightly more bread =1.5.

Tea: A new variable was created for tea (defined as cups) in response to question: *42. How many cups of tea do you usually drink in a day?* We re-coded the following answers: None=0, one or two cups=1.5, three or four cups= 3.5, five or six cups=5.5 and more than six cups=7

Coffee: A transformation was carried out for coffee. In response to question: *43: How many cups of coffee do you usually drink in a day?* The following answers were re-coded: None=0, one or two cups=1.5, three or four cups= 3.5, five or six cups=5.5 and more than six cups=7

Milk: For milk: *44. How much milk do you usually have each day? (Please include milk used in drinks, in cereal and in cooking, e.g. custard, milk puddings)*_was transformed as follows: None= 0, Less than ½ pint=.25, ½ pint-1 pint= .75, Over 1, to 2 pints=1.5, More than 2 pints= 3.

Statistical Analysis: A factorial analysis with the Varimax rotation method was conducted to reduce the large number of food groups into dietary patterns. The dietary patterns were checked to ensure they were also valid for all age, education, socio-demographic and ethnic groups as well for gender. The resulting groups were categorized into 'Western' or 'Prudent' dietary patterns.

Factorial Analysis of Food and drinks consumption:

A preliminary factor analysis was carried out on the main foods and drinks listed in Table 4.1 including bread, tea, coffee and milk. A principal component analysis was calculated and the result subjected to Varimax rotation. Table 4.2 reports the resulting factors whose 'Eigenvalues' were greater than 1.Ten factors resulted that in total accounted for 49 % of the variance.

Table 4.1: Weekly frequency consumption questionnaire of main food and drink

	More than once	Once a Day	Most days (3-6)	Once or twice a week	Less than once a week	Never
Fresh fruit in summer						
Fresh fruit in winter						
Salads or raw veg in summer						
Salads or raw veg in winter						
Tinned fruit						
Chips						
Potatoes (not chips)						
Root vegetables like carrots, and parsnips						
Peas and beans (all kinds; inc. baked beans, lentils, pulses)						
Green vegetables						
Other cooked vegetables including onions and mushrooms, Chinese food						
Nuts						
Potato crisps or similar snacks						
Sweets, chocolates						
Pasta (spaghetti, noodle), or rice						
Breakfast cereal (inc. porridge)						
Biscuits						
Cakes of all kinds						
Sweets or puddings, fruit pies, and flans and tarts						
Ice cream, mousse, yoghurt, milk puddings, drinks made with cocoa, ovaltine						
Soft drinks like squash or colas						
Pure fruit juice						
Jam/marmalade/golden syrup/honey						
Cheese						
Eggs						
Cream						
Fish						
Poultry						
Sausages/tinned meat/pate/meat pies/pasties, etc						
Beef, lamb/pork/ ham/ bacon inc curries						

Table 4.2: Resulting factors with Eigenvalues greater than 1.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.388	9.964	9.964	3.388	9.964	9.964	2.636	7.752	7.752
2	2.645	7.778	17.743	2.645	7.778	17.743	2.154	6.336	14.087
3	1.908	5.610	23.353	1.908	5.610	23.353	1.874	5.512	19.599
4	1.791	5.269	28.622	1.791	5.269	28.622	1.822	5.360	24.959
5	1.418	4.171	32.793	1.418	4.171	32.793	1.505	4.426	29.385
6	1.267	3.727	36.520	1.267	3.727	36.520	1.496	4.400	33.785
7	1.195	3.514	40.033	1.195	3.514	40.033	1.428	4.201	37.986
8	1.138	3.348	43.381	1.138	3.348	43.381	1.387	4.080	42.066
9	1.058	3.113	46.494	1.058	3.113	46.494	1.288	3.788	45.854
10	1.005	2.957	49.451	1.005	2.957	49.451	1.223	3.597	49.451

Factor analysis was carried out again using Varimax rotation to determine whether dietary patterns were similar across age, region, sex and socio-economic levels. The four ethnic groups considered were: (1). Indian, East African, Pakistani, Bangladeshi, (2). Black, African, West Indian, (3). Other non-white and (4) White/European. As the pattern for the White/European group (99%) differed from others, it was decided to consider only those of this background. Another factor analysis was carried out, pre-selecting for this ethnic group. The results are in Table 4.3.

Table 4.3: Principal component analysis with Varimax rotation method

	Component									
	1	2	3	4	5	6	7	8	9	10
Fresh fruit in summer	**.848**	.031	.001	.035	-.006	-.069	.145	-.021	-.010	.060
Fresh fruit in winter	**.819**	.032	.000	-.036	-.057	-.072	.144	-.059	.025	.063
Salads or raw veg summer	**.610**	.183	.004	-.086	.158	.143	-.172	.155	.081	-.080
Salads or raw veg winter	**.579**	.160	-.004	-.134	.129	.153	-.198	.168	.143	-.045
Tinned fruit	.000	.029	.298	.159	.021	.028	.064	-.096	.085	.283
Chips	-.248	-.057	-.015	**.572**	-.032	.169	-.132	-.023	.049	.050
Potatoes (not chips)	-.105	**.507**	.187	-.100	-.150	.012	.210	-.191	-.092	.060
Root veg (eg. carrots, parsnips etc.)	.128	**.734**	.044	-.107	.013	-.047	-.032	-.032	.059	.054
Peas, beans (all kinds incl. baked beans, lentils, pulses)	-.050	**.616**	-.006	.250	.018	.012	-.035	.117	.007	.131
Green veg	.199	**.714**	-.032	-.124	-.027	-.008	.093	-.001	.101	-.034
Other cooked veg incl. onions, mushrooms. Chinese food	.120	**.539**	-.036	-.045	.066	.140	.064	.279	.048	-.101
Nuts	.101	.065	-.048	.048	-.137	-.029	.122	**.636**	-.084	.028
Potato crisps or other similar snacks	-.016	-.021	.061	**.668**	.009	-.013	-.041	.150	-.065	-.014
Sweets, chocolate	.033	-.052	**.476**	.410	-.074	-.134	.054	.126	-.051	-.093
Pasta (eg. spaghetti, noodles) or rice	.016	.046	.030	.009	.193	.070	.027	**.609**	.100	.041
Breakfast cereal (incl. porridge)	.148	.015	.155	-.174	-.074	-.163	.146	.143	.014	**.631**
Biscuits	-.007	-.044	**.661**	.085	-.012	.031	-.090	-.005	-.014	.048
Cakes of all kinds	-.035	.039	**.738**	-.001	-.064	.018	.114	-.060	-.013	-8.61E-005
Sweets or puddings, fruit pies, flans and tarts	-.066	.168	**.535**	.022	.030	-.006	.349	-.008	-.035	.102
Ice cream, mousse, yoghurt, milk puddings, drinks made with cocoa, ovaltine	.173	.028	.151	.022	-.001	-.034	**.448**	.146	.039	.201
Soft drinks eg. squash or colas	.111	-.048	.022	**.611**	.065	-.059	.070	-.074	.003	.024
Pure fruit juice	.390	-.010	-.106	-.056	.057	-.029	.329	.289	.081	.027
Jam/marmalade/golden syrup/honey	.065	.010	**.488**	-.295	-.063	.185	.092	.046	.027	.078

Cheese	.178	-.010	.133	-.069	.058	**.556**	.096	.267	-.082	-.062
Eggs	-.022	.038	-.022	.061	-.083	**.678**	.141	-.056	.114	.031
Cream	-.025	.037	.146	-.021	.115	.116	**.541**	.123	.062	.060
Fish	.074	.044	.006	-.091	-.063	.061	.018	-.017	**.757**	.019
Poultry	.070	.065	-.023	.092	.033	-.028	.052	.050	**.758**	-.009
Sausages/tinned meat/pate/meat pies/pasties	-.214	.025	.006	**.442**	.009	.292	.066	-.068	.071	.036
Red meat (eg. beef, lamb, pork, ham, bacon incl. curries	-.045	.287	.028	.020	-.081	.229	**.487**	-.303	-.066	-.141
Bread	-.072	.032	.089	.215	-.081	**.479**	-.303	-.099	-.088	.290
Tea	-.084	.082	.076	-.063	**-.795**	.138	-.095	-.023	.013	.080
Coffee	.044	.042	-.043	-.005	**.837**	.044	.011	.049	-.025	.028
Milk	-.069	.051	-.015	.093	.003	.175	.023	.009	-.028	**.731**

The dietary patterns were checked again across age, region, sex and socio-economic levels and were found to be broadly similar. Ten factors resulted which in total accounted for 45% of the variance. For ease of presentation, the variables were summarised as follows (% of variance noted in brackets):

1. Fruits & Salad (7.5)
2. Potatoes & vegetables (6.3)
3. Sweet refined foods (5.5)
4. Chips, crisps, squash/colas sausage (5.4)
5. Tea & coffee (4.4)
6. Cheese, eggs & bread (4.4)
7. Yoghurt, cream & red meat (4.2)
8. Nuts, pasta& rice (4.1)
9. Fish & poultry (3.8)
10. Cereal & milk (3.6)

Most of the dietary patterns corresponded well with either the Western or Prudent diets. 'Sweet refined foods', 'Chips, crisps, squash/colas sausage', 'Cheese eggs and bread', 'Yoghurt, cream and red meat' and 'Cereal and milk' fit the Western diet criteria while 'Fruit and salads', 'Fish and poultry' fit the Prudent type. Exceptions to this were the categories 'Nuts, pasta and rice' and 'Potatoes and vegetables' which combined aspects of both Western/Prudent diets and also 'Tea and coffee' where there was no general consensus in the literature as to into which category it fell.

Thus the food groups could be honed down to the following:

1. Fruits and salads (Prudent)
2. Sweet refined foods (Western)
3. Chips, crisps, squash/colas sausage (Western)
4. Cheese, eggs and bread (Western)
5. Yoghurt, cream and red meat (Western)
6. Fish and poultry (Prudent)
7. Cereal and milk (Western)

Discussion:

The large number of subjects studied and the broad nature of the Health and Lifestyle Survey (HALS) rendered a more detailed examination of individual's diets than could be gleaned from an FFQ impractical. Nevertheless, our principal components analysis did reveal ten main dietary patterns which accounted for 42% of the variance. This was substantially higher than that reported by Barker (1990) who, using a 7 day weighed intakes, derived 5 components accounting for 22.6% of the total variance and Whichelow (1996) whose principal components analysis of the HALS 1 food and drinks analysis explained only 27.5% of the variance. In the present study, ten dietary patterns were derived from the HALS 1 survey questionnaire, seven of which were consistent with the Western and Prudent dietary styles.

The 'Western' pattern, characterized by high consumption of refined cereals, processed and red meats, potatoes, desserts, eggs and high-fat dairy products has been associated with an increased risk of coronary heart disease (Hu, 2000; Brunner, 2008) as well as colon cancer (Fung, 2003), type 2 diabetes (van Dam, 2002; Brunner, 2008), obesity (Fung, 2001;) and chronic disease (Esposito, 2008). This dietary pattern can be therefore regarded as unhealthy due to its association with increased disease risk. Analysis of our UK sample population revealed five corresponding Western type patterns: 'Sweet refined foods', 'Chips, crisps, squash/colas sausage', 'Cheese, eggs and bread', 'Yoghurt, cream and red meat' and lastly, 'Cereal and milk'.

'The 'Prudent' pattern has been associated with a lower risk of coronary heart (Hu, 2000; Fung, 2001), obesity, type 2 diabetes and metabolic syndrome (Giugliano, 2008). Its main components are 'fruit, vegetables, whole grains, legumes and poultry. Two dietary patterns found in our UK sample population corresponded well with the Prudent diet. These were 'Fruits and salads' and 'Fish and poultry'.

Table 4.5: Comparison of weekly macro-and micro-nutrients intake by gender in 2 contemporary food surveys

	HALS1	DNSBA		HALS1	DNSBA
	Male	Male		Female	Female
Total Kcal	17989	17150		13816	11760
Total Protein (g)	544	592.9		465	434
Total Fat (g)	730	716.1		581	513.1
Total Carbohydrate (g)	2250	1904		1738	1351
Total Fibre (g)	397	174.3		286	130.2
Total Calcium (mg)	8141	6580		6980	5110
Total Iron (mg)	105	98		94	86.1
Total Vitamin A (mg)	9255	11753		8226	10416
Total Vitamin B1 (mg)	10	14.07		8.9	11.27
Total Vitamin B2 (mg)	13.7	16.03		12	12.88
Total Vitamin B3 (mg)	266	286.3		226	212.1
Total Vitamin C (mg)	757	522.2		872	511.7
Total Sodium (mg)	19348	23632		14952	16457
Total Potassium (mg)	31852	22309		28795	16870

Although it was not possible to fully compare dietary patterns between the HALS 1 and its contemporary studies, 'The National 1946 Birth Cohort' and 'The Dietary and Nutritional Survey of British Adults (DNSBA), we were able to compare the micro- and macro-nutrients of HALS 1and the DSBNA in Table 4.5. This demonstrated a good overview of basic block elements of both diets. On balance, the 2 surveys offered some measure of replication. The macro-and micro-nutrients for HALS 1 were derived from the Food Composition Table calculated especially for this paper (See Appendix C).

<u>CHAPTER SUMMARY:</u>

•

The consumption frequency of foods and drinks of a representative sample of the U.K. population, aged 18 and over, was reduced using factorial analysis to ten patterns, seven of which were consistent with either the Western or Prudent type diet.

Thus in a large sample UK population, Western and Prudent dietary patterns have been identified. Western patterns found were 'Sweet refined foods',' Chips, crisps *squash/colas sausage', 'Cheese, eggs and bread', 'Yoghurt, cream and red meat', 'Cereal and milk' while Prudent patterns were 'Fruits and salads' and 'Fish and poultry'*

Chapter 5: Is there a relationship between UK socio-demographic variables and Prudent and Western dietary styles?

Western and Prudent dietary styles were previously identified in our UK sample. The next step was to analyse the relationship between socio-demographic groups and these dietary styles in order to determine which subsets of the population sample consumed which dietary patterns.

Statistical methods and analysis: Raw data reflecting socio-demographic information on age, socio-economic group and education were recoded where necessary to conduct statistical analysis. The variable 'Socio-economic group-Recoded' (coded according to the Registrar General's classification of occupations) was recoded again by dropping "Unclassified" and "Armed Forces" as they were difficult to categorize. The major categories became: 'Professional, Employers, Managerial', Non-manual, Skilled manual, Semi-skilled and Unskilled. There were 14 various education levels as responses to the question: *88(a). What is the highest qualification you have obtained, either while at school or gained after you left school?* The answers were reduced to six categories so that education qualifications reflecting a comparable length of study and academic demand were grouped together. These were: 'No qualifications', 'CSE 2-5', 'O levels', 'A levels', 'College' and 'University'.

The effects of each socio-demographic variable (age, gender, socio-economic group and education) on each dietary pattern was examined by hierarchical regression analysis. Each socio-demographic variable was forced in succession to a model with the remaining three socio-demographic variables. This was repeated through all the dietary patterns.

An analysis of variance was also carried out to look specifically at variations within each socio-demographic variable and interactions between them.

Do age, gender, socio-economic group and education influence dietary patterns after controlling for other variables?:

In a hierarchical multiple regression analysis, three of age, gender, socio-economic group and education were entered into the model as Block 1. The remaining fourth variable was entered in as Block 2 to determine whether it added to the variance. This was carried out for each dietary pattern. (See Tables 5.1-5.4) A summary of the differences in variances between Blocks 1 and 2 is presented in Table 5.5.

Fruits and salad: Gender was the best predictor (Beta=.213) explaining the largest amount of the variance (4.4%) with level of education following this at 2.1%. (Beta=.169). Age (0.1%) and socio-economic status (0.1%) had a minimal impact.

Sweet refined foods: Age was the best determinant (Beta=.213), explaining the largest part of the variance (4.2%) Education came in second place at 0.1% while socio-economic status (0%) and education (0%) had no impact at all.

Chips, crisps, squash/colas sausages: Age was the best predictor (Beta= -.447), explaining the largest part of variance (18.3%) Considerably smaller was the impact of gender (Beta= -.154) adding 2.4% to the variance. Socio-economic status and education had the least impact at 0.11% and 0.10 % respectively.

Cheese, eggs & bread: The best predictor was gender (Beta=-.188), explaining 3.5% of the variance with socio-economic status (0.1%) and education (0.1%) following with minimal impact. Age made no difference at all.

Yoghurt, cream & red meat: Age was the best predictor (Beta=.123) explaining 1.4% of the variance with socio-economic group playing a far less significant role (1.1%) followed by gender (0.3%) and then education (0.3%).

Fish and poultry: There were hardly any differences in terms of socio-demographic factors. Age and socio-economic group were however a small determinant of food choice explaining each 0.2% of the variance. This was followed by gender at 0.1%.

In other words almost the same level of fish and poultry consumption was enjoyed by all, regardless of age, social background, education and gender.

Cereal and milk: Gender determined choice of this dietary pattern most of all (Beta= -.158) explaining 2.5% of the variance with age following at 0.6%. and then socio-economic level at 0.1%. Education had no impact at all.

Table 5.1: Does age make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Gender	**.213**	*	**-.154**	**-.188**	**.062**	*	**-.158**
Socio-economic group	**.103**	*	**-.112**	*	**.119**	**.045**	*
Education	**.169**	*	**-.112**	*	**.065**	*	*
Age (1)	*	.213	-.447	*	.123	.039	-.052
R2 –age (2)	.089	.002	.045	.037	.024	.003	.024
R2+age (3)	.090	.044	.228	.037	.038	.005	.030

Table shows hierarchical regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
* = Non-significant results
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 5.2: Does gender make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Age	*	**.213**	**-.447**	*	**.123**	**.039**	**-.052**
Socio-economic group	**.103**	*	**-.112**	*	**.119**	**.045**	*
Education	**.169**	*	**-.112**	*	**.065**	*	*
Gender (1)	**.213**	*	**-.154**	**-.188**	**.062**	*	**-.158**
R2 –gender (2)	.046	.044	.204	.002	.034	.004	.005
R2+gender (3)	.090	.044	.228	.037	.037	.005	.030

Table shows hierarchical regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
* = Non-significant results
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 5.3: Does socio-economic group make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Age	*	**.213**	**-.447**	*	**.123**	**.039**	**-.052**
Gender	**.213**	*	**-.154**	**-.188**	**.062**	*	**-.158**
Education	**.169**	*	**-.112**	*	**.065**	*	*
Socio-economic group (1)	**.103**	*	**-.112**	*	**.119**	**.045**	*
R2–socio-economic group (2)	0.08	.044	.217	.036	.027	.003	.029
R2+socio-economicgroup (3)	.090	.044	.228	.037	.038	.005	.030

Table shows hierarchical regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
* = Non-significant results
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 5.4: Does education make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Age	*	.213	**-.447**	*	**.123**	**.039**	**-.052**
Gender	**.213**	*	**-.154**	**-.188**	**.062**	*	**-.158**
Socio-economic group	**.103**	*	**-.112**	*	**.119**	**.045**	*
Education (1)	**.169**	*	**-.112**	*	**.065**	*	*
R2–education (2)	.069	.043	.218	.036	.035	.005	.030
R2+education (3)	.090	.044	.228	.037	.038	.005	.030

Table shows hierarchical regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
* = Non-significant results
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

5.5: Summary of differences from regression analysis tables 5-3-5.9 (*)

	Fruits & salads	**Sweet refined foods**	**Chips, crisps, squash/colas sausage**	**Cheese, eggs & bread**	**Yoghurt, cream & red meat**	**Fish & poultry**	**Cereal & milk**
Age	0.001	0.042	0.183	0	0.014	0.002	0.006
Gender	0.044	0	0.024	0.035	0.003	0.001	0.025
Socio-economic status	0.001	0	0.011	0.001	0.011	0.002	0.001
Education	0.021	0.001	0.010	0.001	0.003	0	0

*= Difference between' constants only' and 'constants plus forced in-in variable'.

<u>The effects of interactions between socio-demographic factors on dietary patterns</u>

The effects of interactions between socio-demographic variables (age, gender, socio-economic group and education) on dietary patterns were investigated. Some variables were re-coded to ensure adequate numbers (N > 100) in each group. Age was reduced to three levels (18-30, 31-40, 41+) while education was collapsed from the six to four levels (No qualifications/CSE2-5, O-level, A-level, College/university) and socio-economic group was honed down to four groups instead of six (Semi/unskilled, Non-manual, Manual, Professional/managerial).

Significant interaction effects are reported in Figures 5.1-5.10 for the following dietary patterns:

<u>Sweet refined foods</u>: There was a significant interaction effect between gender and age (Figure 5.1) for the consumption of 'Sweet refined foods' ($F (2, 8626)=6.15$, $p< .002$). Younger men and women (18-30) consumed at the same lower rates. In the 31-40 age group women ate slightly more than men but both sexes closed the gap again in the 41+ group.

<u>Chips crisps squash/colas sausage:</u> There was a significant interaction (Figure 5.2) between gender and education, ($F (3, 8203) =5.0$, $p< .002$). Consumption in men and women decreased with rising levels of education. Men with less education consumed more than women at the same level, but with higher levels of education there was hardly any difference.

There was a fall in consumption of 'Chips, crisps, squash/colas sausage' with increasing age, with women showing lower overall consumption than men ($F (2, 8626) =34.11$, $p< .001$). There was a far greater difference between men and women in the 18-30 age group but the gap closed in the over 41 year olds (Figure 5.3).

There was a significant interaction between age and education ($F (6, 8203) =15.25$, $p< .001$). There was a wide gap in the age groups in those with no qualifications/CSE 2-5 but with rising levels of education, consumption of 'Chips, crisps, squash/colas sausage' decreased and the gap narrowed in the 41 + age group. The most dramatic fall in consumption of 'Chips, crisps, squash/colas sausage' with rising education occurred in the 18-30 age group while those 41 and over showed less variation regardless of education level (Figure 5.4).

An effect of age and socio-economic group was observed (Figure 5.5). In the youngest group (18-30), consumption was overall higher in the lower socio-economic groups but with age it decreased in all groups. In the oldest group (41+) the differences between the groups minimalised markedly ($F(6, 8447) = 8.0$, $p < .001$).

Cheese eggs bread: Gender and education (Figure 5.6) affected consumption with the least educated men consuming more than women at the same level. With increasing education this gap almost closed ($F(3, 8203) = 11.0$, $p < .001$).

Men consumed considerably more 'Cheese, eggs and bread' (Figure 5.7).than women overall regardless of age. Women consumed considerably less in the 18-30 age group but increased their consumption with age ($F(2, 8626) = 12.6$, $p < .001$).

Men consumed more in the lower socio-economic groups (Figure 5.8) but decreased in higher groups becoming more on par with women ($F(3, 8447) = 12.04$, $p < .001$).

Yoghurt cream red meat: Consumption was lower in the lower socio-economic groups with men consuming slightly more than women (Figure 5.9). In the higher groups, consumption was somewhat higher and at par between the sexes ($F(3, 8447) = 7.43$, $p < .001$).

.

Cereal & milk: There was a significant interaction between gender and age. While a woman's age had little effect on consumption, younger men ate considerably more than women particularly in the 18-30 age group (Figure 5.10) but then the gap narrowed with increasing age ($F(2, 8626) = 39.33$, $p < .001$).

Figure 5.1: The effects of the interaction of gender and age on the consumption of 'Sweet refined foods'.

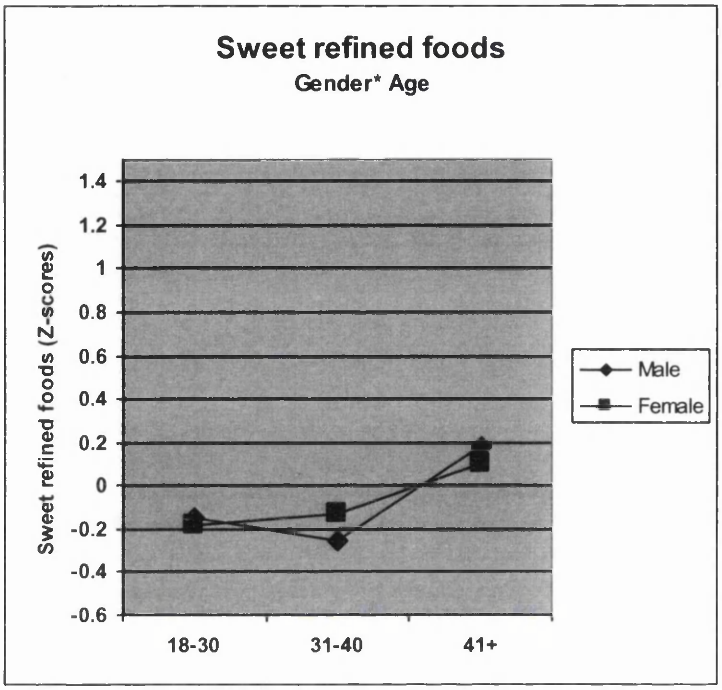


Figure 5.2: The effects of the interaction of gender and education on the consumption of 'Chips, crisps squash/colas sausage'.

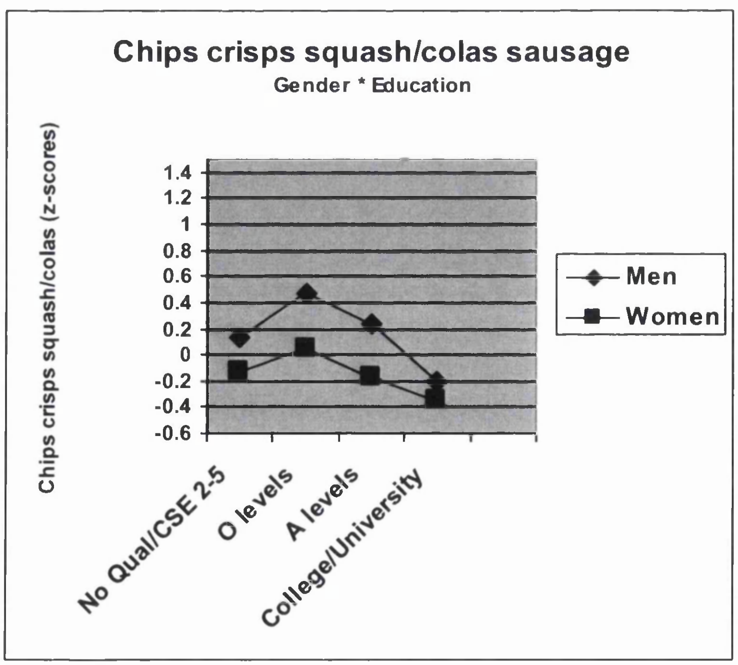


Figure 5.3: The effects of the interaction of gender and age on the consumption of 'Chips, crisps, squash/colas sausage'.

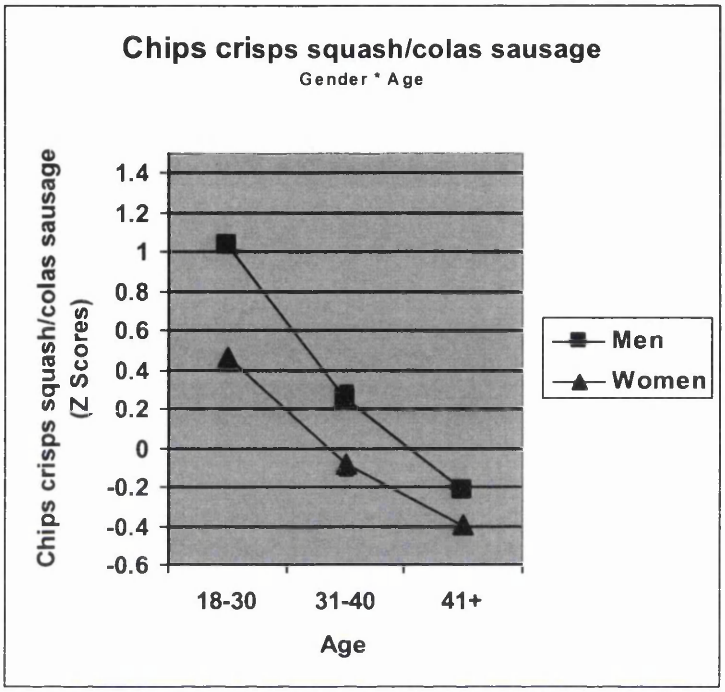


Figure 5.4: The effects of the interaction of age and education on the consumption of 'Chips, crisps, squash/colas sausage'.

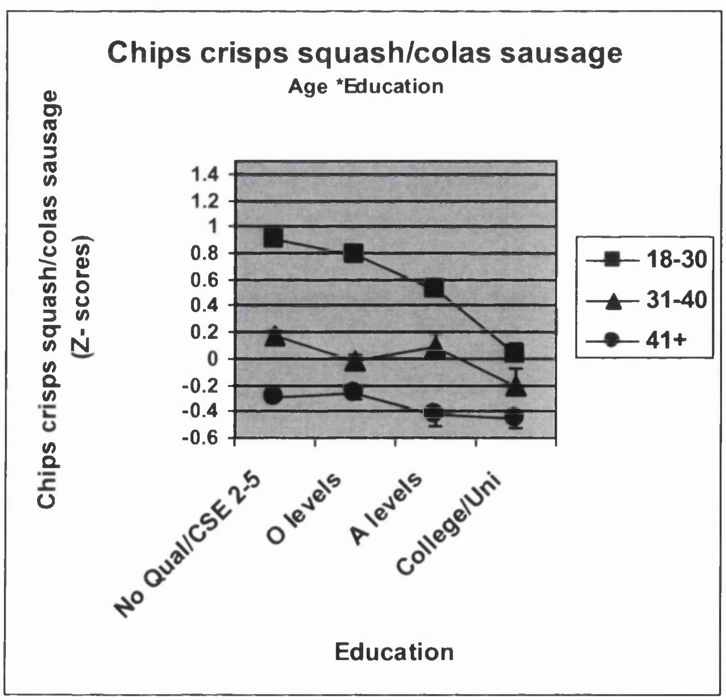


Figure 5.5: The effects of the interaction of age and socio-economic group on the consumption of 'Chips, crisps, squash/colas sausage'.

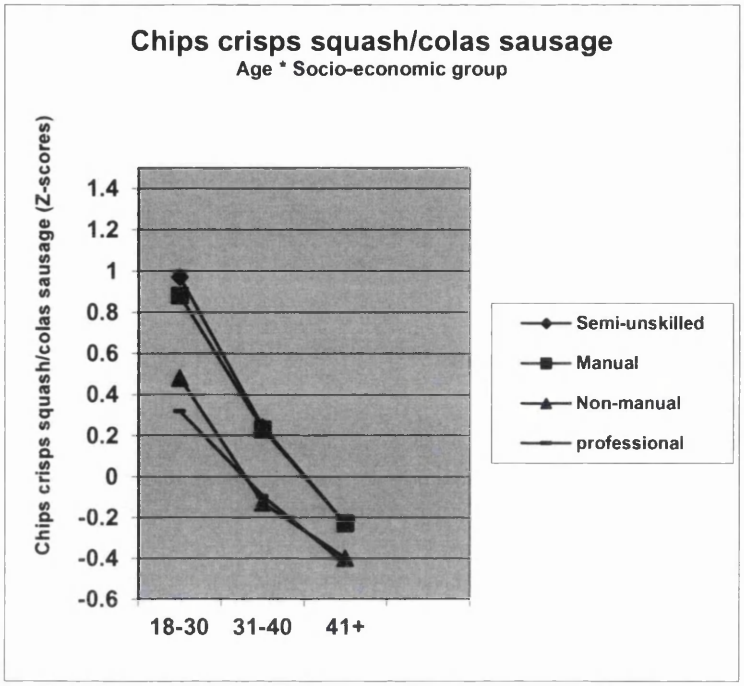


Figure 5.6: The effects of the interaction of gender and education on the consumption of 'Cheese, eggs and bread'.

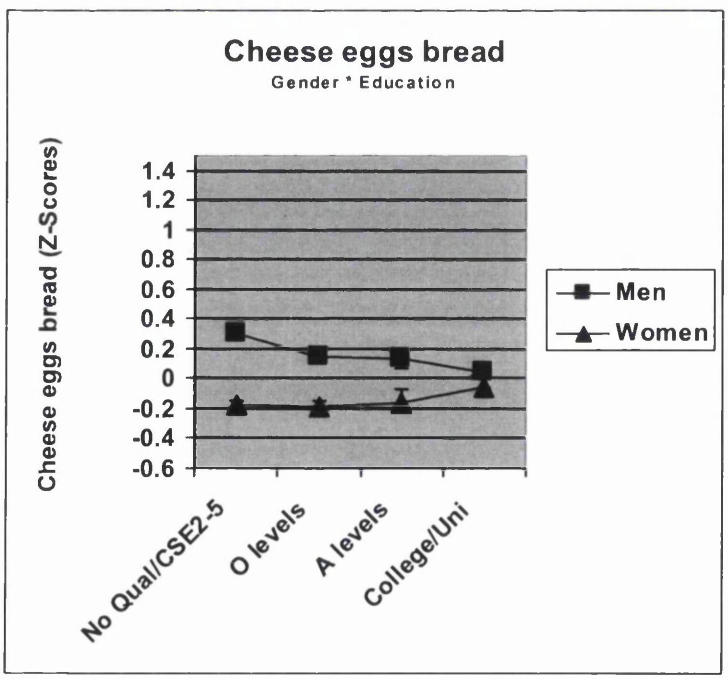


Figure 5.7: The effects of the interaction of gender and age on the consumption of 'Cheese, eggs and bread'.

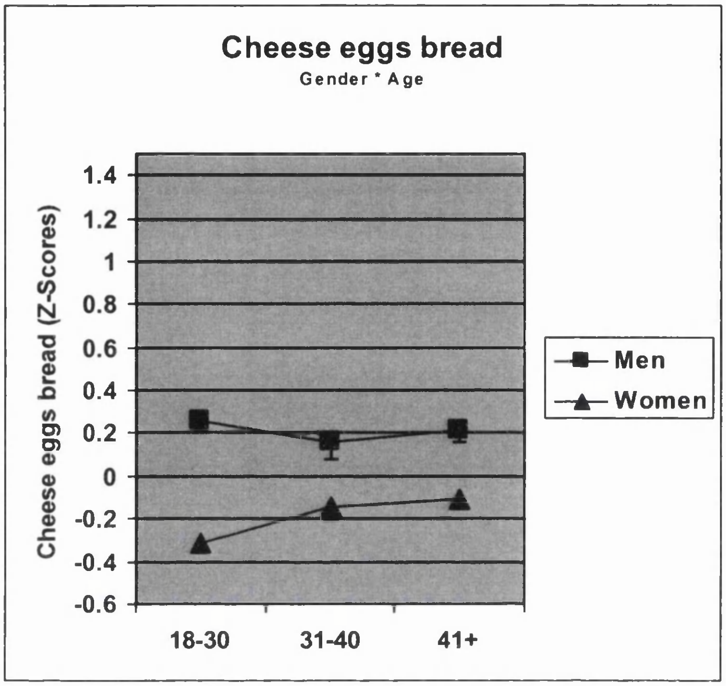


Figure 5.8: The effects of the interaction of gender and socio-economic group on the consumption of 'Cheese, eggs and bread'.

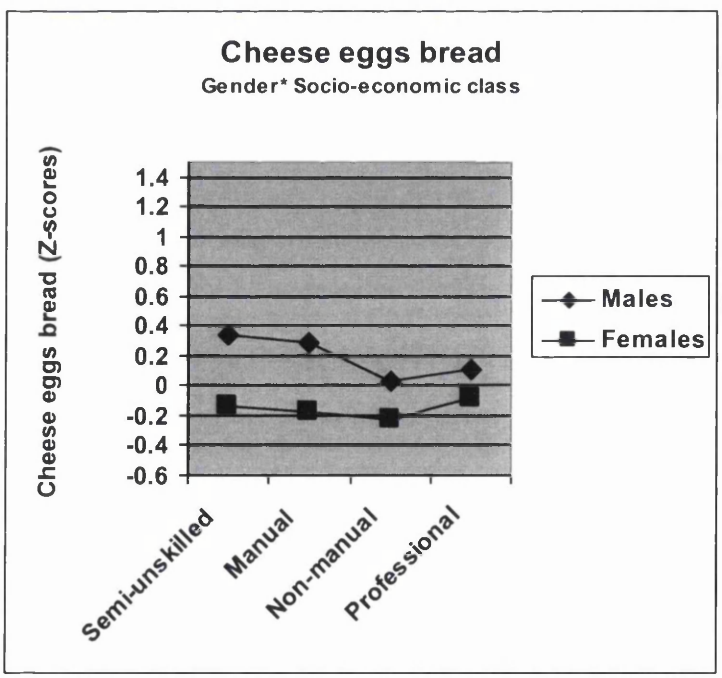


Figure 5.9: The effects of the interaction of gender and socio-economic group on the consumption of 'Yoghurt, cream, and red meat'.

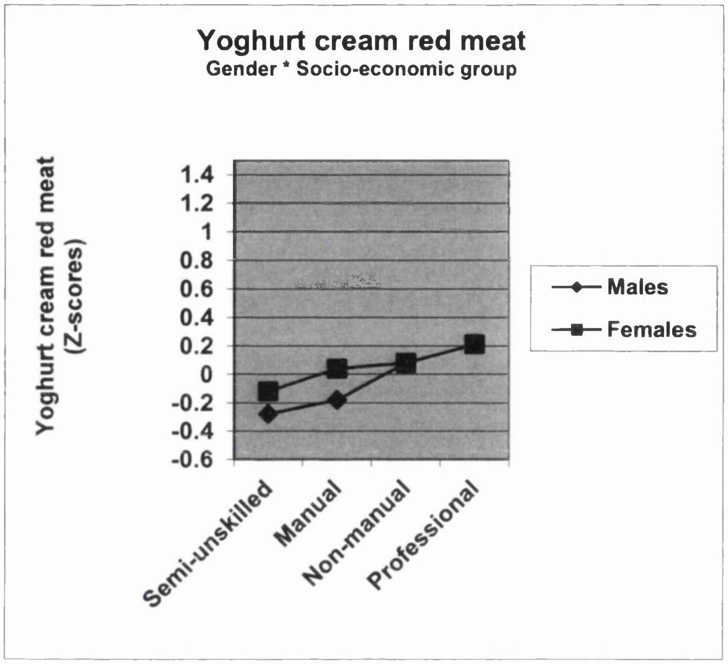
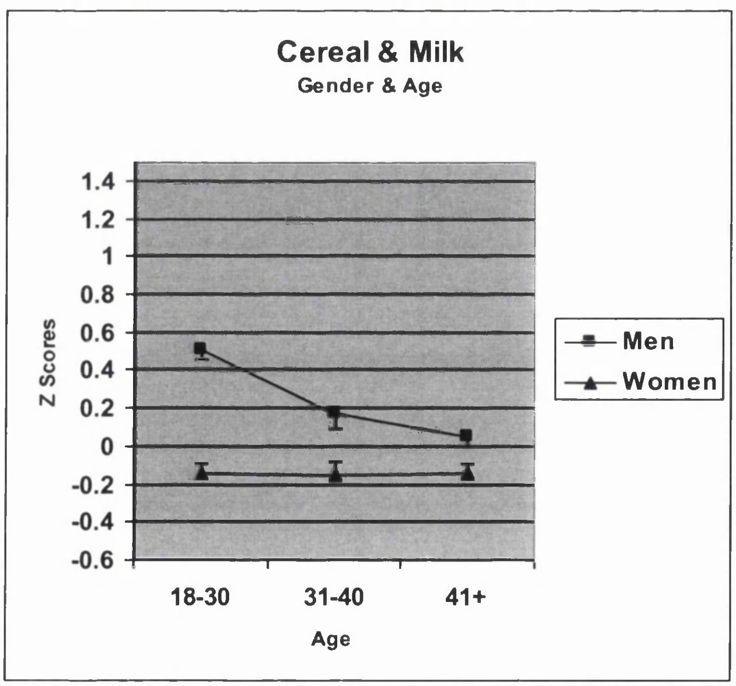


Figure 5.10: The effects of the interaction of gender and age on the consumption of 'Cereal and milk'.



Summary results:

Subsets of a UK representative sample population were identified as consumers of dietary patterns consistent with either Western or Prudent diets. 'Sweet refined foods', 'Chips, crisps squash/colas sausage', 'Cheese, eggs and bread', 'Yoghurt, cream and red meat' and 'Cereal and milk' were categorised as Western type foods while 'Fruits and salads' and 'Fish and poultry' were consistent with the Prudent style.

A summary of socio-demographic characteristics of consumers of the seven dietary patterns is presented below grouped according to defining Prudent or Western diet style:

Dietary patterns consistent with 'Prudent' style diet:

Consumers of 'Fruits and salads' were more likely to be female and better educated. Age and socio-economic status had very minimal impact.

No dominant socio-demographic group could be identified for those with 'Fish and poultry' preferences. This was the one food group which was consumed consistently more or less across all age levels, regardless of education, gender and socio-economic status.

Dietary patterns consistent with 'Western' style diet:

Age had the greatest impact on the choice of 'Sweet refined foods'. The 41+ group were the most likely consumers. Otherwise gender, education and socio-economic status made little impact.

The highest consumers of 'Chips, crisps, squash/colas sausage' were most likely to be young men in lower socio-economic groups and with lower education achievement.

'Cheese, eggs and bread' were more likely consumed by men of all ages in the lower groups with lower educational achievement.

In terms of 'Yoghurt, cream and red meat', socio-economic group had the greatest bearing on food choice regardless of gender.

'Cereal and milk' was consumed more often by men. Younger men tended toward this choice unaffected by level of education and very little by what socio-economic group they were in.

Discussion:

Age:

The consumption of specific food groups was noticeably dependent on age of the individual and this was quite linear. Four patterns stand out. Older people ate considerably more 'Sweet refined food' and 'Yoghurt, cream and red meat' while in stark contrast, they ate less 'Chips, crisps, squash/colas sausage' as well as 'Cereal and milk'. Although not clearly identifiable as such in our HALS analysis, the DNSBA survey did show that older people preferred sweetish type foods and younger adults preferred the savoury type snacks. Two other studies (Murphy, 1993; Rolls, 1999) also found an increase the consumption sweet foods with increasing age. Thus, there seems to be a pattern where as one ages, sweet foods are preferred and savoury (salty) foods are eschewed.

The perception of sugar, salt, sour and bitter flavours by humans when eating varies according to age (Gonazalez, 2002). Studies have shown that the elderly need higher concentration levels of sugar and salt than young subjects to obtain a similar perceived intensity level (Gonazalez, 2002; De Graaf, 1996; Mojet, 2003; Stevens, 1993). Taste sensitivity to sucrose decreases slightly with age and to NaCl significantly (Klimacka-Nawrot, 2006). It becomes clear then that as age increases, greater concentrations are required in order to distinguish salt or sugar solutions. Here it may serve to explore taste in ageing as this may explain the trend.

Taste in aging:

Sensitivity to chemical stimuli in the environment is vital for the survival of organisms throughout the animal kingdom. From an early age, human behaviour towards food seems to be strongly influenced by the effects of taste and flavor. A human baby, only a few days old, already can distinguish sweet and bitter and express pleasure for sweet taste but displeasure for bitter taste (Ganchrow, 1983; Steiner, 1977). The sense of taste provides an assessment of foods (Lindemann, 1995). Sweet indicates high-calorific foods; salty and sour relate to important aspects of homeostasis; bitter warns of toxic constituents (Rosenzweig, 2002).

According to Lindemann (1995), salt taste mechanisms detect the presence of sodium chloride in the mouth. The detection of salt is important to many organisms, but specifically mammals, as it serves a critical role in ion and water homeostasis in the body. It is specifically needed in the mammalian kidney as an osmotically-active compound which facilitates passive re-uptake of water into the blood. Because of this, salt elicits a pleasant response in most humans.

Sweet taste signals the presence of carbohydrates in solution. Since carbohydrates have a very high calorie count (saccharides have many bonds, therefore much energy), they are desirable to the human body, which has evolved to seek out the highest calorie intake foods, as the human body in the distant past has never known when its next meal will occur. They are used as direct energy (sugars) and storage of energy (glycogen) (Lindemann, 1995).

Investigations with laboratory animals reveal much about basic psychobiological determinants of food preferences. When offered a choice of foods, rats typically prefer high-fat and/or high-sugar food items over their nutritionally balanced rat chow diet (Sciafani, 2001). This same taste preference is reflected throughout the entire mammalian group, including humans. In contrast, low calorie foods are apparently unsatisfactory (Mizushige, 2006). One study (Frank, 2008) specifically looked at reactions to sugar (sucrose) and its artificial analog, sucralose. Only sucrose was able to elicit a dopamine response in the brain showing that the brain can distinguish between a caloric (sucrose) and a non-caloric (sucralose) sweetener. It is pointed out that this could have as important implications on the effectiveness of the substitution of artificial sweeteners for natural sugar intake.

'Food palatability and hedonic value play a central role in nutrient intake', suggests de Araujo, (2008). Sucrose intake has been shown to induce dopamine release in the ventral striatum of mice (de Araujo, 2008), nucleus accumbens in rats (Hajnal, 2004). Even in the absence of gustatory input, the very act of sucrose stimulates the dopamine release as shown by mice which lack sweet taste induction (de Araujo, 2008). It is suggested that calorie rich nutrients can directly influence brain reward circuits that control food intake, independently of palatability or functional taste transduction. Mizushige (2007) supports this stance further, 'Generally palatable food ingestion stimulates the brain's reward system so it could very well be that the chemical reception of fats in the oral cavity bypasses the traditional flavour mechanisms to directly induce a hedonic impact of rewarding stimuli'. His research demonstrated that beta-endorphin, an opioid peptide, was released just 15 minutes after fat intake and (Liang, 2006) was able to demonstrate dopamine release in the brain during sham licking of 100% corn oil. These results would indicate that signals of dietary fat, calorie rich, were accepted in the oral cavity and transmitted to the brain, and neuropeptides and neurotransmitters such as beta-endorphin and dopamine were released just after fat intake.

Parkinson's patients whose illness is characterized by a dopamine deficiency, tend to eat more sweet snacks after initiation of Levadopa therapy demonstrating that sweet preference may be possibly linked to excessive dopaminergic transmission (Miwa, 2008).

The role of the dopaminergic cells in the ventral tegmental area of the brain in response to sucrose and NaCl was tested in rats. Dopaminergic lesions lead to a significantly reduced preference for sucrose solutions (Shibata, 2009; Shimura, 2002).

Aside from dopamine, endogenous opioid peptides also operate as rewards. Opioids and their receptors were first reported more than 30 years ago, and studies suggesting a role of opioids in the regulation of food intake date back nearly as far. Opioid agonists and antagonists have corresponding stimulatory and inhibitory effects on feeding. In addition to studies aimed at identifying the relevant receptor subtypes and sites of action within the brain, there has been a continuing interest in the role of opioids on diet/taste preferences, food reward, and the overlap of food reward with others types of reward. Data exist that suggest a role for opioids in the control of appetite for specific macronutrients, but there is also evidence for their role in the stimulation of intake based on already-existing diet or taste preferences and in controlling intake motivated by hedonics rather than by energy needs (Gosnell, 2009). Drewnowski tested this hypothesis in 1992 by administering an IV opioid antagonist to 12 female binge eaters and 12 normal controls. During infusion, the subjects tasted 20 sugar/fat mixtures and were allowed to select and consume snack foods of varying sugar and fat content. Naloxone, an opioid antagonist, effectively reduced taste preferences relative to baseline in both binge eaters and controls. The reduction was apparently most pronounced for sweet high-fat foods such as cookies or chocolate.

The dopamine system, which plays a crucial role in reward processing, is particularly vulnerable to aging (Ivo, 1993). Significant losses over a normal lifespan have been reported for dopamine receptors and transporters (Dreher, 2008). Despite substantial data indicating dopamine was closely associated to reward processing and that the mid-brain dopamine neurons send reward-related signals to post-synaptic sites, particularly the prefrontal cortex, direct evidence could never be established until 2002 (Dreher). Dreher et al. using fMRI and PET established a link between midbrain synaptic dopamine synthesis and activation of the reward circuit in humans at which time age-related changes were also identified in the regulation of this system. If dopamine is reduced with age, then possibly there would be an increasing requirement for more sweet foods in older people in order to elicit the same dopamine response as in younger people. This may explain the increased preference for sweet foods demonstrated by HALS participants, in that older groups showed a higher preference than younger groups.

In the HALS study there was a distinct linear decrease in preference for the food group 'Chips, crisps, squash/colas sausage' with age. Older participants over 65 showed a lesser preference for these types of foods as compared to the 18-25 year group. On closer examination of the nutrient composition of this food group (See Food Composition Table Summary, Appendix B), one sees that this group had the second highest levels of sodium compared to the other 6 food groups. Perhaps the decreased preference for this food group with increasing age may have to do with sodium levels?

As already discussed elsewhere, salt taste mechanisms detect the presence of sodium chloride in the mouth. The detection of salt is important to many organisms, but specifically mammals, as it serves a critical role in ion and water homeostasis in the body (Lindemann, 1995). However, aging seems to be accompanied with a sensitivity to salt (Zemel, 1988). The author ascribes this to the 'reduced ability to appropriately excrete a salt load, which is due to a decline in renal function and to a reduced generation of natriuretic substances such as prostaglandins (E2) and dopamine'. Berridge (1984) demonstrated experimentally in rats that oral infusions of sodium altered taste reactivity. When rats were sodium replete they reacted with stereotypical behaviour indicating their acceptance of salt ingestion but when sodium deplete they became aversive to salt.

While declining ability to process salt in older people may be responsible for decreased salt preference, preference for salt in younger people after exercise would support Berridge's results. In younger people with healthy kidney function and intact inability to excrete salt, their salt levels would require repletion and their increased preference for salt would reflect this physiological state. In the HALS study, younger people did report higher sport activity which is a marker for exercise.

Or it might just be a question of convenience. Dental studies (Mack, 2001) point out that with age, dental apparatus preclude proper chewing. 'Sweet refined foods' are easier to masticate than 'Chips, crisps, squash/colas sausage'. They are also easier to access. 'Chips, crisps, squash/colas sausage' require either a visit to a take-out or oven preparation at home whereas with 'Sweet refined food' it is a question of removing from a package for prompt disposal. Then again, it may be dependent on financial considerations. 'Sweet refined foods' are cheaper than the 'Chips, crisps, squash/colas sausage' group where meat would increase the price.

<u>Gender:</u>

Women in our sample consumed more frequently 'Fruits & salads', 'Yoghurt, cream and red meat' as well as 'Fish & poultry', reflecting a preference for whole foods. Men on the other hand ate 'Chips, crisps, squash/colas sausage', 'Cheese, eggs & bread' and 'Cereal & milk' with more frequency. Although whole foods made up a proportion of the selection, there was a fair amount of take-out style and processed foods in the mix.

There is some degree of resonance in terms of the differences in gender preferences for food with two contemporary studies, namely, the 1946 British Cohort (1946 b.c.) analysis of 1982 and the Dietary and Nutritional Survey of British Adults (DNSBA). Pryer (2001) was able to determine four different dietary patterns in men and four different ones in women in the DNSBA. In men, the two most predominant patterns were 'beer and convenience food' and 'traditional British diet' and in women, the 'traditional British diet' followed by the 'healthy cosmopolitan diet'. As in HALS 1, it would seem again that women tended to eat whole food based diets whereas men ate a mixture of these and processed foods. The 1946 British Cohort has not been analysed in terms of dietary patterns so it is difficult to draw any comparisons. However, similarities between the two studies were observed in Vitamin C intake in that men and women tended to consume far more of this vitamin as the level of education increased. On the whole, one can perhaps deduce from this that women tended to eat more of the whole foods, which may be construed as healthy foods and that with better education, the tendency to eat Vitamin C based foods could be a marker of their desire to eat healthier foods. Men on the other hand were more inclined to eat processed foods.

Education:

Quite clearly in the HALS survey, some dietary patterns were especially seen related to educational level. For example, the lesser educated were far more likely to consume the less healthy 'Chips, crisps, squash/colas sausage' overall particularly when younger. Lesser educated men consumed more than their female counterparts but this gap closed at the college/university levels. So too with 'Fruits and salads' which seemed to find more adherents in the college and university graduates than in secondary school leavers demonstrating perhaps a better awareness of the benefits of healthy eating or effects of affluence. Analysis of the 1946 Birth Cohort at 43 years of age by Mishra et al. 2006 demonstrated a link between higher education and increased consumption of fruit. Unfortunately, we could not draw comparisons with the DNSBA as the relationship between diet and education was not studied. Thus, in HALS, educational achievement was associated with higher consumption of fruits and this was consistent with findings in the DNSBA. Over and above that, we were able to clearly delineate a decreased preference in the more educated study participants for unhealthy foods as epitomised by the pattern, 'Chips, crisps etc.' and an increased tendency to consume more healthy foods such as 'Fruits & salads'.

Socio-economic Status:

Even more clearly definable trends were seen in the dietary patterns in terms of socio-economic status. The so-called professional socio-economic groups, were far more likely to consume 'Fruits & salads' and 'Yoghurt, cream and red meat' while the lower groups demonstrated a strong preference for the 'Chips, crisps, squash/colas sausage' category. This trend is particularly concerning as the latter contains one of the highest measures of fat and sodium content of all dietary patterns (See Appendix B). Overall, it shows an increasing shift from processed savoury foods to whole foods in the higher socio-economic groups. This pattern was relatively consistent with results from the DNSBA (Gregory, 1990) in that convenience diets were preferred by the manual groups. (By convenience, one can reasonably assume that these are processed foods which do not require the same time preparation as whole foods.) Also, as in HALS, the non-manual groups were more inclined to eat healthier foods. In sum, the level of socio-economic status predicted quite clearly the type of diet consumed. Upper socio-economic groups preferred healthy foods while lower groups were more inclined to consume the unhealthy, unprocessed foods.

Chapter 6: Can psychological variables predict dietary patterns?

A cursory examination of correlations between extraversion, neuroticism and self-reported mental health (GHQ), anxiety, depression, sleep quality, social function (sub-scales of the GHQ)) and dietary patterns was carried out. Extraversion quickly came to the fore as having the strongest correlation with dietary patterns, particularly 'Sweet refined foods' and 'Chips, crisps, squash/colas sausage'. What became most apparent was that with increasing measures of extraversion, preference for 'Chips, crisps, squash/colas sausages' increased quite dramatically while choice of 'Sweet refined foods' declined but not quite at the same rate. Clearly this was a phenomenon that required further investigation. Although not quite as profound as extraversion, some significant correlations of self-reported mental health (GHQ) and neuroticism with dietary patterns were felt worthy of further analysis. It was decided to continue with extraversion, neuroticism and self-reported mental health (GHQ). The initial correlations are recorded in Tables 6.1-2

Statistical analysis: Raw data reflecting socio-demographic information on age, socio-economic group and education were recoded to conduct statistical analysis (See chapter 5).

Scores of extraversion and neuroticism were derived from the Eysenck Personality Inventory, (Eysenck, HJ and Eysenck, SBJ, 1964). The 'extraversion' score was created by counting one point for every time the respondent ticked 'yes' to questions: 1, 3, 8, 10, 13, 17, 22, 25, 27, 39, 44, 46, 49, 53 and 56 and 'no' to 5, 15, 20, 29, 32, 34, 37, 41 and 51. All these values were then added up to obtain a measure for 'extraversion', so that the higher the score, the higher the levels of extraversion. For the analyses of variance, the total scores were divided into quartiles such that: 0-8=1 (low extraversion); 9-11=2; 12-14=3; 15-24=4 (high extraversion).

Likewise with neuroticism, one point was counted when the respondent ticked 'yes' for questions: 2, 4, 7, 9, 11, 14, 16, 19, 21, 23, 26, 28, 31, 33, 35, 38, 40, 43, 45, 47, 50, 52, 55, 57. All these values were then added up to obtain a level for 'neuroticism, so that the higher the score, the higher the measure of neuroticism. For the analyses of variance, the total scores were divided into quartiles such that: 0-5=1 (low neuroticism); 6-9=2; 10-13=3; 14-24=4 (high neuroticism).

Self-reported mental health was measured using the General Health Questionnaire (GHQ) which was based on factor analysis according to Chan (1985) and Burvill & Krumian (1983)
The questionnaire comprised 30 multiple choice questions, each question requiring one of 4 responses arranged in columns. These were recoded so that the answers were weighted as follows: column 1=0; column 2=1; column 3=2 and column 4=3. End results meant the higher the score, the worse the mental health condition. For the analysis of variance, the scores were divided into quartiles such that 0-18= 1 (best self-reported mental health); 19-23=2; 24-29=3 and 30-90=4 (worst self-reported mental health).

The effects of extraversion on each of the seven dietary patterns were examined by hierarchical regression analysis. Each one of extraversion, neuroticism and self-reported mental health (GHQ) were successively forced-into a model consisting of the socio-demographic variables and remaining psychological variables. This was repeated through all the dietary patterns.

An analysis of variance was also carried out to look specifically at consumption of each dietary pattern at each level of extraversion, neuroticism and 'GHQ' and for interactions.

Regression results:

In a hierarchical multiple regression analysis, possible confounding variables (age, gender, socio-economic group, education, neuroticism and self-reported mental health) were entered into the model as Block 1. Extraversion was entered in as Block 2 to determine whether it added to the variance. This was carried out for each dietary pattern. The same procedure was conducted to see whether neuroticism and self-reported mental health also added to the variance (See Table 6.3-6.9). A summary of the differences in variances between Blocks 1 and 2 is presented in Table 6.10.

Controlling for socio-demographic, neuroticism and self-reported mental health variables dramatically reduced the effects of extraversion to only slightly perceptible differences. However notwithstanding consideration of the cofounding variables, extraversion did have a significant effect in some cases. There were no significant effects ($p < .001$) of self-reported mental health (GHQ) on any dietary patterns. Neuroticism had an extremely small effect on one dietary pattern. Significant results ($p < .001$) are reported below.

Fruits and salads: After controlling for variables, extraversion had a significant impact but very low (0.3%) but its effect was superceded mainly by gender (Table 6.10) which explained the greatest part of the variance (4.7%), followed by socio-economic group (0.8%) and education (0.9%). Gender was the best predictor (Beta = .226).

Sweet refined foods: Extraversion also had a significant but very minimal impact (0.6%).Its effect was masked only by age (Table 6.10) which explained the greatest difference in variance (2.2%). Age was the best predictor (Beta= .172).

Chips, crisps, squash/colas sausage: Extraversion explained slightly more of the variance as compared to the two previous dietary patterns. However its effect was almost completely overshadowed by age (Table 6.10) which explained the greatest part of the variance (13.3%) followed by gender (2.4%), socio-economic group (1.1%) and then education (0.6%). Age was the best predictor (Beta =-.406), then gender (Beta = -.161).

Cheese, eggs and bread: Extraversion had very little impact on this food group (Table 6.10) explaining only 0.3% of the variance with gender explaining a little more at 2.3% and age 0.3%. Gender was the best predictor (Beta = -.157).

Yoghurt, cream and red meat: Extraversion and neuroticism (Table 6.10) had very slight effects (both 0.1%) masked minimally by first age (1.1%), socio-economic group (1.0%), gender (0.5%) and lastly education (0.2%). Age was the best predictor although quite weak (Beta =.114), then socio-economic group (Beta =.113).

Fish and poultry: None of the variables had any considerable effect (Table 6.10). Extraversion showed little impact (0.2%). These were exceeded ever so slightly by age (0.3%) and socio-economic group (0.3%) followed by gender (0.2) and education (0.1%).

Cereal and milk: Extraversion (Table 6.10) had an impact but almost imperceptible (0.1%). Gender was the strongest predictor (2.3%), followed by age (0.4%), then socio-economic group (0.1%).

Thus the possibility exists that extraversion does not influence dietary patterns so much but rather it correlates with other influential variables.

Table 6.1: Correlations of male dietary pattern (Z-scores) with socio-demographic and psychological variables.

Men	Age	Socio-economic	Education	Extraversion	Neuroticism	Total GHQ
Fruits & salads	*	0.149	0.170	*	*	*
Sweet refined Foods	0.222	*	*	-0.147	*	*
Chips, crisps, squash/colas, sausage	-0.473	-0.152	*	0.266	*	*
Cheese, eggs & Bread	*	-0.103	-0.09	0.116	*	*
Yoghurt, cream & red meat	0.108	0.176	0.103	-0.077	-0.89	*
Fish & poultry	*	*	*	*	*	*
Cereal & milk	-0.162	*	*	*	*	*

Significant correlations (p< .001) are in BOLD print.

Table 6.2: Correlations of female dietary pattern (Z-scores) with socio-demographic and psychological variables.

Women	Age	Socio-economic	Education	Extraversion	Neuroticism	Total GHQ
Fruits & salads	*	0.188	0.234	*	-0.76	-.066
Sweet refined Foods	0.186	*	-0.046	-0.113	*	*
Chips, crisps squash/colas sausage	-0.376	-0.146	*	0.188	.077	*
Cheese, eggs & Bread	0.056	*	*	*	*	*
Yoghurt, cream & red meat	0.1	0.119	0.061	-0.063	-.059	*
Fish & poultry	0.046	*	*	*	*	*
Cereal & milk	*	*	*	-0.075	*	*

Significant correlations (p< .001) are in BOLD print.

Table 6.3: Does Extraversion make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Age	**.063**	**.172**	**-.406**	**.054**	**.114**	**.061**	**-.074**
Gender	**.226**	*	**-.161**	**-.157**	**.075**	*	**-.159**
Socio-economic group	**.098**	*	**-.117**	*	**.113**	**.056**	*
Education	**.161**	*	**-.092**	*	*	*	*
Neuroticism	*	*	*	*	*	*	*
Total GHQ	*	*	*	*	*	*	*
Extraversion (1)	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
R2 –extraversion (2)	.088	.038	.222	.033	.040	.008	.032
R2+ extraversion (3)	.091	.044	.228	.036	.041	.010	.033

Table shows hierarchical regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.4: Does Neuroticism make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Age	**.063**	**.172**	**-.406**	**.054**	**.114**	**.061**	**-.074**
Gender	**.226**	*	**-.161**	**-.157**	**.075**	*	**-.159**
Socio-economic group	**.098**	*	**-.117**	*	**.113**	**.056**	*
Education	**.161**	*	**-.092**	*	*	*	*
Total GHQ	*	*	*	*	*	*	*
Extraversion	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
Neuroticism (1)	*	*	*	*	*	*	*
R2 –neuroticism (2)	.091	.044	.228	.036	.040	.010	.033
R2+ neuroticism (3)	.091	.044	.228	.036	.041	.010	.033

Table shows hierarchical multiple regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.5: Does Mental health (GHQ) make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Age	**.063**	**.172**	**-.406**	**.054**	**.114**	**.061**	**-.074**
Gender	**.226**	*	**-.161**	**-.157**	**.075**	*	**-.159**
Socio-economic group	**.098**	*	**-.117**	*	**.113**	**.056**	*
Education	**.161**	*	**-.092**	*	*	*	*
Extraversion	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
Neuroticism	*	*	*	*	*	*	*
Total GHQ (1)	*	*	*	*	*	*	*
R2– Total GHQ (2)	.091	.044	.228	.036	.041	.010	.033
R2+ Total GHQ (3)	.091	.044	.228	.036	.041	.010	.033

Table shows hierarchical multiple regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.6: Does Age make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Gender	**.226**	*	**-.161**	**-.157**	**.075**	*	**-.159**
Socio-economic group	**.098**	*	**-.117**	*	**.113**	**.056**	*
Education	**.161**	*	**-.092**	*	*	*	*
Extraversion	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
Neuroticism	*	*	*	*	*	*	*
Total GHQ	*	*	*	*	*	*	*
Age (1)	**.063**	.172	**-.406**	**.054**	**.114**	**.061**	**-.074**
R2– Age (2)	.088	.021	.095	.034	.030	.007	.029
R2+ Age (3)	.091	.043	.228	.036	.041	.010	.033

Table shows hierarchical multiple regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.7: Does Gender make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Socio-economic group	**.098**	*	**-.117**	*	**.113**	**.056**	*
Education	**.161**	*	**-.092**	*	*	*	*
Extraversion	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
Neuroticism	*	*	*	*	*	*	*
Total GHQ	*	*	*	*	*	*	*
Age	**.063**	.172	**-.406**	**.054**	**.114**	**.061**	**-.074**
Gender (1)	**.226**	*	**-.161**	**-.157**	**.075**	*	**-.159**
R2– Gender (2)	.044	.044	.204	.013	.036	.008	.010
R2+ Gender (3)	.091	.044	.228	.036	.041	.010	.033

Table shows hierarchical multiple regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.8: Does Socio-economic group make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Education	**.161**	*	**-.092**	*	*	*	*
Extraversion	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
Neuroticism	*	*	*	*	*	*	*
Total GHQ	*	*	*	*	*	*	*
Age	**.063**	.172	**-.406**	**.054**	**.114**	**.061**	**-.074**
Gender	**.226**	*	**-.161**		**.075**	*	**-.159**
				-.157			
Socio-economic group (1)	**.098**	*	**-.117**	*	**.113**	**.056**	*
R2–Socio-economic group (2)	.083	.044	.217	.036	.031	.007	.032
R2+Socio-economic group (3)	.091	.044	.228	.036	.041	.010	.033

Table shows hierarchical multiple regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.9 Does Education make a difference?

	Fruits & salads	Sweet refined foods	Chips, crisps, squash/colas sausage	Cheese, eggs & bread	Yoghurt, cream & red meat	Fish & poultry	Cereal & Milk
Extraversion	**.057**	**-.087**	**.084**	**.061**	*	**.049**	*
Neuroticism	*	*	*	*	*	*	*
Total GHQ	*	*	*	*	*	*	*
Age	**.063**	**.172**	**-.406**	**.054**	**.114**	**.061**	**-.074**
Gender	**.226**	*	**-.161**	**-.157**	**.075**	*	**-.159**
Socio-economic group	**.098**	*	**-.117**	*	**.113**	**.056**	*
Education (1)	**.161**	*	**-.092***	*	*	*	*
R2– Education (2)	.072	.044	.222	.036	.039	.009	.033
R2+ Education (3)	.081	.044	.228	.036	.041	.010	.033

Table shows hierarchical multiple regressional analysis highlighting significant correlates and R2
Significant beta scores (p< .001) are in BOLD print.
*** = Non-significant results**
(1)= Correlate of forced-in variable after constants entered
(2) =R2 of total constants before forced-in variable
(3)= R2 of total constants plus forced-in variable

Table 6.10: Summary of differences from regression analysis tables 5-3-5.9 (*)

	Fruits & salads	**Sweet refined foods**	**Chips, crisps, squash/colas sausage**	**Cheese, eggs & bread**	**Yoghurt, cream & red meat**	**Fish & poultry**	**Cereal & milk**
Extraversion	0.003	0.006	0.006	0.003	0.001	0.002	0.001
Neuroticism	0	0	0	0	0.001	0	0
Total GHQ	0	0	0	0	0	0	0
Age	0.003	0.022	0.133	0.002	0.011	0.003	0.004
Gender	0.047	0	0.024	0.023	0.005	0.002	0.023
Socio-economic group	0.008	0	0.011	0	0.010	0.003	0.001
Education	0.009	0	0.006	0	0.002	0.001	0

***= Difference between' constants only' and 'constants plus forced in-in variable'.**

The effects of interactions between psychological and socio-demographic variables on dietary patterns

The effects of interactions between psychological and socio-demographic variables on dietary patterns were investigated. Some variables were re-coded to ensure adequate numbers (N > 100) in each group. Age was reduced to three levels (18-30, 31-40, 41+) while education was collapsed to four levels (No qualifications/CSE2-5, O-level, A-level, College/university) and socio-economic group was honed down to four groups instead of six (Semi/unskilled, Non-manual, Manual and Professional/managerial).

Significant interaction effects are reported in Tables 6.1-6.7 for the following dietary patterns:

Sweet refined foods: Increasing levels of extraversion had a slightly dampening effect on consumption (F (9, 5615) =2.9, p< .047). The interaction reflects that college and university graduates were more susceptible to the effects of extraversion (Figure 6.1)

Chips crisps squash/colas sausage: With increasing levels of extraversion (Figure 6.2), consumption rose, and the effect was greatest in the 18-30 age group (F (6, 5899) =8.1, p< .001).

Consumption frequency hardly differed between males and females in the lowest extraversion group (Figure 6.3). However, higher levels of extraversion were associated with increased consumption more in males (F (3, 5899) =8.1, p< .001.

Lower extraversion had the least effect in all socio-economic groups on consumption (Figure 6.4). However with rising extraversion, consumption increased in all groups, particularly the manual, non-manual and unskilled ones but not so much in the professional/managerial groups (F (9, 5803) =2.05, p< .030).

Lower extraversion had the least effect on education (Figure 6.5) but with higher levels of this trait, consumption increased substantially, particularly in the 'No qualification', 'O-levels' and 'A-levels' groups but not as much in the 'College/university' ones.

Cheese eggs bread: Consumption frequency hardly differed between males and females in the lowest extraversion group (Figure 6.6). However, increasing levels of extraversion were associated with increased consumption more in males ($F (3, 5899) = 8.5, p < .001$).

Cereal and milk: With increasing levels of extraversion, women's consumption decreased (Figure 6.7) while in men it increased ($F (3, 5899) = 7.71, p < .001$).

Figure 6.1: The effects of the interaction of extraversion and education on the consumption of 'Sweet refined foods'.

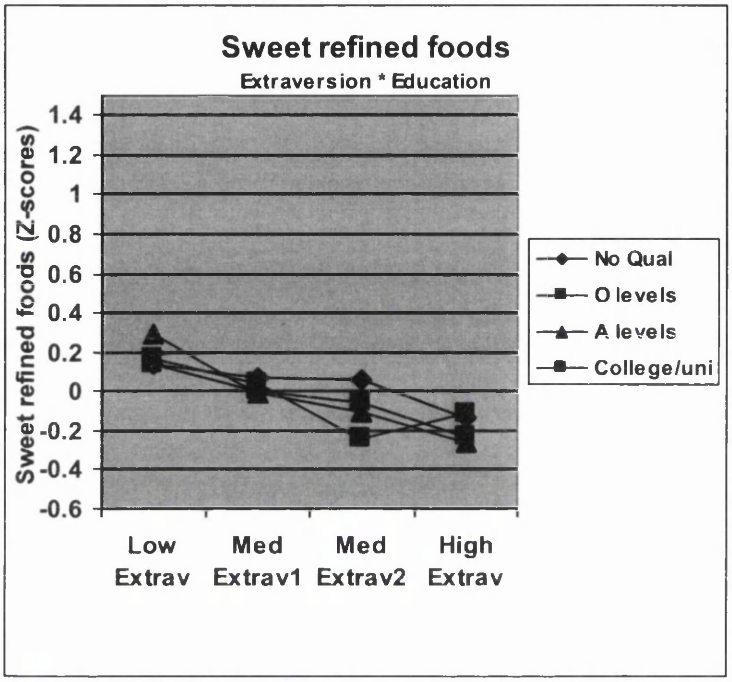


Figure 6.2: The effects of the interaction of extraversion and age on the consumption of 'Chips, crisps, squash/colas sausage'.

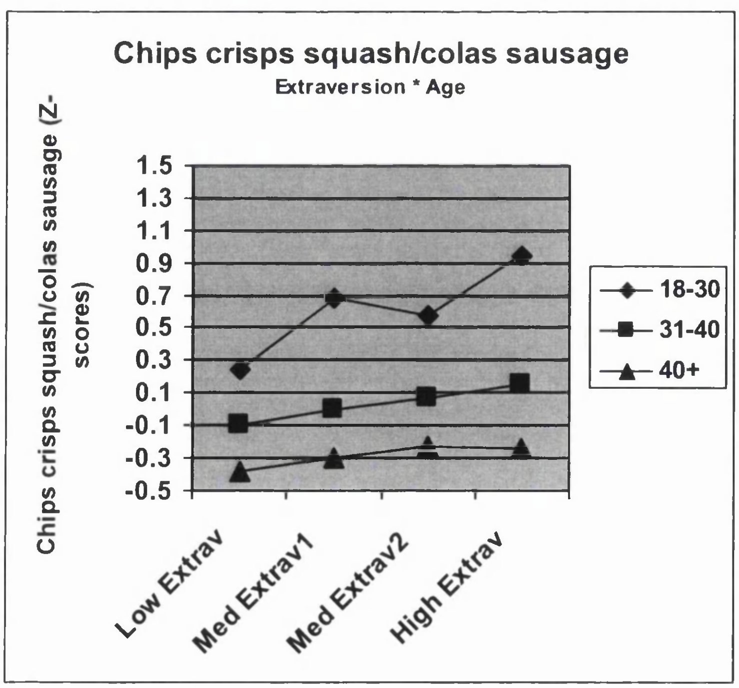


Figure 6.3: The effects of the interaction of extraversion and gender on the consumption of 'Chips, crisps, squash/colas sausage'.

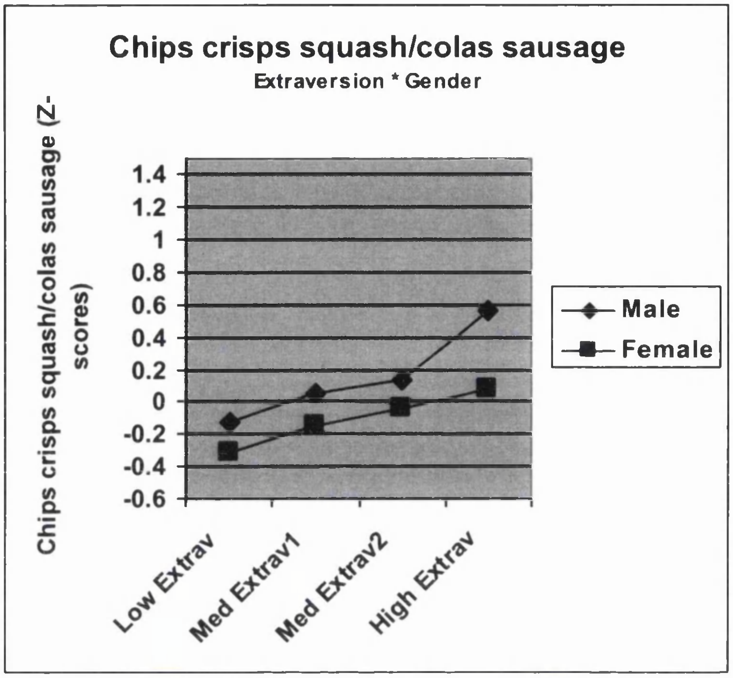


Figure 6.4: The effects of the interaction of extraversion and socio-economic groups on the consumption of 'Chips, crisps, squash/colas sausage'.

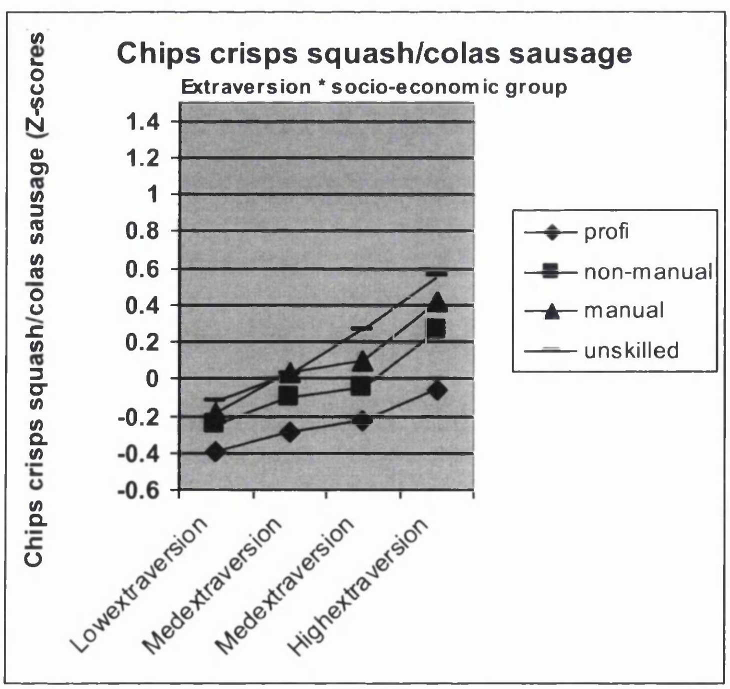


Figure 6.5: The effects of the interaction of extraversion and education on the consumption of 'Chips, crisps, squash/colas sausage'.

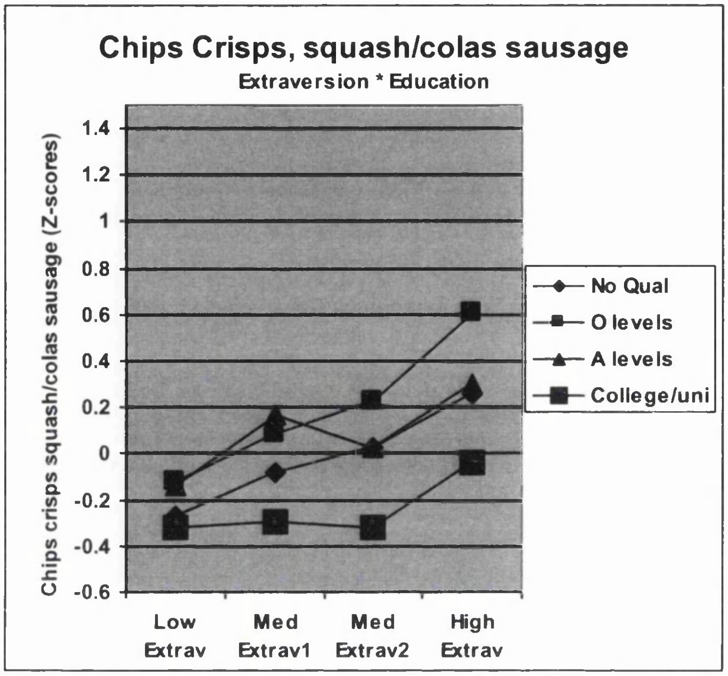


Figure 6.6: The effects of the interaction of extraversion and gender on the consumption of 'Chips, crisps, squash/colas sausage'.

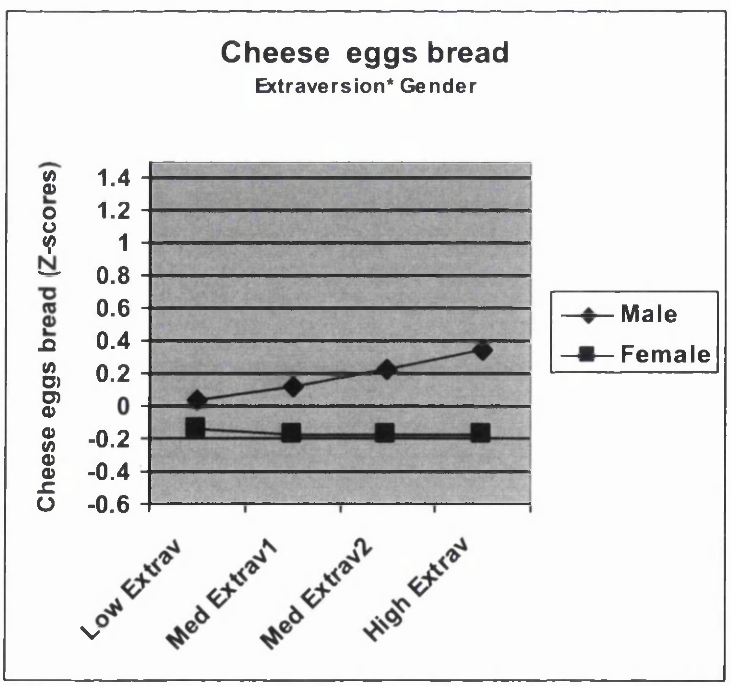
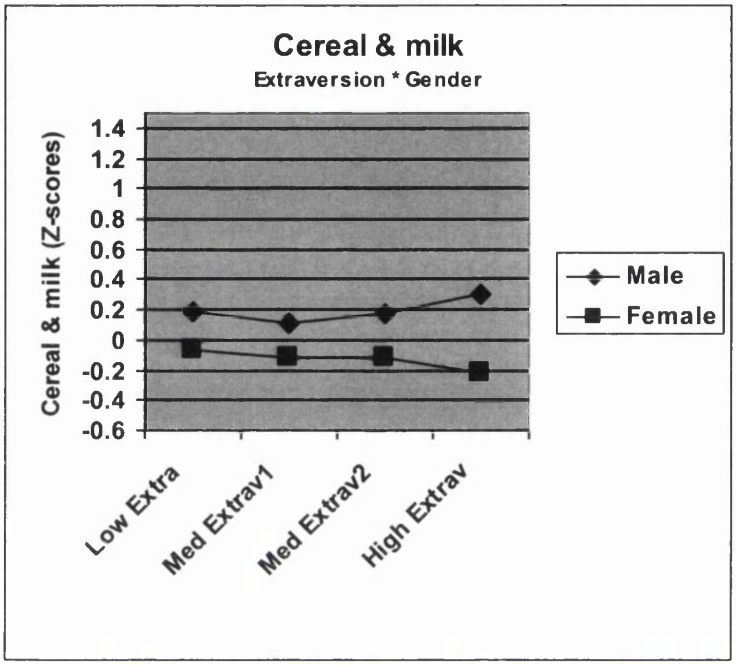


Figure 6.7: The effects of the interaction of extraversion and gender on the consumption of 'Cereal and milk'.



Summary results:

Although regression analysis showed that extraversion on its own accounted for little additional variance, it did interact with other variables (age, level of education and socio-economic group) to affect consumption patterns.

Dietary patterns consistent with 'Prudent' style diet:

Fruits and salads & Fish and poultry:

No significant interaction effects were observed on these dietary patterns

Dietary patterns consistent with 'Western' style diet:

Sweet refined foods: *Increasing levels of extraversion had a suppressive effect on consumption in all socio-economic groups.*

Chips, crisps, squash/colas sausage: *Extraversion exerted its largest effects on this food group in its interaction with all four socio-demographic variables. Higher consumption was associated with highly extraverted young males in lower groups with lesser educational achievement.*

Cheese, eggs bread: *Extraversion had no effect on women but higher levels increased consumption in men.*

Cereal and milk: *Higher extraversion had the effect of decreasing consumption in women but increasing it in men.*

What is most striking about these results is that although extraversion on its own was found to account for little additional variance, it did exert an effect on consumption when interacting with other variables. This was certainly the case with the dietary pattern, 'Chips, crisps, squash/colas sausage' where the effect of higher extraversion was seen to increase consumption when it interacted with other variables. The message here is that one cannot use regression alone to investigate relationships. One must look at interactions particularly when pinpointing subsets is required.

Discussion:

The HALS 1 survey analysis revealed significant relationships between extraversion and several dietary groups; a relationship between mental health and one dietary pattern and no apparent results vis-à-vis neuroticism.

Revelle (1980) wrote that introversion/extraversion is one of the few personality dimensions that can be reliably identified from study to study. Indeed, we were able to relate extraversion to dietary patterns. In both men and women, a strong positive relationship was demonstrated between extraversion and eating 'Chips, crisps, squash/colas sausage' and in stark contrast, an equally strong but negative relationship was seen between extraversion and the consumption frequency of 'Sweet refined foods'. Of the seven dietary patterns, the strength of the association with these two food groups was the highest observed.

It may not be surprising to find a relationship with food as evidence suggests a physiological basis to extraversion. High levels of this trait have been associated with higher cortisol level (Leblanc, 2005) increased physical activity (Sale, 2000), broader physique (Rees, 1960) and other anthropometric indices (Segraves, 1970). Certain disease states have also been linked with higher extraversion levels (Eysenck, 1965). An increasing body of evidence points also to a neurobiological basis of extraversion. Highly significant correlations have been found with perfusion of the basal ganglia, thalamus, inferior frontal gyrus and cerebellum areas of the brain.

Some of the literature on the relationship between diet and extraversion is consistent with our findings. For example, Falconer (1993) noted that extraversion correlated with sodium intake which is what we observed also. Japanese researchers (Kikuchi 1998) found that extraverts tended to eat meat and legumes as well as salty foods. As our 'Chips, crisps, squash/colas sausage' category contained the second highest amount of sodium compared with the other HALS dietary patterns, we could say possibly that this group can be classified as being salty.

In 1993, the Eyckensian personality factors of psychoticism, extraversion and neuroticism were examined in a randomly selected population based Australian study (Falconer 1993) of the relationship between between personality and nutrients densities. Sex and nutrient specific correlations were found. In terms of extraversion, this trait correlated positively with sodium intake in women. In the HALS survey, after a further analysis of the composition of all the food groups was carried out (Appendix A, B), 'Chips, crisps, squash/colas sausage' was noted to have the second highest content of sodium (mg.) and similar again to Falconer's findings was found to be positively correlated with extraversion also. An earlier study by Shepherd (1986) carried out on 36 female subjects found that non-discretionary salt (sodium in foods) was positively related to extraversion. So our results would concur also with Shepherd and Falconer in terms of sodium intake.

The inverse relationship between extraversion and 'Sweet refined foods' was apparently identifiable only in our sample. We found no mention of comparative dietary patterns in our literature review.

The General Health Questionnaire contained in HALS afforded us the opportunity to examine the relationship between mental health and diet. The only study to be found addressing this same issue using the GHQ could not find any effects of diet on mental health (Sorensen, 1999). Our initial analysis did show a significant association between 'Fruits and salads' and mental health but only in women. However, after controlling for other variables, the relationship was no longer significant.

Extraversion and food patterns:

Japanese researchers have reported distinctive eating patterns in extroverts. Kikuchi (1998) studied 942 Japanese college students and found that extroverts ate meat and legumes. A further but separate study of 470 college students by the same author (Kikuchi, 1999) showed those scoring high on the extroversion scales preferred salty foods, oily dishes, fish and had breakfast only once a week. Our results are partly in line with Kikuchi's smaller study in that HALS participants who were highly extroverted ate more meat dishes, although of the processed sort and more oily food as represented by crisps and chips which are fried.

It would be useful in this discussion to review possible factors contributing to changing food preferences which change with age.

When investigating the association between extraversion and diet, two trends emerged. Both age and extraversion seemed to predict certain dietary patterns, that extraversion predicted higher consumption of 'Chips, crisps, squash/colas sausage' but less 'Sweet refined foods' while age predicted exactly the opposite. An inverse relationship between age and extraversion emerged vis-a-vis mediated by these two food groups. Other researchers have reported similar findings (e.g., Mroczek & Spiro, 2003; Roberts, Robins, Caspi & Tresniewski, 2003; Roberts et al., 2006;

Small et al., 2003; Terraciano et al., 2005). If extraversion reduces with age and if both conditions can predict the same dietary pattern, then extraversion may be a reflection of age.

Mathias Allemand at Zurich University asserts there is now growing evidence that both stability and change mark personality trait development across the adult lifespan (e.g Allemand, Zimprich & Hendriks, 2008; Caspri, Roberts & Shiner, 2005; McRae et al., 1999; Roberts & Delvecchio, 2000; Roberts, Walton & Viechtbauer, 2006; Srivastra, John, Gosling & Potter, 2003; Terraciano, McCrae, Brant & Costa 2005). Moreover, this is a phenomenon which appears to hold across cultures. Cross-sectional age differences in the BIG Five personality traits were investigated using two huge datasets from the UK and Germany (N=14,039 and 20,852 respectively). The observed age trends were generally consistent across both datasets and where extraversion was again negatively associated with age (Donnellan, 2008). Comparison of a Chinese and American population samples (Labouvie-Vief, 2000) also demonstrated an inverse association between extraversion and age providing more evidence for validity of this phenomenon across cultures.

Our regressional analysis revealed that age for the most part explained a far greater part of the variance with respect to the consumption of 'Sweet refined foods' and 'Chips, crisps, squash/colas sausage' than did extraversion (Table 6.10).

Chapter 7: Conclusions

Our analysis of 'The Health and Lifestyle Survey 1' provides a snapshot of dietary behaviour and lifestyle of a UK random sample population (N=9003) in the years 1986-7. Statistics taken from The DEFRA Expenditure and Food Survey (1974-2007) and illustrated in Table 1 show the trend in food and drink purchases between the time the HALS1 survey was conducted (1986-7) and present day (2007). Public health messages encouraging people to consume '5 a day' have evidently been penetrating through to the general public. However, messages regarding unhealthy foods do not seem to be translated into actual purchasing behaviour. Purchase of foods which have been associated with chronic disease and obesity have either plateaued over the last 20 years or are on the increase with the exception of biscuits which has decreased.

Table 2: A comparison of selection of Prudent/Western style food and drink purchases by unit/person/week in a UK household

	Unit	1986	1992	2007	Change
PRUDENT					
Fresh fruit	Gr.	593		855	+
Fresh fruit and vegetables (no potatoes)	Gr.	2246		2421	+
Fish	Gr.	148		170	+
Salads	Gr.	48		69	+
WESTERN					
Biscuits	Gr.	206		163	-
Cakes	Gr.	146		159	+
Confectionary	Gr.		121	123	+
Chips	Gr.	74		101	+
Crisps	Gr.	39		55	+
Soft drinks	ml.		1448	1686	+
Meat pies	Gr.	21		23	+

Table 3: Expenditure & Food Survey, 1974-2007, DEFRA 2008

There is evidently more requirement for strategies to discourage unhealthy eating if we are to stem the rise in obesity and its associated increase in chronic disease.

From a public health perspective, identification of groups within a population that consume similar patterns of diet would be of value to policy makers when making dietary recommendations, for monitoring population trends towards nutritionally 'healthier' diets, for identification and surveillance of those at nutritional risk and for tailoring and targeting public health messages. A focus on subsets would help in optimizing valuable resources.

By analyzing a large representative sample of the UK population, we were able to identify subsets consuming Prudent (healthy) and Western (unhealthy) type dietary patterns by age, gender, social background, education and personality type.

Based on this analysis of the Health and Lifestyle Survey 1, the following recommendations for public health strategies can be offered:

1. A focus on younger men in the lower socio-economic echelons with lesser education to encourage them to move away from the Western dietary pattern of 'Chips, crisps, squash/colas sausage'.

2. A focus on older people to encourage alternatives to the Western dietary pattern of 'Sweet refined foods'.

3. Although in places the effect of extraversion was small, it did on occasion exert some influence, particularly with regards to 'Chips, crisps, squash/colas sausage'. For example, looking at Figure 6.5 illustrating the effect of the interaction of extraversion and education on the consumption of 'Chips, crisps, squash/colas sausage', we see those who had O-levels differed in their consumption more than 0.7 standard deviations depending on their level of extraversion. By the same token, the effect of the interaction of extraversion and age exerted a difference depending on age up to 0.6 standard deviations (Figure 6.2). Further research would be warranted to explore the mechanism behind this.

BIBLIOGRAPHY

Abdel-Wahab YHA, O'Harte FPM, Mooney MH, Barnett CR, Flatt PR. 2002. Vitamin C supplementation decreases insulin glycation and improves glucose homeostasis in obese hyperglycemic (*ob/ob*) mice. *Metabolism* **51**, pp. 514-17.

Allemand M, Zimprich D, Martin M. 2008. Long-term correlated change in personality traits in old age. *Psychology and Aging* **23**, pp. 545-557.

Andrews ZB, Horvath TL. 2008. Tasteless food reward. *Neuron* **57**, pp. 806-8.

Angleman SB, Harris TB, Melzer D. 2006. The role of waist circumference in predicting disability in preretirement age adults. *Int J Obes (Lond)* **30**, pp. 364-74.

Arai Y, Hisamichi S. 1998. Self-reported exercise frequency and personality: a population-based study in Japan. *Percept Mot Skills* **87**, pp. 1371-5.

Ashwell M. 1994. Obesity in men and women. *Int J Relat Metab Disord* **18,** pp. 1-7.

Baksi SN, Hughes MJ. 1982. Chronic vitamin D deficiency in the weanling rat alters catecholamine metabolism in the cortex. *Brain Res* **242**, pp. 387-90.

Balder HF, Vitanen M, Brants HAM, Krogh V, Dixon LB, Tan F, Mannisto S, Bellocco R, Pietinen P, et al. 2003. Common and country specific dietary patterns in four European cohort studies. *J Nutr* **133**, pp. 4246–51.

Ballard-Barbash R, Graubard I, Krebs-Smith S.M, Schatzkin A, Thompson F.E. 1996. Contribution of dieting to the inverse association between energy intake and body mass intake. *Eur J Clin Nutr* **50**, pp. 98-106.

Bamia C et al. 2005, Dietary patterns among older Europeans: the EPIC-Elderly study. *Br J Nutr* **94,** pp. 100-113.

Barclay AW, Petocz P, McMillan-Price J, Flood VM, Pryan T, Mitchell P, Brand-Miller JC. 2008. Glycaemic index, glycaemic load, and chronic disease risk-a meta-analysis of observational studies. *Am J Clin Nutr* **87**, pp. 627-37.

Barker M.E, McClean S.I, Thompson K.A, Reid N.G. 1990. Dietary behaviours and socio-demographics in Northern Ireland. *British Journal of Nutrition* **64,** pp. 319-329.

Barrett-Connor E. 1991. Nutrition epidemiology: how do we know what they ate? *Am J Clin Nutr* **54,** pp. 182S-187S.

Bartoshuk LM, Duffy VB, Hayes JE, Moskowitz HR, Snyder DJ. 2006. Psychophysics of sweet and fat perception in obesity: problems, solutions and new perspectives. *Philos Trans R Soc London B Biol Sci* **361,** pp. 1137-48.

Bates CJ, Prentice A, Finch S. 1999. Gender differences in food and nutrient intakes and status indices from the National Diet and Nutrition Survey of people aged 65 years and over. *Eur J Clin Nutr* **53,** pp. 694-9.

Beard TC, Blizzard L, O'Brien DJ, Dwyer T. 1997. Association between blood pressure and dietary factors in the dietary and nutritional survey of British adults. *Arch Intern Med* **157,** pp. 234-8.

Beer-Borst S et al. 2000. Dietary patterns in six European populations: results from EURALIM, a collaborative European data harmonization and information campaign. *Eur J Clin Nutr* **54,** pp. 253-62.

Berg CM, Lappas G, Strandhagen E, Wolk A, Toren K, Rosengren A, Aires N, Thelle DS, Lissner L. 2008. Food patterns and cardiovascular disease risk factors: the Swedish INTERGENE research programme. *Am J Clin Nutr* **88,** pp. 289-97.

Billson H, Pryer J.A, Nichols R. 1999. Variation in fruit and vegetable consumption among adults in Britain. An analysis from the dietary and nutritional survey of British adults. *Eur J Clin Nutr* **53,** pp. 946-52.

Black AE, Goldberg GR, Jebb SA, Livingstone MB, Cole TJ, Prentice AM. 1991. Critical evaluation of energy intake data using fundamental principles of energy physiology: 2. Evaluating the results of published surveys. *Eur J Clin Nutr* **45,** pp. 583-99.

Black AE, Prentice AM, Goldberg GR., Jebb SA, Bingham SA, Livingstone MBE, Coward A. 1993. Measurements of total energy expenditure provide insights into validity of dietary measurements of energy intake. *Journal of the American Dietetic Association* **93**, pp. 572-579.

Blaha MJ, Gebretsadik T, Shintani A, Elasy TA. 2008. Waist circumference, not the metabolic syndrome, predicts glucose deterioration in type 2 diabetes. *Obesity (Silver Spring)* **16**, pp. 869-74.

Braddon FEM, Wadsworth MEJ, Davies JMC, Cripps HA. 1988. Social and regional differences in food and alcohol consumption and their measurement in a national birth cohort. *Journal of Epidemiology and Community Health* **42**, pp. 341-49.

Brion F, Dupuis Y. 1980. Calcium and monoamine regulation: role of vitamin D nutrition. *Can J Physiol Pharmacol* **58**, pp. 1431-4.

Brody S, Preut R, Schommer K, Schurmeyer TH. 2002. A randomized controlled trial of high dose ascorbic acid for reduction of blood pressure, cortisol and subjective responses to psychological stress. *Psychopharmacology (Berl.)* **159**, pp. 319-24.

Brown CA, Bolton-Smith C, Woodward M, Tunstall-Pedoe H. 1993. Coffee and tea consumption and the prevalence of coronary heart disease in men and women: results from the Scottish Heart Health Study. *J Epidemiol Community Health* **47**, pp. 171-5.

Brunner E, Stallone D, Juneja M, Bingham S, Marmot M. 2001. Dietary assessments in Whitehall II: comparison of 7 d diet and food frequency questionnaire and validity against biomarkers. *Br J Nutr* **86**, pp. 405-14.

Brunner EJ, Mosdøl A, Witte DR, Martikainen P, Stafford M, Shipley MJ, Marmot MG. 2008. Dietary patterns and 15-y risks of major coronary events, diabetes, and mortality. *Am J Clin Nutr.* **87**, pp. 1414-21.

Cannon CM, Scannell CA, Palmiter RD. 2005. Mice lacking dopamine D1 receptors express normal lithium chloride-induced conditioned taste aversion for salt but not sucrose. *Eur J Clin Nutr* **21**, pp. 2600-4.

Canoy D, Wareham N, Welch A, Bingham S, Luben R, Day N, Khaw KT. 2005. Plasma ascorbic acid concentrations and fat distribution in 19 068 British men and women in the European Prospective Investigation into Cancer and Nutrition Norfolk cohort study. *Am J Clin Nutr* **82**, pp. 1203-9.

Chan MM, Kare MR. 1979. Effect of B-6 deficiency on preference for several taste solutions in the rat. *J Nutr* **109**, pp. 339-44.

Chapelot et al. 2006. Consequence of omitting or adding a meal in man on body composition, food intake and metabolism. *Obesity* **14,** pp. 215-227.

Ciok J, Dolna A. 2006. Carbohydrates and mental performance-the role of glycemic index of food products. *Pol Merkur Lekarski* **20**, pp. 367-70.

Classification of Occupations, 1980. *Office of Population Censuses and Surveys*, London.

Cook A, Pryer J, Shetty P. 2000. The problem of accuracy in dietary surveys. Analysis of the over 65 UK National Diet and Nutrition Survey. *J Epidemiol Community Health* **54,** pp. 611-616.

Cox BD et al. 1988. Health and Lifestyle Survey (computer file) *ESRC Data Archive*, Colchester, UK.

Daures JP, Gerber M, Scali J, Astre C, Bonifacj C, Kaaks R. 2000. Validation of a food-frequency questionnaire using multiple-day records and biochemical markers: application of the triads method. *J Epidemiol Biostat* **5**, pp. 109-15.

Davies J, Dickerson J. 1991. Nutrient Content of Food Portions. Royal Society of Chemistry, Letchworth, UK.

De Araujo IE, Oliveira-Maia AJ, Sotnikova TD, Gainetdinov RR, Caron MG, Nicolelis MA, Simon SA. 2008. Food reward in the absence of taste receptor signaling. *Neuron* **57**, pp. 930-941.

De Castro JM. 1993. Genetic influences on daily intake and meal patterns of humans. *Physiol Rev* **53**, pp. 777-82.

De Graaf C, van Staveren W, Burema J. 1996. Psychophysical and psychohedonic functions of four common food flavours in elderly subjects. *Chem Senses* **21,** pp. 293-302.

Dinn WM, Aycicegi A, Harris CL. 2004. Cigarette smoking in a student sample: neurocognitive and clinical correlates. *Addict Behav* **29**, pp. 107-26.

Donnellan MB, Lucas RE. 2008. Age differences in the Big Five across the life span: evidence from two national samples. *Psychol Aging* **23**, pp. 558-66.

Dreher J-C, Meyer-Lindenberg A. Kohn P, Berman KF. 2008. Age-related changes in midbrain dopaminergic regulation of the human reward system. *PNAS* **105** pp. 15106-15111.

Drewnowski A. 2000. Sensory control of energy density at different life stages. *Proc Nutr Soc* **59**, pp. 239-44.

Drewnowski A, Brunzell JD, Sande K, Iverius PH, Greenwood MR. 1985. Sweet tooth re-considered: taste responsiveness in human obesity. *Physiol Behav* **35**, pp. 617-22.

Drewnowski A, Henderson SA, Driscoll A, Rolls BJ. 1996. Salt taste perceptions and preferences are unrelated to sodium consumption in healthy older adults. *J Am Diet Assoc* **96**, pp.471-4.

Drewnowski A, Krahn DD, Demitrack MA, Nairn K, Gosnell BA. 1995. Naloxone, an opiate blocker, reduces the consumption of sweet high-fat foods in obese and lean female binge eaters. *Am J Clin Nutr* **61**, pp. 1206-12.

Drewnowski A, Kurth C, Holden-Wiltse J, Saari J. 1992. Food preferences in human obesity: carbohydrates versus fats. *Appetite* **18**, pp. 207-21.

Drewnowski A, Krahn DD, Demitrack MA, Nairn K, Gosnell BA. 1992 Taste responses and preferences for sweet high-fat foods: evidence for opioid involvement. *Physiol Behav* **51**, pp. 371-9.

Drummond SE, Crombie NE, Cursiter MC, Kirk TR. 1998. Evidence that eating frequency is inversely related to body weight status in male, but not female, non obese adults reporting valid dietary intakes. *Int J Obes Relat Metab Disord* **22,** pp. 105-12.

Durlach PJ, Edmunds R, Howard L, Tipper SP. 2002. A rapid effect of caffeinated beverages on two choice reaction time tasks. *Nutritional Neuroscience* **5**, pp. 433-442.

Edwards P, Roberts I. 2008. Transport policy is food policy. *The Lancet* (Letter) **371,** pp. 1661.

Elfag K, Erlanson-Albertsson C. 2006. Sweet and fat taste preference in obesity have different associations with personality and behavior. *Physiol Behav* **88**, pp. 61-66.

Epstein AN, Stellar E. 1955. The control of salt preference in the adrenalectomized rat. *The Journal of Comparative and Physiological Psychology* **48**, pp. 167-172.

Esposito K, Giugliano D. 2008. Mediterranean dietary patterns and chronic diseases. *Am J Clin Nutr* **88,** pp. 1179-80.

EUROFIR, Institute of Food Research, Norfolk, UK.

Eysenck HJ, Eysenck SBG. 1964 Manual of the Eysenck Personality Inventory, London: Hodder and Stoughton.

Eysenck HJ, Eysenck SB. 1991 Manual of the Eysenck Personality Scales (EPS Adult) London: Hodder and Stoughton.

Eysenck HJ. 1965. Smoking, Health and Personality, London.

Fabry P, Tepperman J. 1970. Meal frequency-a possible factor in human pathology. *Am J Clin Nutr* **23**, pp. 1059-1068.

Falconer H, Baghurst KI, Rump EE. 1993. Nutrient intakes in relation to health-related aspects of personality. *Journal of Education Nutrition* **25**, pp. 307-318.

Farnam A, Somi MH, Sarami F, Farhang S. 2008. Five personality dimensions in patients with irritable bowel syndrome. *Neuropsychiatr Dis Treat* **4**, pp. 959-62.

Finkelstein B, Fryer BA. 1971. Meal frequency and weight reduction of young women. *Am J Clin Nutr* **24**, pp. 465-468.

Fischer K, Colombani PC, Langhans W, Wenk C. 2001. Cognitive changes and its relationship with postprandial metabolic changes after ingestion of different micronutrients in the morning. *Br J Nutr* **85**, pp. 393-405.

Foster-Powell K, Holt SHA, Brand-Miller JC. 2002. International table of glycaemic index and glycaemic load values. *Am J Clin Nutr* **76,** pp. 5-56.

Frank GK, Oberndorfer TA, Simmons AN, Paulus MP, Fudge JL, Yang TT, Kaye WH. 2008. Sucrose activates human taste pathways differently from artificial sweetener. *Neuroimage* **15**, pp. 1559-69.

Franz MJ. 2006. The argument against glycaemic index: what are the other options? *Nestle Nutr Workshop Ser Clin Programme* **11**, pp. 69-72.

Fraser GE, Welch A, Luben R, Bingham SA and Day NE. 2000. The effect of age, sex, and education on food consumption of a middle-aged English cohort—EPIC in East Anglia. *Preventive Medicine **30**,* pp. 26-34.

Fung T, Hu FB, Fuchs C, Giovannucci E, Hunter DJ, Stampfer MJ, Colditz GA, Willett WC. 2003. Major dietary patterns and the risk of colorectal cancer in women. *Arch Intern Med* **163**, pp. 309-14.

Fung TT, Rimm EB, Spiegelman D, Rifai N, Tofler GH, Willett WC, Hu FB. 2001. Association between dietary patterns and plasma biomarkers of obesity and cardiovascular disease risk. *Am J Clin Nutr* **73**, pp. 61-67.

Fung TT, Willett WC, Stampfer MJ, Manson JE, Hu FB. 2001. Dietary patterns and the risk of coronary heart disease in women. *Arch Intern Med* **161**, pp. 1857-1862.

Gallagher D, Visser M, Sepulveda D, Pierson RN, Harris T, Heymsfield SB. 1996. How useful is body mass index for comparison of body fatness across age, sex and ethnic groups? *Am J Epidemiol* **143**, pp. 228-39.

Ganchrow JR, Steiner JE, Daher M. 1983. Neonatal facial expressions in response to different qualities and intensities of gustatory stimuli. *Infant Behav Dev* **6**, pp. 189–200.

Gex-Fabry M, Raymond L, Jeaneret O. 1988. Multivariate analysis of dietary patterns in 939 Swiss adults: sociodemographic parameters and alcohol consumption profiles. *Int J Epidemiol* **17**, pp. 548-55.

Gibson G. 1998. Dietary assessment. In: Essentials of human nutrition (eds Mann J & Truswell S), pp 409-426, *Oxford University Press*: New York

Gibson EL. 2006. Emotional influences on food choice: sensory, physiological and psychological pathways. *Physiol Behav* **90**, pp. 53-61.

Giugliano D, Esposito K. 2008. Mediterranean diet and metabolic diseases. *Curr Opin Lipidol* **19**, pp. 63-8.

Goldberg DP, Gater R, Sartorius N, Ustun TS, Picinelli M, Gureje O, Rutter C. 1997. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med* **27**, pp. 191-7.

González Carnero J, de la Montaña Miguélez J, Míguez Bernárdez M. 2002. Perception of sweet and salty flavors in different population groups. *Nutr Hosp* **17**, pp. 256-8.

Gosnell BA, Levine AS. 2009 Reward systems and food intake: role of opioids. *Int J Obes (Lond)* **33,** Suppl 2:S54-8.

Gregory J, Foster K, Tyler H, Wiseman M 1990. The Dietary and Nutritional Survey of British Adults, *HMSO*, London.

Hajna A, Smith GP, Norgren R. 2004. Oral sucrose stimulation increases accumbens dopamine in the rat. *Am J Physiol Regul Integr Comp Physiol* **286,** R31-37.

Haveman-Nies A, de Groot LC, Van Staveren WA. 1997. Fluid intake of elderly Europeans. *J Nutr Health Aging* **1**, pp. 151-5.

Haveman-Nies A, Tucker KL, de Groot LC, Wilson PW, van Staveren WA. 2001. Evaluation of dietary quality in relationship to nutritional and lifestyle factors in elderly people of the US Framingham Heart Study and the European SENECA study. *Eur J Clin Nutr* **55**, pp. 870-80.

Haynes SG, Levine S, Scotch N, Feinleib M, Kannel WB. 1978. The relationship of psychosocial factors to coronary heart disease in the Framingham Study I. methods and risk factors. *American Journal of Epidemiology* **107**, pp. 362-383.

He FJ, MacGregor GA. 2008. Beneficial effects of potassium on human health. *Physiol Plant* **133**, pp. 725-35.

Hill RJ, Davies PSW. 2001. The validity of self-reported energy intake as determined using the doubly labeled water technique. *British Journal of Nutrition* **85**, pp. 415-430.

Hirvonen T, Mannisto S, Roos E, Pietinen P. 1997. Increasing prevalence of underreporting does not necessarily distort dietary surveys. *Eur J Clin Nutr* **51**, pp 297-301.

Horgan GW, Stubbs J. 2003. Predicting basal metabolic rate in the obese is difficult. *Eur J Cln Nutr* **57,** pp. 335-40.

Horner NK, Patterson RE, Neuhouser ML, Lampe JW, Beresford SA, Prentice RL. 2002. Participant characteristics associated with errors in self-reported energy intake from the Women's Health Initiative food-frequency questionnaire. *Am J Clin Nutr* **76,** pp. 766-773.

Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, Willett WC. 2001. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *N Engl J Med* **13,** pp. 790-7.

Hu FB, Rimm E, Smith-Warner SA, Feskanich D, Stampfer MJ, Ascherio A, Sampson L, Willett WC. 1999. Reproducibilty and validity of dietary patterns assessed with a food frequency questionnaire. *Am J Clin Nutr* **69**, pp. 243-9.

Hu FB, Rimm EB, Stampfer MJ, Ascherio A, Spiegelman D, Willett WC. 2000. Prospective study of major dietary patterns and risk of coronary heart disease in men. *Am J Clin Nutr* **72,** pp. 912-21.

Iqbal R, Anand S, Ounpuu S, Islam S, Zhang X, Rangarajan S, Chifamba J, Al-Hinai A, Keltai M, Yusuf S. 2008. Dietary patterns and the risk of acute myocardial infarction in 52 countries: results of the INTERHEART study. .*Circulation* **118,** pp. 1929-37.

Jablonski KL, Seals DR, Eskurza I, Monahan KD, Donato AJ. 2007. High-dose ascorbic acid infusion abolishes chronic vascoconstriction and restores leg blood flow in healthy older men. *J Appl Physio* **103**, pp. 1715-21.

Jacques PF, Tucker KL. 2001. Are dietary patterns useful for understanding the role of diet in chronic disease. *Am J Clin Nutr* **73**, pp. 1-2.

James PT, Leach R, Kalamara E, Shayeghi M. 2001. The worldwide obesity epidemic. *Obesity* **9**, pp. s228-S233.

Johnston CJ. 2005. Strategies for healthy weight loss: From Vitamin C to the glycemic response. *Journal of the American College of Nutrition* **24**, pp. 158-165.

Johnston CS, Beezhold BL, Mostow B, Swan PD. 2007. Plasma Vitamin C is inversely related to body mass index and waist circumference but not to plasma adiponectin in non-smoking adults. *J Nutr* **137**, pp. 1757-62.

Kakisaki M, Kuriyama S, Sato Y, Shimazu T et al. 2008. Personality and body mass index: a cross-sectional analysis from Miyagi Cohort study. *J Psychosom Res* **64**, pp. 71-80.

Kant A. 2004. Dietary patterns and health outcomes. *J Am Diet Assoc* **104**, pp. 615-635.

Kanter VB, Hazleton JE. 1964. An attempt to measure some aspects of personality in young men with duodenal ulcer by means of questionnaires and a projective test. *Journal of Psychosomatic Research* **8**, pp. 297-309.

Karisto A, Prattala R, Berg M. 1993. The good, the bad and the ugly-Differences and changes in health related lifestyles. In *Regulating Markets relating People on Food and Nutrition Policy*, eds U Kjærnes et al, Oslo: Novus Press. pp 185–204.

Katsouyanni K, Rimm EB, Gnardellis C, Trichopoulos D, Polychronopoulos E, Trichopoulou A. 1997. Reproducibility and relative validity of an extensive semi-quantitative food frequency questionnaire using dietary records and biochemical markers among Greek schoolteachers. *Int J Epidemiol* **26,** (Suppl), S118-27.

Kelley AE, Baldo BA, Pratt WE, Will MJ. 2005. Corticostriatal-hypothalamic circuitry and food motivation: integration of energy, action and reward. *Physiol Behav* **86**, pp. 773-95.

Kennedy ET, Bowman SA, Spence JT, Freedman M, King J. 2001. Popular diets: Correlation to health, nutrition and obesity. *J Am Diet Assoc* **101**, pp. 411-20.

Keskitalo K, Silventoinen K, Tuorilla H, Perola M, Pietilainen KH, Rissanen A, Kaprio J. 2008. Genetic and environmental contributions to food use patterns of young adult twins. *Physiol Behav* **93**, pp. 235-42.

Khani BR, Ye W, Terry P, Wolk A. 2004. Reproducibility and validity of major dietary patterns among Swedish women assessed with a food-frequency survey. *J Nutr* **134**, pp. 1541-1545.

Kikuchi Y, Inoue T, Ito M, Masuda M, Yoshimura K, Watanabe S. 1998. Health consiousness of young people in relation to their personality. *JEpidemiol* **9**, pp. 121-131.

Kikuchi Y, Watanabe S. 1999. Personality and dietary habits. *J Epidemiol* **10**, pp. 191-198.

Kirk TR. 2000. Role of dietary carbohydrate and frequent eating in body-weight control. *Proc Nutr Soc* **59**, pp. 349-358.

Kleinbaum DG, Kupper LL, Muller KE. 1980. Applied regression analysis and other multivariable methods. *PWS-Kent Publishing Company*, Boston.

Klimacka-Nawrot E, Suchecka W, Błlońska-Fajfrowska B. 2006. Taste sensitivity to natrium chloride and saccharose in women and men of different age. *Wlad Lek* **59**, pp. 778-83.

Kretsch MJ, Green MW, Fong AK, Elliman NA, Johnson HL. 1997. Cognitive effects of long term weight reducing diet. *Int J Obes Relat Metab Disord* **21**, pp. 14-21.

Labouvie-Vief G, Diehl M, Tarnowski A, Shen J. 2000. Age differences in adult personality: findings from the United States and China. *J Gerontol B Psychol Sci Soc ScI* **55,** pp.P4-17.

Landsberg L. 1999. Weight reduction and obesity. *Clin Exp Hypertens* **21**, pp. 763-8.

Laurent-Jaccard A, de Matteis L, Hofstetter JR, Schutz Y. 1994. Are food preferences affected by body mass index, age, sex or tobacco? *Schweiz Med Wochenschr* **124**, pp. 2039-41.

Lawes CMM, Hoom SV, Rodgers A. 2008. Global burden of blood-pressure. 2001. *The Lancet* **371**, pp. 1513-1517.

Leblanc J, Ducharme MB. 2005. Influence of personality traits on plasma levels of cortisol and cholesterol. *Physiology & Behavior* **84**, pp. 677-680.

Lee CD, Jacobs DR. Jr, Schreiner PJ, Iribarren C, Hankinson A. 2007. Abdominal obesity and coronary artery calcification in young adults: the Coronary Artery Risk Development in Young Adults (CARDIA) study. *Am J Clin Nutr* **86**, pp. 48-54.

Leshem M, Abutbul A, Eilon R. 1999. Exercise increases the preference for salt in humans. *Appetite* **32**, pp. 251-260.

Leterme A, Brun L, Dittmar A, Robin O. 2008. Autonomic nervous system responses to sweet taste: evidence for habituation rather than pleasure. *Physio Behav* **18**, pp. 994-9.

Liang NC, Hajnal A, Norgren R. 2006. Sham feeding corn oil increases accumbens dopamine in the rat. *Am J Physiol Regul Integr Comp Physiol.* **291**, pp.R1236-9.

Lin H, Bermudez OI, Tucker KL. 2003. Dietary patterns of Hispanic elders are associated with acculturation and obesity. *J Nutr* **133**, pp. 3651–7.

Lindemann B. 1995. Sweet and salty: transduction in taste. *New in Physiological Sciences* **10**, pp. 166-170.

Logue AW, Smith ME. 1986. Predictors of food preferences in adult humans. *Appetite* **7**, pp. 109-25.

Louis-Sylvestre J, Lluch A, Neant F, Blundell JE. 2003. Highlighting the positive impact of increasing feeding frequency on metabolism and weight management. *Forum Nutr* **56**, pp. 126-8.

Lowden A, Holmback U, Akerstedt T, Forslund J, Lennernas M, Forslund A. 2004. Performance and sleepiness during a 24 hour wake in constant conditions are affected by diet. *Biol Psychol* **65**, pp. 251-63.

Luce RD. 1986. Response Times: Their role in inferring elementary mental organization. *Oxford University Press,* New York.

Maskarinec G, Novotny R, Tasaki K. 2000. Dietary patterns are associated with body mass index in multiethnic women. *J Nutr* **130**, pp. 3068–72.

McDaid O, Stewart-Knox B, Parr H, Simpson E. 2007. Dietary zinc intake and sex differences in taste acuity in healthy young adults. *J Hum Nutr Diet* **20**, pp. 103-10.

McMahon S, Alderman MH, Kindholm LH, Liu L, Sanchez RA, Seedat YK. 2008. Blood pressure-related disease is a global priority. Comment. *The Lancet* **371**, pp. 1480-1482.

McNaughton SA, Mishra GD, Bramwell G, Paul AA, Wadsworth MEJ. 2005. Comparability of dietary patterns assessed by multiple dietary assessment methods: results from the 1946 British Birth Cohort. *Eur J Clin Nutr* **59**, pp. 341-352.

McNaughton SA, Mishra GD, Stephen AM, Wadsworth MEJ. 2007. Dietary patterns throughout adult life are associated with body mass index, waist circumference, blood pressure and red cell folate. *J Nutr* **137**, pp. 99-105.

Menotti A, Kromhout D, Blackburn H, Fidanza F, Buzina R, Nissinen A. 1999. Food intake patterns and 25-year mortality from coronary heart disease: cross-cultural correlations in the Seven Countries Study. The Seven Countries Study Research Group. *Eur J Epidemiol* **15**, pp. 507-15.

Meunier N, O'Connor JM, Maiani G, Cashman KD, Secker DL, Ferry M, Roussel AM, Coudray C. 2005. Importance of zinc in the elderly: the ZENITH study. *Eur J Clin Nutr* **59**, pp. S1-4.

Michels KB, Schulze MB. 2005. Can dietary patterns help us detect diet-disease associations? *Nutr Res Rev* **18**, pp. 241- 248.

Mikkila V, Rasanen L, Raitakari OT, Marniemi J, Pietinen P, Ronnemaa T, Viikari J. 2007. Major dietary patterns and cardiovascular risk factors from childhood to adulthood. The Cardiovascular Risk in Young Finns Study. *Br J Nutr* **98**, pp. 218-25.

Mishra GD, McNaughton SA, Bramwell GD, Wadsworth ME. 2006. Longitudinal changes in dietary patterns during adult life. *Br J Nutr* **96**, pp. 735-44.

Mishra GD, Prynne CJ, Paul AA, Greenberg DC, Bolton-Smith, C. 2005. The impact of inter-generational social and regional circumstances on dietary intake patterns of British adults: results from the 1946 British Birth Cohort. *Public Health Nutr* **7,** pp. 737-44.

Mishra G, Ball K, Arbuckle J, Crawford D. 2002. Dietary patterns of Australian adults and their association with socio-economic status: results from the 1995 national nutrition survey. *Eur J Clin Nutr* **56,** pp. 687–93.

Miwa H, Kondo T. 2008. Alteration of eating behaviors in patients with Parkinson's disease: possibly overlooked? *Neurocase* **14**, pp. 480-4.

Mizushige T, Inoue K, Fushiki T. 2007. Why is fat so tasty? Chemical reception of fatty acid on the tongue. *J Nutr Sci Vitaminol (Tokyo)* **53**, pp.1-4.

Mizushige T, Saitoh K, Manabe Y, Nishizuka T et al. 2009. Preference for dietary fat induced by release of beta-endorphin in rats. *Life Sci* **84**, pp. 760-5.

Mojet J, Heidema J, Christ-Hazelhof E. 2003. Taste perception with age: generic or specific losses in supra-threshold intensities of five taste qualities? *Chem Senses* **28**, pp. 397-413.

Moller SE, Mortensen EL, Breum L, Alling C, Larsen OG. Et al. 1996. Aggression and personality: association with amino acids and monamine metabolites. *Psychol Med* **26**, pp. 323-31.

Mroczek DK, Spiro A, Griffin PW. 2006. Personality and Aging. In JE Birren & KW Schaie (Eds) Handbook of Psychology of Aging 6th Edition (pp.363-377) New York: Academic Press.

Mucignat-Caretta C. 1998. Changes in female cognitive performance after energetic drink consumption: a preliminary study. *Prog Neuropsychopharmacol Biol Psychiatry* **22**, pp. 1035-42.

Murphy C, Gilmore MM. 1989. Quality-specific effects of aging on the human taste system. *Percept Psychophys* **45**, pp. 121-8.

Murphy C. 1993. Nutrition and chemosensory perception in the elderly. *Crit Rev Food Sci Nutr* **33**, pp. 3-15.

National Research Council, Committee on Diet and Health. Diet and Health: implications for reducing chronic disease risk. Washington, DC. *National Academy Press*, 1989.

Ness AR, Chee D, Elliott P. 1997. Vitamin C and blood pressure: an overview. J *Hum Hypertens* **11**, pp. 343-50.

Newby PK, Muller D, Hallfrisch J, Qiao N, Andres R, Tucker KL. 2003. Dietary patterns and changes in body mass index and waist circumference in adults. *Am J Clin Nutr* **77,** pp. 1417-1425.

Newby PK, Muller D, Hallfrisch J, Andres R, Tucker KL. 2004. Food patterns measured by factor analysis and anthropometric changes in adults. *Amer J Clin Nutr* **80,** pp. 504-513.

O'Gorman RL, Kumari V, Williams SC, Zelaya FO, Connor SE, Alsop DC, Gray. 2006. Personality factors correlate with regional cerebral perfusion. *Neuroimage* **31**, pp. 489-95.

Ortega RM, Redondo MR, Zamora MJ, Lopez-Sobaler AM. 1998. Relationship between the number of daily meals and the energy and nutrient intake in the elderly. Effect on various cardiovascular risk factors. *Nutr Hosp* **13**, pp. 186-92.

Oswald LM, Zandi P, Nestadt G, Potash JB, Kalaydijan AE, Wand GS. 2006. Relationship between cortisol responses to stress and personality. *Neuropsychopharmacology* **31**, pp. 1583-91.

Park SY, Murphy SP, Wilkens LR, Yamamoto JF, Sharma S, Hankin JH, Henderson BE, Kolonel LN. 2005. Dietary patterns using the food guide pyramid groups are associated with sociodemographic and lifestyle factors: the multiethnic cohort study. *J Nutr* **135**, pp. 843–9.

Paul AA, Southgate DAT. 1985. McCance and Widdowson's The Composition of Foods. *Her Majesty's Stationery Service*, London.

Perry A, Wang X, Kuo YT. 2008. Anthropometric correlates of metabolic syndrome components in a diverse sample of overweight/obese women. *Ethn Dis* **18,** pp. 163-8.

Poppitt SD, Swann D, Black AE, Prentice AM. 1998. Assessment of selective under-reporting of food intake by both obese and non-obese women in a metabolic facility. *Int J Obes Relat Metab Disord* **22**, pp. 303-11.

Prevost AT, Whichelow MJ, Cox BD. 1997. Longitudinal dietary changes between 1984-5 and 1991-2 in British adults: associations with socio-demographic, lifestyle and health factors. *British Journal of Nutrition* **78**, pp. 873-888.

Price GM, Uauy R, Breeze E, Bulpitt CJ, Fletcher AE. 2006. Weight, shape, and mortality risk in older persons: elevated waist-hip ratio, not body mass index, is associated with greater risk of death. *Am J Clin Nutr* **84,** pp. 449-60.

Pryer JA, Cook A, Shetty P. 2001. Identification of groups who report similar patterns of diet among a representative national sample of British adults aged 65 years of age or more. *Public Health Nutr* **4**, pp.787–95.

Pryer JA, Nichols R, Elliott P, Thakrar B, Brunner E, Marmot M. 2001. Dietary patterns among a national random sample of British adults. *J Epidemiol Community Health* **55**, pp. 29–37.

Pryer JA, Vrijheid M, Nichols R, Kiggins M, Elliott P. 1997. Who are the 'low energy reporters' in the dietary and nutritional survey of British adults? *Int J Epidemiol* **26**, pp. 146-54.

Randall E, Marshal JR, Graham S, Brasure J. 1990. Patterns in food use and their associations with nutrients intakes. *Am J Clin Nutr* **52**, pp. 739-45.

Rees WL. 1960. Constitutional factors and abnormal behaviour. Handbook of abnormal Behavior. (ed. HJ Eysenck), New York.

Revelle W, Humphreys MS, Simon L, Gilliland K. 1980. The interactive effect of personality, time of day, and caffeine: A test for model arousal. *J. Experimental Psychology: General* **109**, pp.1-31.

Richter CP. 1936. Increased salt appetite in adrenalectomized rats. *Am J Physiol* **115**, pp. 155-161.

Roberts BW, Walton KE, Viechtbauer W. 2006. Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin* **132**, pp.1-25.

Roberts BW, DelVecchio W. 2000. The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin* **126**, pp. 3–25.

Roberts BW, Robins RW, Trzesniewski KH, Caspi A. 2003. Personality trait development in adulthood. In J. T. Mortimer & M. J. Shanahan *(Eds.), Handbook of the life course* (pp. 579–595). New York: Plenum.

Rolls BJ. 1999. Do chemosensory changes influence food intake in the elderly? *Physiol Behav* **66**, pp. 193-7.

Rolls BJ. 1993. Appetite, hunger, and satiety in the elderly. *Crit Rev Food Sci* **33**, pp. 39-44.

Rosenzweig MR, Breedlove SM, Leiman AL. 2002. Biological Psychology. *Sinauer associates, Massachussetts* p. 269.

Rothenburg E, Bosaeus I, Lernfelt B, Landahl S, Steen B. 1998. Energy intake and expenditure: validation of a diet history by heart rate monitoring, activity diary and doubly labeled water. *Eur J Clin Nutr* **52**, pp. 832-8.

Roy A, De Jong J, Linnoila M. 1989. Extraversion in pathological gamblers. Correlates with indexes of noradrenergic function. *Arch. Gen Psychiatry* **46**, pp. 679-81.

Sale C, Guppy A, El-Sayed M. 2000. Individual differences, exercise and leisure activity in predicting affective well-being in young adults. *Ergonomics* **43**, pp.1689-97.

Samaras K, Kelly PJ, Campbell LV. 1999. Dietary underreporting is prevalent in middle-aged British women and is not related to adiposity (percentage body fat). *Int J Obes Relat Metab Disord* **23**, pp. 881-8.

Sanchez-Castillo CP, Warrender S, Whitehead TP, James WP. 1987. An assessment of the sources of dietary salt in a British population. *Clin Sci (Lond)* **72**, pp. 95-102.

Schoeller DA. 1988. Measurement of energy expenditure in free-living humans by using doubly labeled water. *J Nutr* **118**, pp. 1278-89.

Schroll K, Carbajal A, Decarli B, Martins I, Grunenberger F, Blauw YH, de Groot CP. 1996. Food patterns of elderly Europeans. SENECA Investigators. *Eur J Clin Nutr* **50** Suppl, pp. S86-100.

Schwerin HS, Stanton JL, Smith JL et al. 1982. Food, eating habits, and health: a further examination of the relationship between food eating patterns and nutritional health. *Am J Clin Nutr* **35**, pp. 1319-1325.

Sciafani A. 2001. Psychobiology of food preferences. *Int J Obes Relat Metab Disorders* **25**, pp. S13-6.

Segraves RT. 1970. Personality, body build and adrenocortical activity. *Brit J Psych* **117**, pp. 405-411.

Seidell JC, Bjorntorp P, Sannerstedt R, Krotkiewski M, Kvist H. 1989. Regional distribution of muscle and fat mass in men-new insight into the risk of abdominal obesity using computed tomography. *In J Obes* **13**, pp. 289-303.

Shepherd R, Farleigh CA. 1986. Preferences, attitudes and personality as determinants of salt intake. *Hum Nutr Appl Nutr* **40**, pp. 195-208.

Shibata R, Kameishi M, Kondoh T, Torii K. 2009. Bilateral dopaminergic lesions in the ventral tegmental area of rats influence sucrose intake, but not umami and amino acid intake. *Physiol Behav* **96**, pp. 667-74

Shimura T, Kamada Y, Yamamoto T. 2002. Ventral tegmental lesions reduce overconsumption of normally preferred taste fluid in rats. *Behav Brain Res* **134**, pp. 123-30

Sieri S, Krogh V, Pala V, Muti P, Micheli A, Evangelista A, Tagliabue G, Berrino F. 2004. Dietary patterns and risk of breast cancer in the ORDET cohort. *Cancer Epidemiol Biomarkers Prev* **13**, pp. 567-72.

Slimani N et al. 2002. Diversity of dietary patterns observed in the European Prospective Investigation into Cancer and Nutrition (EPIC) project. *Public Health Nutr* **5**, pp. 1311-28.

Speakman JR. 1998. The history and theory of doubly labeled water technique. *Am J Clin Nutr* **68** pp. 932S-938S.

Stampfer MJ, Hu FB, Manson JE, Rimm EB, Willett WC. 2000. Primary prevention of coronary heart disease in women through diet and lifestyle. *N Engl J Med* **343**, pp. 16-22.

Steiner JE. 1997. Facial expressions of the neonate infant indicating the hedonics of food related chemical stimuli. In *Taste and development: The genesis of sweet preference. DHEW Publications* **no. NIH 77-1068**, pp. 173-189. JM Weiffenbach, editor, Washington DC: US government publishing office.

Stellar E. 1993. Salt appetite: its neuroendocrine basis. *Acta Neurobiol Exp (Wars)* **53**, pp. 475-84.

Steptoe A, Perkins-Porras L, McKay C, Rink E, Hilton S, Cappuccio FP. 2003. Psychological factors associated with fruit and vegetable intake and with biomarkers in adults from a low-income neighborhood. *Health Psychol* **22**, pp. 148-55.

Stevens JC, Cain WS. 1993. Changes in taste and flavor in aging. *Crit Rev Food Sci Nutr* **33**, pp. 27-37.

Stewart-Knox BJ, Simpson EE, Parr H et al. 2005. Zinc status and taste acuity in older Europeans: the ZENITH study. Eur J Clin Nutr **59**, pp. S31-6.

Stewart-Knox BJ, Simpson EE, Parr H et al. 2008. Taste acuity in response to zinc supplementation in older Europeans. *Br J Nutr* **99**, pp. 129-36.

Stitt S, O'Connell C, Grant D. 1995. Old, poor & malnourished. *Nutr Health* **10**, pp. 135-54.

Summerbell CD, Moody RC, Shanks J, Stock MJ, Geissler C. 1995. Sources of energy from meals versus snacks in 220 people in four age groups. *Eur J Clin Nutr* **49**, pp. 33-41.

Summerbell CD, Moody RC, Shanks J, Stock MJ, Geissler C. 1996. Relationships between feeding patterns and body mass index in 220 free-living people in four age groups. *Eur J Clin Nutr* **50**, pp. 513-9.

Togo P, Osler M, Sorensen TI, Heitmann BL. 2001. Food intake patterns and body mass index in observational studies. *Int J Obes Relat Metab Disord* **25**, pp. 1741-51.

Turnbull F et al. 2003. Effects of different blood-pressure-lowering regimens on major cardiovascular events: results of prospectively-designed overviews of randomized trials. *The Lancet* **362**, pp. 1527-35.

Umemura T, Ueda K, Nishioka K, Hidaka T et al. 2006. Effect of acute administration of caffeine on vascular function. *Am J Cardiol* **98**, pp. 1538-41.

Van Baak MA. 2008. Meal-induced activation of the sympathetic nervous system and its cardiovascular and thermogenic effects in man. *Physiol Behav* **94**, pp.178-86.

Van Dam RM, Rimm EB, Willett WC, Stampfer MJ, Hu FB. 2002. Dietary patterns and risk for type 2 diabetes mellitus in U.S. men. *Ann Intern Med* **136** pp. 201-9.

Van den Bree MBM., Eaves LJ, Dwyer JT. 1999. Genetic and environmental influences on eating patterns of twins aged > 50 y. *Am J Clin Nutr* **70**, pp. 456-465.

Voss S, Kroke A, Klipstein-Grobusch K, Boeing H. 1997. Obesity as a major determinant of underreporting in a self-administered food frequency questionnaire: results from the EPIC-Potsdam Study. *Z Ernahrungswiss* **36**, pp. 229-36.

Wacker J, Chavanon M-L, Stemmler G. 2006. Investigating the dopaminergic basis of extraversion in humans: A multilevel approach. *Journal of Personality and Social Psychology* **91**, pp. 171-187.

Wadsworth M, Kuh D, Richards M, Hardy R. 1946. The 1946 National Birth Cohort

Wahlquist ML, Kouris-blazos A, Wattenapenpaiboon N. 1999. The significance of eating patterns: an elderly Greek case study. *Appetite* **32**, pp. 23-32.

Welford AT, Choice Reaction Time: Basic concepts. In AT Welford (Ed.) *Reaction Times.* Academic Press, New York pp. 73-128.

Westerterp KR, Speakman JR, 2008. Physical activity and energy expenditure has not declined since the 1980s and matches energy expenditures of wild mammals. *International Journal of Obesity* **32**, pp. 1256-1263.

Whichelow MJ, Prevost AT. 1996. Dietary patterns and their associations with demographic, lifestyle and health variables in a random sample of British adults. *Br J Nutr* **76**, pp. 17-30.

Woolcott DM, Sabry JH, Kawash GF. 1983. A study of some aspects of food-related behaviour among a group of men. *Hum Nutr Appl Nutr* **37**, pp. 199-209.

World Health Organization, 2000. Obesity: Preventing and managing the global epidemic. *WHO Obesity Technical Report Series* **894,** World Health Organization, Geneva.

World Health Organization. World Health Report. 2002. Reducing risk, promoting healthy life. World Health Organization. Geneva.

World Health Organization. 2003. Diet, nutrition and the prevention of chronic diseases. *WHO technical report series Report of a joint WHO/FAO expert consultation.* Geneva, Switzerland.

WHO World Mental Health Survey. 2004. Prevalence, severity and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. *JAMA* **291**, pp. 2581-2590.

WHO. World Health Organization. 2004. Prevention of Mental Disorders: Effective intervention and policy options. Geneva

Winkler S, Garg AK, Mekayarajjananonth T, Bakaeen LG, Khan E. 1983. Depressed taste and smell in geriatric patients. *Hum Nutr Appl Nutr* **37**, pp. 199-209.

Wurtman RJ, Wurtman JJ. 1995. Brain serotonin, carbohydrate-craving, obesity and depression. *Obes Res.* **3** Suppl 4:477S-480S.

Yannakoulia M, Melistas L, Yiannakouris N. 2007. Association of eating frequency with body fatness in pre-and postmenopausal women. *Obesity* **15**, pp. 100-106.

Zemel MB, Sowers JR. 1988. Salt sensitivity and systemic hypertension in the elderly. *Am J Cardiol* **15**, 7H-12H.

Zhang J, Mckeown RE, Muldoon MF, Tang S. 2006. Cognitive performance is associated with macronutrients intake in healthy young and middle-aged adults. *Nutr Neuro* **9**, pp. 179-87.

APPENDIX: A

Appendix A: 'The Food Composition Table'-Macro-and micro-nutruents and Glycaemic Load analysis derived from Food Frequency Questionnaire

	Portion	Kcal Kcal	Protein g.	Fat g.	Carb g.	Fibre g.	Ca Mg.	Fe mg	A mg	B1 gm	B2 mg	B3 mg	C mg	Na mg	K Mg.	Glycaemic Load (GL)
Fruits summer		**42.8**	**0.7**	**0.05**	**10.6**	**2.75**	**24.17**	**0.48**	**10.5**	**0.05**	**0.03**	**0.43**	**30.67**	**3.43**	**272**	**4.98**
Apples	120	42	0.2	0	11	1.7	4	0.2	5	0.04	0.02	0.1	2	2.4	144	4
Pears	150	44	0.3	0	11.4	2.3	9	0.2	2	0.03	0.03	0.2	3	4.5	150	6.3
Oranges	245	64	1.5	0	15.7	3.4	76	0.7	15	0.2	0.05	0.7	93	7.35	490	7.8
Bananas	135	63	0.9	0.3	15.4	2.4	5	0.3	27	0.03	0.05	0.7	8	1.35	472	7.8
Strawberries	100	26	0.6	0	6.2	2	22	0.7	5	0.02	0.03	0.5	60	2	160	2.5
Raspberries	100	18	0.6	0	3.9	4.7	29	0.8	9	0.01	0.02	0.4	18	3	220	1.5
Total		257	4.1	0.3	63.6	16.5	145	2.9	63	0.33	0.2	2.6	184	20.6	1636	29.9
Fruits winter		**53**	**0.7**	**0.07**	**13.37**	**2.5**	**23.5**	**0.35**	**12.25**	**0.07**	**0.04**	**0.42**	**26.5**	**3.9**	**314**	**5.52**
Apples	120	42	0.2	0	11	1.7	4	0.2	5	0.04	0.02	0.1	2	2.4	144	4
Pears	150	44	0.3	0	11.4	2.3	9	0.2	2	0.03	0.03	0.2	3	4.5	150	4
Oranges other citrus	245	64	1.5	0	15.7	3.4	76	0.7	15	0.2	0.05	0.7	93	7.35	490	6.3
Bananas	135	63	0.9	0.3	15.4	2.4	5	0.3	27	0.03	0.05	0.7	8	1.35	472	7.8
Total		213	2.9	0.3	53.5	9.8	94	1.4	49	0.3	0.15	1.7	106	15.6	1256	22.1
Salads summer		**9.3**	**0.63**	**0.03**	**1.7**	**0.86**	**11.3**	**0.33**	**66.66**	**0.04**	**0.03**	**0.47**	**12.33**	**3.92**	**186**	**0.6**
Raw tomatoes	150	21	1.4	0	4.2	2.1	20	0.6	150	0.09	0.06	1.2	30	4.5	435	1.6
Lettuce	30	4	0.3	0.1	0.4	0.4	7	0.3	50	0.02	0.02	0.1	5	2.97	79.2	0.1
Cucumber	30	3	0.2	0	0.5	0.1	7	0.1	0	0.01	0.01	0.1	2	4.29	46.2	0.1
Total		28	1.9	0.1	5.1	2.6	34	1	200	0.12	0.09	1.4	37	11.76	560.4	1.8
Salads winter		**9.3**	**0.63**	**0.03**	**1.7**	**0.86**	**11.3**	**0.33**	**66.66**	**0.04**	**0.03**	**0.47**	**12.33**	**3.92**	**186**	**0.6**
Raw tomatoes	150	21	1.4	0	4.2	2.1	20	0.6	150	0.09	0.06	1.2	30	4.5	435	1.6
Lettuce	30	4	0.3	0.1	0.4	0.4	7	0.3	50	0.02	0.02	0.1	5	2.97	79.2	0.1
Cucumber	30	3	0.2	0	0.5	0.1	7	0.1	0	0.01	0.01	0.1	2	4.29	46.2	0.1
Total		28	1.9	0.1	5.1	2.6	34	1	200	0.12	0.09	1.4	37	11.76	560.4	1.8

Tinned fruit	**130**	**124**	**0.4**	**0**	**32.5**	**1.2**	**10**	**1.3**	**65**	**0.03**	**0.01**	**0.4**	**4**	**2.6**	**156**	**14.3**
Chips fries	**265**	**670**	**10.1**	**28.9**	**98.8**	**0**	**37**	**2.4**	**0**	**0.27**	**0.11**	**5.6**	**27**	**31.8**	**2703**	**21**
Potatoes		**175**	**2.76**	**4.96**	**31.9**	**0.93**	**13**	**0.63**	**0**	**0.13**	**0.06**	**2.06**	**13.6**	**19**	**875**	**20.4**
Boiled	150	120	2.1	0.2	29.6	1.4	6	0.5	0	0.12	0.05	1.7	14	4.5	495	20.3
Roast	130	204	3.6	6.2	35.5	0	13	0.9	0	0.13	0.05	2.5	13	11.7	975	20
Mashed	170	202	2.6	8.5	30.6	1.4	20	0.5	0	0.14	0.07	2	14	40.8	1156	21
		526	8.3	14.9	95.7	2.8	39	1.9	0	0.39	0.17	6.2	41	57	2626	61.3
Root veg		**32**	**1**	**0**	**7.4**	**2.4**	**38**	**0.43**	**433**	**0.05**	**0.05**	**0.8**	**11.33**	**72**	**216**	**5.32**
Carrots	65	12	0.4	0	2.8	1.8	24	0.3	1300	0.03	0.03	0.3	3	196	210	3.47
Swedes	120	22	1.1	0	4.6	3	50	0.4	0	0.05	0.04	1.2	20	16.8	120	5.32
Parsnips	110	62	1.4	0	14.9	2.5	40	0.6	0	0.08	0.07	1	11	4.4	319	7.17
Total		96	2.9	0	22.3	7.3	114	1.3	1300	0.16	0.14	2.5	34	217.2	649	15.96
Pulses		**64.4**	**5.22**	**0.5**	**10.42**	**6.24**	**43.4**	**1.66**	**29**	**0.07**	**0.06**	**1.72**	**4.6**	**228**	**275**	**4.58**
peas frozen/tinned	85	40	3.9	0.3	6	4.8	20	1.4	43	0.11	0.09	2.4	7	149	114	2.3
Broad	75	36	3.1	0.5	5.3	2.9	16	0.8	32	0.08	0.03	2.8	11	15	172	4.1
Haricot	105	98	6.9	0.5	17.4	7	68	2.6	0	0	0	0	0	15.75	336	4.9
Runner	105	20	2	0.2	2.8	3.3	23	0.7	70	0.03	0.07	0.8	5	2.1	157	2
Baked beans	200	128	10.2	1	20.6	13.2	90	2.8	0	0.14	0.1	2.6	0	960	600	9.6
Total		322	26.1	2.5	52.1	31.2	217	8.3	145	0.36	0.29	8.6	23	1141.85	1379	22.9
Green veg		**21**	**3.5**	**0.2**	**1.36**	**4.2**	**297.3**	**2.2**	**578**	**0.06**	**0.14**	**1.23**	**25.3**	**56**	**309.5**	**0.1**
Spinach	130	39	6.6	0.7	1.8	7.4	780	5.2	1300	0.09	0.2	2.3	33	156	637	0.1
Cabbage	75	7	1	0	0.8	1.7	40	0.5	38	0.02	0.02	0.3	11	9	82.5	0.1
Broccoli	95	17	2.9	0	1.5	3.5	72	1	396	0.06	0.19	1.1	32	5.7	209	0.1
Total		63	10.5	0.7	4.1	12.6	892	6.7	1734	0.17	0.41	3.7	76	170.7	928.5	0.3
Other veg		**127**	**0.95**	**12.8**	**2**	**1.8**	**13**	**0.45**	**0**	**0.02**	**0.1**	**1.2**	**0.5**	**7.02**	**210.5**	**0.05**
Onions	40	138	0.7	13.3	4	1.6	24	0.2	0	0	0	0	0	8	108	0.1
Mushrooms	55	116	1.2	12.3	0	2	2	0.7	0	0.04	0.19	2.4	1	6.05	313	0

Total		254	1.9	25.6	4	3.6	26	0.9	0	0.04	0.19	2.4	1	14.05	421	0.1
Nuts		**153.3**	**4.3**	**14.02**	**3.15**	**1.63**	**27.17**	**0.77**	**0.67**	**0.16**	**0.06**	**1.83**	**0**	**34**	**194**	**0.5**
Almond	20	113	3.4	10.7	0.9	2.6	50	0.8	0	0.05	0.18	0.9	0	1.2	172	0.5
Brazil	30	186	3.6	18.5	1.2	2.4	54	0.8	0	0.3	0.04	1.3	0	0.6	228	
Cashew		224	6.9	18.3	11.2	0	15	1.5	4	0.17	0.1	0.8	0			
Hazel		95	1.9	9	1.7	1.4	11	0.3	0	0.1	0	0.8	0			
Peanuts	30	171	7.3	14.7	2.6	2.2	18	0.6	0	0.27	0.03	6.4	0	132	204	
Walnuts	25	131	2.7	12.9	1.3	1.2	15	0.6	0	0.08	0.03	0.8	0	5.75	172	
		920	25.8	84.1	18.9	9.8	163	4.6	4	0.97	0.38	11	0	139.55	776	0.5
Crisps	**30**	**160**	**1.9**	**10.8**	**14.8**	**3.1**	**11**	**0.6**	**0**	**0.06**	**0.02**	**1.8**	**5**	**165**	**357**	**8**
Sweets/chos		**236**	**2.02**	**5.8**	**47**	**0**	**62.87**	**1.68**	**1.1**	**0.01**	**0.03**	**0.34**	**0**	**78.75**	**117**	**16.85**
boiled sweets	100	327	0	0	87.3	0	5	0.4	0	0	0	0	0	25	8	
fruit gums	30	52	0.3	0	13.4	0	108	1.3	0	0	0	0	0	19.2	108	
fruit pastilles	40	101	2.1	0	24.8	0	16	0.6	0	0	0	0	0	30.8	15	
liq allsorts	100	313	3.9	2.2	74	0	63	8.1	0	0	0	0.7	0	75	220	
pepper,ints	30	118	0.2	0.2	30	0	2	0.1	0	0	0	0	0	2.7	0	
Toffee	100	430	2.1	17.2	71	0	95	1.5	0	0	0	0.4	0	320	210	
Mars	65	287	3.4	12.3	43.2	0	104	0.7	5	0.03	0.13	0.8	0	97.5	162	20
choc bar milk	50	265	4.2	15.2	29.7	0	110	0.8	4	0.05	0.12	0.8	0	60	220	13.7
Total		1893	16.2	47.1	373.4	0	503	13.5	9	0.08	0.25	2.7	0	630.2	943	33.7
Pasta/rice		**146.3**	**3.8**	**0.6**	**33.2**	**2.5**	**9.3**	**0.5**	**0**	**0.04**	**0.02**	**1.46**	**0**	**210**	**99**	**16**
Pasta	150	156	5.4	1.1	33.3	2.7	11	0.8	0	0.02	0.02	1.8	0	3	75	15
Rice	165	203	3.6	0.5	48.8	1.3	2	0.3	0	0.02	0.02	1.3	0	3.3	61	24
Noodles	125	80	2.4	0.5	17.6	3.5	15	0.4	0	0.09	0.01	1.3	0	625	162.5	10
Total		439	11.4	2.1	99.7	7.5	28	1.5	0	0.13	0.05	4.4	0	631.3	298.5	49
Breakfastcereal		**130.4**	**3.51**	**1.21**	**28.1**	**2.9**	**25.57**	**2.56**	**6.42**	**0.32**	**0.48**	**5.5**	**0**	**396**	**150**	**18.28**
Allbran	45	113	6.8	1.5	19.4	13.5	31	5.4	0	0.45	0.68	8.6	0	751	481	7.98
Cocopops	35	135	1.9	0.5	32.9	0.4	12	2.3	0	0.35	0.53	6	0	290		24.6
Cornflakes	25	89	2	0.2	21.2	0.9	4	1.7	0	0.25	0.38	4.2	0	290	24	17

Frosties	45	172	2.4	0.2	42.9	0.5	5	3	0	0.45	0.68	7.5	0			23
Porridge	45	133	5.1	5	18.1	1.3	106	0.8	45	0.13	0.14	1.4	0	261	189	10.4
Ricecrispies	35	129	2.1	0.3	31.4	0.4	7	2.3	0	0.35	0.53	6.1	0	388	56	25
Weetabix	40	142	4.3	0.8	31.3	3.4	14	2.4	0	0.28	0.4	4.8	0			21
Total		913	24.6	8.5	197.2	20.4	179	17.9	45	2.26	3.34	38.6	0	1980	750	128.98
Biscuits		**135.5**	**1.85**	**6.5**	**18.5**	**0.82**	**26.2**	**0.47**	**23.75**	**0.04**	**0.02**	**0.72**	**0**	**98.75**	**30.75**	**11.2**
Creamcrackers	21	92	2	3.4	14.3	1.3	23	0.4	0	0.05	0.01	0.8	0	183	36	8.8
Digestivechoc	30	148	2	7.2	20	0.9	25	0.6	0	0.02	0.03	0.8	0	63	25	12.6
Shortbread	35	174	2.1	9.1	22.4	0.8	32	0.5	95	0.05	0.01	0.8	0	94	32	14
Sandwichbourbon	25	128	1.3	6.5	17.3	0.3	25	0.4	0	0.04	0.03	0.5	0	55	30	9.5
Total		542	7.4	26.2	74	3.3	105	1.9	95	0.16	0.08	2.9	0	395	123	44.9
Cakes		**139.2**	**2**	**5.8**	**21.06**	**0.78**	**24.2**	**0.56**	**31.2**	**0.03**	**0.03**	**0.66**	**0**	**111**	**53**	**8.9**
Choc	40	192	2.3	11.9	20.4	1.2	23	0.6	120	0.03	0.04	0.8	0	40	100	7.7
Fruit	60	212	3.1	7.7	34.7	1.5	36	1	0	0.05	0.04	1	0	258	45	10
Madeira	25	98	1.4	4.2	14.6	0.3	11	0.3	0	0.02	0.03	0.4	0	95	30	7.8
Sponge	35	106	1.5	1.7	22.5	0.4	15	0.6	0	0.01	0.02	0.5	0	147	49	10.3
Pancake	30	88	1.7	3.5	13.1	0.5	36	0.3	36	0.04	0.03	0.6	0	15	42	8.7
Total		696	10	29	105.3	3.9	121	2.8	156	0.15	0.16	3.3	0	555	266	44.5
Puddings		**164.4**	**3.05**	**6.8**	**24.4**	**1.07**	**65.4**	**0.55**	**69**	**0.05**	**0.08**	**1.04**	**4.14**	**146**	**129**	**8.8**
Breadbutter	130	208	8.1	10.1	22.8	0.3	169	0.9	143	0.09	0.27	2.5	1	195	270	
sponge pudding	95	316	4.8	13.7	46.3	1	72	1	143	0.08	0.08	1.6	0	294	83	11.5
stewedapple sugar	120	79	0.4	0	20.8	2	4	0.2	5	0.04	0.02	0.1	13	2.4	112	
Fruitpie	120	223	2.4	9.5	34.4	2.5	58	0.6	56	0.06	0.02	1.1	6	252	144	
Fruit flans	60	94	1.1	3.5	15.4	0.6	18	0.4	44	0.05	0.02	0.6	8			
Jamtart	35	129	1.2	4.6	22.2	0.9	25	0.6	20	0.02	0.01	0.4	0	80	38	9.75
custard	75	102	3.4	6.2	8.9	0.2	112	0.2	72	0.04	0.15	1	1	57	127	5
Total		1151	21.4	47.6	170.8	7.5	458	3.9	483	0.38	0.57	7.3	29	880.4	774	26.25
Yog		**89.57**	**3.12**	**2.18**	**15.77**	**0.06**	**88.28**	**0.28**	**36.57**	**0.11**	**0.21**	**1.61**	**0.85**	**47**	**140**	**10**
Vanillaicecream	75	146	2.7	7.4	18.3	0	98	0.1	111	0.03	0.19	0.7	1	60	135	10.9
Yogfruitlowcal	150	135	6.2	1.1	26.9	0	225	0.2	17	0.08	0.32	1.7	2	96	330	7.2

Cocoa milk	3	9	1.9	0	0.1	0	2	0.7	0	0.46	0.37	4.3	0	28.5	45	
Ovaltine	15	54	1.4	0.4	11.9	0	12	0.3	94	0.15	0.2	2.6	0	22.5	127	
Instant desserts	90	85	2.8	4	13.4	0.2	90	0.1	0	0.03	0.14	0.7	1			
milk jelly	135	107	3.5	0.9	22.7	0	80	0.5	14	0.03	0.11	0.4	1	36.45	89.1	
rice pudding	85	91	3.4	1.5	17.1	0.2	111	0.1	20	0.03	0.14	0.9	1	42.5	119	10.9
Total		627	21.9	15.3	110.4	0.4	618	2	256	0.81	1.47	11.3	6	285.95	845.1	29
Squash/colas		**63**	**0**	**0**	**17**	**0**	**6**	**4.5**	**0**	**0**	**0**	**0**	**0**	**12.5**	**4.5**	**9.9**
Cola	200	78	0	0	21	0	8	0	0	0	0	0	0	16	2	11.1
Orange squash	45	48	0	0	12.8	0	4	9	0	0	0	0	0	9	7	8.7
Total		126	0	0	33.8	0	12	9	0	0	0	0	0	25	9	19.8
Pure fruit juice		**89**	**1.2**	**0**	**22.5**	**0**	**18**	**0.6**	**8**	**0.11**	**0.03**	**0.6**	**60**	**5**	**230**	**11.05**
Grapefruit	200	76	1	0	19.4	0	18	0.6	0	0.08	0.02	0.6	58	4	220	9.3
Orange	200	102	1.4	0	25.6	0	18	0.6	16	0.14	0.04	0.6	62	6	240	12.8
		178	2.4	0	45	0	36	1.2	16	0.22	0.06	1.2	120	10	460	22.1
Jam etc		**27**	**0.03**	**0**	**7.16**	**0.07**	**2.3**	**0.1**	**0.33**	**0**	**0**	**0**	**0.66**	**1.5**	**6.83**	**3.17**
Jam	10	26	0.1	0	6.9	0.1	2	0.2	0	0	0	0	1	1.6	11	3.5
Marmalade	10	26	0	0	7	0.1	4	0.1	1	0	0	0	1	1.8	4.4	3.36
Honey	10	29	0	0	7.6	0	1	0	0	0	0.01	0	0	1.1	5.1	2.66
Total		81	0.1	0	21.5	0.2	7	0.3	1	0	0.01	0	2	4.5	20.5	9.52
Cheese		**90.6**	**5.96**	**7.36**	**0.06**	**0**	**172**	**0.1**	**78.6**	**0**	**0.09**	**1.4**	**0**	**194.66**	**25.96**	**0**
Cheddar	40	165	10.2	13.8	0	0	288	0.1	145	0.01	0.16	2.4	0	244	48	0
processed cheese	20	66	4.2	5.4	0.2	0	120	0.1	57	0.01	0.06	1	0	272	16.4	0
Parmesan	9	41	3.5	2.9	0	0	108	0.1	34	0	0.04	0.8	0	68	13.5	0
Total		272	17.9	22.1	0.2	0	516	0.3	236	0.02	0.26	4.2	0	584	77.9	0
Eggs		**97.5**	**7.8**	**7.4**	**0**	**0**	**36.5**	**1.2**	**121.5**	**0.04**	**0.2**	**2.35**	**0**	**108**	**96**	**0**
Boiled	60													84	84	0
Fried	60													132	108	0
														216	192	0

Cream		**119**	**0.7**	**12.4**	**1.1**	**0**	**24**	**0**	**187**	**0.01**	**0.06**	**0.2**	**0**	**12**	**34.8**	**0.1**
Doub sing whipping	35													12	34.8	0.1
Fish		**215.2**	**20.15**	**13.37**	**3.85**	**0.17**	**63**	**0.95**	**26**	**0.1**	**0.14**	**9.97**	**0**	**350.75**	**300**	**0.05**
Cod battered	85	169	16.7	8.8	6.4	0.3	68	0.4	0	0.06	0.06	4.6	0	85	314	0.1
Plaice	120	239	18.9	14.4	9	0.4	70	0.8	0	0.24	0.19	6.6	0	264	276	0.1
Salmon canned	115	178	23.3	9.4	0	0	107	1.6	104	0.05	0.21	12.4	0	655	345	0
Tuna	95	275	21.7	20.9	0	0	7	1	0	0.04	0.1	16.3	0	399	266	0
Total		861	80.6	53.5	15.4	0.7	252	3.8	104	0.39	0.56	39.9	0	1403	1201	0.2
Poultry		**143.5**	**23.8**	**5.3**	**0**	**0**	**8**	**0.65**	**0**	**0.06**	**0.15**	**12.35**	**0**	**58.5**	**263**	**0**
Chicken	85	160	23.6	7.2	0	0	9	0.7	0	0.07	0.16	12.3	0	69	263	0
Turkey	85	127	24	3.4	0	0	7	0.6	0	0.06	0.15	12.4	0	48	263	0
Total		287	47.6	10.6	0	0	16	1.3	0	0.13	0.31	24.7	0	117	526	0
Sausages		**339.6**	**13.5**	**23**	**20.6**	**0.79**	**47.7**	**1.9**	**19**	**0.14**	**0.17**	**5.56**	**0**	**861**	**195**	**10.8**
Sausages/pork/beef	90	262.5	11.9	18.8	12	0.5	57	1.5	0	0	0.13	6.75	0	945	180	3.36
Chopped/ham/pork	60	162	8.6	14.2	0	0	8	0.7	0	0.11	0.13	3.5	0	570	84	0
Corned/beef	60	130	16.1	7.3	0	0	8	1.7	0	0	0.14	5.4	0	654	138	0
Ham	55	66	10.1	2.8	0	0	5	0.7	0	0.29	0.14	3.8	0	687	155	
Luncheon/meat	70	219	8.8	18.8	3.9	0.1	11	0.8	0	0.05	0.08	3.2	0	735	98	
Porkpie	150	564	14.7	40.5	37.4	1.4	71	2.1	0	0.24	0.14	5.9	0	1080	225	20.65
Steak/kid/pie	140	466	18.1	30.3	32.4	1.25	69.5	4	152.5	0.2	0.5	7.55	0	714	196	20.65
Pasties/cornish	255	847	20.4	52	79.3	3.1	153	3.8	0	0.26	0.15	8.4	0	1504	484	20.65
		2717	108.7	184.7	165	6.35	382.5	15.3	152.5	1.15	1.41	44.5	0	6889	1560	65.31
Red meat		**237.8**	**23.28**	**16.06**	**0**	**0**	**7.6**	**1.8**	**0**	**0.28**	**0.22**	**9.57**	**0**	**356.1**	**289**	**0**
Beef topside lean fat	85	182	22.6	10.2	0	0	5	2.2	0	0.06	0.26	9.7	0	40	297	0
Beef steak lean fat	155	338	42.3	18.8	0	0	11	5.3	0	0.14	0.56	19.4	0	79	494	0
Pork chop lean	135	180	25.8	8.5	0	0	7	0.9	0	0.7	0.2	10.9	0	67.5	337	0
Pork joint lean fat	85	243	22.9	16.8	0	0	9	1.1	0	0.55	0.23	8.5	0	67	297	0
Lamb loin chops lean fat	160	443	29.3	36.2	0	0	11	2.4	0	0.14	0.26	12.6	0	89	400	0
Lamb leg lean fat	85	226	22.2	15.2	0	0	7	2.1	0	0.1	0.26	9.4	0	56	263	0
Gammon lean fat	85	229	21	16	0	0	8	1.1	0	0.37	0.13	6.8	0	1003	263	0

Bacon rashers	45	131	13.7	8.5	0	0	6	0.7	0	0.27	0.1	5.4	0	1008	130	0
Bacon streaky	45	169	9.8	14.4	0	0	5	0.6	0	0.16	0.06	3.5	0	796	120	0
Total		2141	209.6	144.6	0	0	69	16.4	0	2.49	2.06	86.2	0	3205.5	2601	0
white 2 slice g)		176	6.3	1.4	37	2.9	83	1.2	0	0.16	0.05	2.6	0			
white slice divide by 2	**35**	**88**	**3.15**	**0.7**	**18.5**	**1.45**	**41.5**	**0.6**	**0**	**0.08**	**0.02**	**1.3**	**0**	**189**	**35**	**12.6**
white bap		147	5.1	2.3	28.4	2.1	66	1.2	0	0.15	0.02	2.1	0			
brown 2 slice		153	6	1.4	31	4.1	70	1.5	0	0.19	0.06	2.9	0			
Brown slice divide by 2	**35**	**76.5**	**3**	**0.7**	**15.5**	**2.05**	**35**	**0.75**	**0**	**0.1**	**0.03**	**1.45**	**0**	**192**	**73**	**10**
brown bap		147	5.5	2.1	28.5	3.5	61	1.9	0	0.23	0.04	3	0			
wholemeal 2 slice		151	6.4	1.8	29.1	5.2	38	1.9	0	0.24	0.06	4.1	0			
wholemeal slice divide by 2	**35**	**75.5**	**3.2**	**0.9**	**14.55**	**2.6**	**19**	**0.95**	**0**	**0.12**	**0.03**	**2.05**	**0**	**189**	**77**	**7.5**
wholemeal bap		133	5	1.6	26.6	4.8	30	1.9	0	0.17	0.05	3.2	0			
Crispbread	**8.5**	**26**	**0.7**	**0.16**	**5.6**	**0.93**	**3.6**	**0.24**	**0**	**0.02**	**0.01**	**0.23**	**0**	**17**	**40**	**3.86**
pitta white		**172**	**6**	**0.8**	**37.6**	**2.5**	**59**	**1.1**	**0**	**0.16**	**0.03**	**2.1**	**0**			
pitta wholemeal		**159**	**5.5**	**0.7**	**34.8**	**5.9**	**31**	**1.8**	**0**	**0.16**	**0.03**	**2.1**	**0**			
chapatis with fat		230	5.7	9	33.8	4.9	46	1.6	0	0.18	0.03	2.4	0			
chapatis without fat		141	5.1	0.7	30.6	4.5	42	1.5	0	0.16	0.03	2.1	0			
Naan		571	15.1	21.3	85.2	3.7	272	2.2	165	0.32	0.17	5.1	0			
		942	25.9	31	149.6	13.1	360	5.3	165	0.66	0.23	9.6	0			
Chapsnaan/3		**314**	**8.63**	**10.3**	**49.86**	**4.36**	**120**	**1.76**	**55**	**0.22**	**0.08**	**3.2**	**0**			
tea cup......................h)	**3**	**0**	**0.2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.02**	**0.2**	**0**	**1.35**	**64.8**	**0**
																0.1
coffee cup...................i)	**2**	**3**	**0.4**	**0**	**0.4**	**0.1**	**3**	**0.1**	**0**	**0**	**0.02**	**1**	**0**	**1.15**	**90**	
sugar teaspoon	**5**	**20**	**0**	**0**	**5.3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3.6**

Silvertop (whole) a)	**585**	**387**	**18.6**	**22.8**	**28.2**	**0**	**672**	**0.3**	**327**	**0.18**	**0.99**	**4.8**	**6**	**292**	**877**	**9.58**
Gold (Channel Islands)	**585**	**456**	**21.06**	**29.82**	**28.1**	**0**	**759**	**0.29**	**269.1**	**0.23**	**1.11**	**0.57**	**5.85**	**292**	**818**	**10**
semi and skimmed (ave)	**585**	**231**	**19.2**	**4.95**	**29.4**	**0**	**702**	**0.3**	**72**	**0.24**	**1.02**	**5.1**	**6**	**292**	**818**	**10**
evaporated (half whole)		**23**	**1.3**	**1.4**	**1.3**	**0**	**44**	**0.05**	**17**	**0.01**	**0.06**	**0.35**	**0**			
15g Divide by 2 then x cups															
powdered (semi/unskim)	**585**	**231**	**19.2**	**4.95**	**29.4**	**0**	**702**	**0.3**	**72**	**0.24**	**1.02**	**5.1**	**6**	**292**	**818**	**10**
9reconsituted															
unpasteurized (whole)	**585**	**387**	**18.6**	**22.8**	**28.2**	**0**	**672**	**0.3**	**327**	**0.18**	**0.99**	**4.8**	**6**	**292**	**877**	**10**
Soya	**585**	**186**	**17.1**	**11.1**	**4.8**	**0**	**75**	**2.4**	**0**	**0.36**	**1.59**	**3.6**	**0**	**0.3**	**403**	**2.1**
condensed		**40**	**1.5**	**0.03**	**9**	**0**	**49.7**	**0.03**	**4.7**	**0.02**	**0.08**	**0.4**	**0.7**			
One cup of condensed =one cup evaporated plus 1.5 cups of sugar															
Goat	**585**	**351**	**18**	**20.4**	**25.8**	**0**	**585**	**0.6**	**258**	**0.24**	**0.75**	**6**	**6**	**233**	**1052**	**8**
semi-skimmed		90	6.4	3.1	9.8	0	234	0.1	45	0.08	0.35	1.7	2			
skimmed (third of pint)		64	6.4	0.2	9.8	0	234	0.1	2	0.08	0.33	1.7	2			
Total		154	12.8	3.3	19.6	0	468	0.2	47	0.16	0.68	3.4	4			
Ave		77	6.4	1.65	9.8	0	234	0.1	24	0.08	0.34	1.7	2			
times 3		231	19.2	4.95	29.4	0	702	0.3	72	0.24	1.02	5.1	6			
butter med. Layer b)	**8**	**59**	**0**	**6.5**	**0**	**0**	**1**	**0**	**71**	**0**	**0**	**0**	**0**	**69**	**1.2**	**0**
margarine med. Layer c)	**8**	**59**	**0**	**6.5**	**0.1**	**0**	**0**	**0**	**72**	**0**	**0**	**0**	**0**	**64**	**0.25**	**0**
beef dripping med d)	**8**	**71.2**	**0**	**7.92**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.04**	**0.32**	**0**
Low fat spread............e)	**8**	**31**	**0.5**	**3.2**	**0**	**0**	**3**	**0**	**87**	**0**	**0**	**0.1**	**0**	**55.2**	**0**	**0**

Beer unit..................f)	**unit**	**86.06**	**0.75**	**0**	**7.08**	**0**	**20.86**	**0.07**	**0**	**0**	**0.07**	**1.31**	**0**	**29.15**	**92**	**0**
bitter draught pint		182	1.7	0	13.1	0	62	0.1	0	0	0.23	3.4	0			
mild draught pint		142	1.1	0	9.1	0	57	0.1	0	0	0.17	2.3	0			
keg bitter pint		176	1.7	0	13.1	0	45	0.1	0	0	0.17	2.6	0			
Total		500	4.5	0	35.3	0	164	0.3	0	0	0.57	8.3	0			
		166.6	1.5	0	11.8	0	54.66	0.1	0	0	0.19	2.76	0			
Divided by half																
to get unit		83.3	0.75	0	5.9	0	27.3	0.05	0	0	0.09	1.38	0			
brown ale bottle		77	0.8	0	8.3	0	19	0.1	0	0	0.06	1.1	0			
lager bottle		80	0.6	0	4.1	0	11	0	0	0	0.06	1.5	0			
pale ale bottle		88	0.8	0	5.5	0	25	0.1	0	0	0.06	1.4	0			
stout bottle		102	0.8	0	11.6	0	22	0.1	0	0	0.08	1.2	0			
Total		430.3	3.75	0	35.4	0	104.3	0.35	0	0	0.35	6.58	0			
Divide by 5		86.06	0.75	0	7.08	0	20.86	0.07	0	0	0.07	1.31	0			
wine unit	**unit**	**85.6**	**0.18**	**0**	**2.44**	**0**	**10.2**	**0.8**	**0**	**0**	**0.01**	**0.1**	**0**	**10.6**	**98**	**0**
Red		78	0.2	0	0.3	0	8	1	0	0	0.02	0.1	0			
Rose		81	0.1	0	2.9	0	14	1.1	0	0	0.01	0.1	0			
white dry		75	0.1	0	0.7	0	10	0.6	0	0	0.01	0.1	0			
white sparkling		87	0.3	0	1.6	0	3	0.6	0	0	0.01	0.1	0			
white sweet		107	0.2	0	6.7	0	16	0.7	0	0	0.01	0.1	0			
Total		428	0.9	0	12.2	0	51	4	0	0	0.06	0.5	0			
spirits unit	**unit**	**55**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Portion	**Kcal**	**Protein**	**Fat**	**Carb**	**Fib**	**Ca**	**Fe**	**A**	**B1**	**B2**	**B3**	**C**	**Na**	**K**	**GL**

Source: The Composition of Foods. (McCance and Widdowson's) AA Paul and DAT Southgate, 1985, Her Majesty's Stationery Office, London.
Estimate of portions derived from 'Nutrient Content of Food Portions', J. Davies & J. Dickerson

a) Milk:

For milk:

44. How much milk do you usually have each day? (Please include milk used in drinks, in cereal and in cooking, e.g. custard, milk puddings)

was transformed as follows: None= 0, Less than ½ pint=.25, ½ pint-1 pint= .75, Over 1, to 2 pints=1.5, More than 2 pints= 3.

When assessing individual nutrient intake and as specific preference types were recorded, new variables were created for: whole, Channel Island, semi/unskimmed and evaporated milk. Powdered milk (low fat) was included in the skimmed/semi-skimmed category and the unpasteurized farm milk under whole milk. It was decided to leave out evaporated milk as it was difficult to calculate how much was used customarily on puddings. Each of the above categories was multiplied by daily consumption.

b) Butter:

A new variable was created derived from the Question 40a, "Do you usually spread soft margarine, hard margarine or butter on bread?" We recoded the ISPREADO values (pg. 68) into butter as follows: None=0, Butter=1, Hard margarine=0, Ordinary soft margarine=0, Other e.g. Dripping=0, Soft margarine with high polysaturates=0, Low fat spreads=0. Daily consumption was then multiplied by seven to obtain a weekly sum.

c) Margarine:

A new variable was created derived from the Question 40a, "Do you usually spread soft margarine, hard margarine or butter on bread?". We recoded the ISPREADO values into butter as follows: None=0, Butter=0, Hard margarine=1, Ordinary soft margarine=1, Other e.g. Dripping=0, Soft margarine high polysaturates=1, Low fat spread=1. Daily consumption was then multiplied by seven to obtain a weekly sum.

d) Dripping:

A new variable was created derived from the Question 40a, "Do you usually spread soft margarine, hard margarine or butter on bread?". We recoded the ISPREADO values into butter as follows: None=0, Butter=0, Hard margarine=0, Ordinary soft margarine=0, Other Dripping=1, Soft margarine high polysaturates=0, Low fat spread=0. Daily consumption was then multiplied by seven to obtain a weekly sum.

e) Low Fat Spread:

A new variable was created derived from the Question 40a, "Do you usually spread soft margarine, hard margarine or butter on bread?". We recoded the ISPREADO values into low fat spread as follows: None=0, Butter=0, Hard margarine=0, Ordinary soft margarine=0, Other e.g. Dripping=0, Soft margarine high polysaturates=0, Low fat spread=1. Daily consumption was then multiplied by seven to obtain a weekly sum.

f) Alcohol:

Three separate variables were created for spirits, beer and wine by recoding "**altype**'. Where participant did not specifically state the type of alcohol but indicated varied alcohol, one unit was divided between spirits, beer and wine showing as .33 in the column. Otherwise weekly alcohol consumption was calculated by multiplying alcohol type by number of weekly units. Thus we derived the new variables weekly spirits, beer and wine units.

g) Bread:

A value for bread consumption was created by combining the responses of two questions:

39 (a) How many slices of bread or crisp bread do you usually eat each day, including toast and sandwiches?

(Respondents choose number of slices between 0-98) and

39 (b) In addition, how many rolls or similar types of bread do you usually eat each day?

(Respondents chose number of rolls between 0-98.) Thus, one slice of bread =1 and one roll, which contained slightly more bread =1.5.

When assessing individual nutrient intake and as specific bread preference types were recorded (question 38), we produced a value for different bread varieties by recoding for: white bread, brown bread, wholemeal bread, crispbreads, white pitta, wholemeal pitta and chapatis/naans. In the end, we decided to drop white and wholemeal pitta, chapatis/naans as there was some confusion regarding proper categorization. Sometimes they were noted as rolls and sometimes slices. As these foods are eaten for the most part by ethnics, and we had already excluded the ethnic population from our analysis, those left over amounted to 29 people, a negligible number.

The number of rolls was multiplied by 1.5 as they are slightly bigger in volume compared to slices) Daily consumption was then multiplied by seven to obtain a weekly sum.

h) Tea:

A new variable was created for tea (defined as cups) in response to question:

42. How many cups of tea do you usually drink in a day?

We re-coded the following answers: None=0, one or two cups=1.5, three or four cups= 3.5, five or six cups=5.5 and more than six cups=7.

i) Coffee:

A transformation was carried out for coffee. In response to question:

43: How many cups of coffee do you usually drink in a day?

The following answers were re-coded: None=0, one or two cups=1.5, three or four cups= 3.5, five or six cups=5.5 and more than six cups=7.

Appendix B

Food Composition Table Summary by Dietary Pattern

	Portions	Kcal	Protein	Fat	Carb	Fibre	Cal	Fe	Vit A	B1	B2	B3	C	Na	K	GL
fruits summer		42.8	0.7	0.05	10.6	2.75	24.17	0.48	10.5	0.05	0.03	0.43	30.67	3.43	272	4.98
fruits winter		53	0.7	0.07	13.37	2.5	23.5	0.35	12.25	0.07	0.04	0.42	26.5	3.9	314	5.52
salads summer		9.3	0.63	0.03	1.7	0.86	11.3	0.33	66.66	0.04	0.03	0.47	12.33	3.92	186	0.6
salads winter		9.3	0.63	0.03	1.7	0.86	11.3	0.33	66.66	0.04	0.03	0.47	12.33	3.92	186	0.6
Average for' Fruits and salads'		28.6	0.66	0.045	6.84	1.743	17.57	0.37	39.02	0.05	0.03	0.448	**20.46**	3.793	239.5	2.92
potatoes		175	2.76	4.96	31.9	0.93	13	0.63	0	0.13	0.06	2.06	13.6	19	875	20.4
rootveg		32	1	0	7.4	2.4	38	0.43	433	0.05	0.05	0.8	11.33	72	216	5.32
pulses		64.4	5.22	0.5	10.42	6.24	43.4	1.66	29	0.07	0.06	1.72	4.6	228	275	4.58
greenveg		21	3.5	0.2	1.36	4.2	297.3	2.2	578	0.06	0.14	1.23	25.3	56	309.5	0.1
otherveg		127	0.95	12.8	2	1.8	13	0.45	0	0.02	0.1	1.2	0.5	7.02	210.5	0.05
Average for 'Potatoes and vegetables'		83.88	2.68	3.69	10.62	***3.11***	***80.94***	***1.074***	***208***	0.066	0.082	1.402	***11.07***	76.404	377.2	6.09
Sweets chos		236	2.02	5.8	47	0	62.87	1.68	1.1	0.01	0.03	0.34	0	78.75	117	16.85
biscuits		135.5	1.85	6.5	18.5	0.82	26.2	0.47	23.75	0.04	0.02	0.72	0	98.75	30.75	11.2
cakes		139.2	2	5.8	21.06	0.78	24.2	0.56	31.2	0.03	0.03	0.66	0	111	53	8.9
puddings		164.4	3.05	6.8	24.4	1.07	65.4	0.55	69	0.05	0.08	1.04	4.14	146	129	8.8
Average for' Sweet refined foods'		168.77	2.23	6.225	27.74	0.66	44.67	0.81	31.26	0.032	0.04	0.69	1.03	108.63	82.438	***11.43***
chips fries	265	670	10.1	28.9	98.8	0	37	2.4	0	0.27	0.11	5.6	27	31.8	2703	21
crisps	30	160	1.9	10.8	14.8	3.1	11	0.6	0	0.06	0.02	1.8	5	165	357	8
sausages		339.6	13.5	23	20.6	0.79	47.7	1.9	19	0.14	0.17	5.56	0	861	195	10.8
squashcolas		63	0	0	17	0	6	4.5	0	0	0	0	0	12.5	4.5	9.9
Average for'Chips crisps squash/colas sausage'		***308.15***	6.375	***15.675***	***37.8***	0.9725	25.425	***2.35***	4.75	0.1175	0.07	3.24	8	***267.58***	***814.88***	12.425
tea cup	3	0	0.2	0	0	0	0	0	0	0	0.02	0.2	0	1.35	64.8	0
																0.1
coffee cup	2	3	0.4	0	0.4	0.1	3	0.1	0	0	0.02	1	0	1.15	90	
Average for' tea & coffee'		3	0.4	0	0.4	0.1	3	0.1	0	0	0.02	1	0	1.15	90	0.05

cheese		90.6	5.96	7.36	0.06	0	172	0.1	78.6	0	0.09	1.4	0	194.66	25.96	0
eggs		97.5	7.8	7.4	0	0	36.5	1.2	121.5	0.04	0.2	2.35	0	108	96	0
white slice divide by 2	35	88	3.15	0.7	18.5	1.45	41.5	0.6	0	0.08	0.02	1.3	0	189	35	12.6
brown slice divide by 2	35	76.5	3	0.7	15.5	2.05	35	0.75	0	0.1	0.03	1.45	0	192	73	10
brown slice divide by 2	35	76.5	3	0.7	15.5	2.05	35	0.75	0	0.1	0.03	1.45	0	192	73	10
crispbread	8.5	26	0.7	0.16	5.6	0.93	3.6	0.24	0	0.02	0.01	0.23	0	17	40	3.86
Average for 'Cheese eggs bread'		75.85	3.935	2.8367	9.20	1.08	53.933	0.6067	33.35	0.0567	0.0633	1.3633	0	148.78	57.16	6.07
yog		89.57	3.12	2.18	15.77	0.06	88.28	0.28	36.57	0.11	0.21	1.61	0.85	47	140	10
cream		119	0.7	12.4	1.1	0	24	0	187	0.01	0.06	0.2	0	12	34.8	0.1
redmeat		237.8	23.28	16.06	0	0	7.6	1.8	0	0.28	0.22	9.57	0	356.1	289	0
Average for 'Yoghurt cream red meat'		148.79	9.03	10.213	5.62	0.02	39.96	0.6933	74.523	***0.133***	***0.163***	***3.793***	0.2833	138.37	154.6	3.366
nuts		153.3	4.3	14.02	3.15	1.63	27.17	0.77	0.67	0.16	0.06	1.83	0	34	194	0.5
pasta rice		146.3	3.8	0.6	33.2	2.5	9.3	0.5	0	0.04	0.02	1.46	0	210	99	16
Average for 'Nuts pasta rice'		149.8	4.05	7.31	18.17	***2.065***	18.235	0.635	0.335	0.1	0.04	1.645	0	122	146.5	8.25
fish		215.2	20.15	13.37	3.85	0.17	63	0.95	26	0.1	0.14	9.97	0	350.75	300	0.05
poultry		143.5	23.8	5.3	0	0	8	0.65	0	0.06	0.15	12.35	0	58.5	263	0
Average for 'Fish & poultry'		179.35	***21.975***	9.335	1.92	0.085	35.5	0.8	13	0.08	0.145	11.16	0	204.63	281.5	0.025
breakfastcereal		130.4	3.51	1.21	28.1	2.9	25.57	2.56	6.42	0.32	0.48	5.5	0	396	150	18.28
Silvertop (whole)	585	387	18.6	22.8	28.2	0	672	0.3	327	0.18	0.99	4.8	6	292	877	9.58
Gold (Channel Islands)	585	456	21.06	29.82	28.1	0	759	0.29	269.1	0.23	1.11	0.57	5.85	292	818	10
semi and skimmed (ave)	585	231	19.2	4.95	29.4	0	702	0.3	72	0.24	1.02	5.1	6	292	818	10
Average for 'Cereal & milk'		***301.1***	***15.59***	***14.69***	***28.45***	0.725	***539.64***	0.8625	***168.63***	***0.242***	***0.9***	***3.992***	4.4625	***318***	***665.75***	***11.96***

* Figures in ***BOLD ITALICS*** represent the highest average macro-and micro-nutrient content in each food group, eg. 'Chips, crisps, squash/colas sausage' and 'Cereal and milk' contain the highest fat amounts compared to other food groups.

APPENDIX C

Table 1: Weekly average nutrient totals by gender derived from Food Composition Table in Appendix A

	Male	Female
Total Kcal	17989; (5432)	13816; (3646)
Total Protein (g)	544; (145)	465; (111)
Total Fat (g)	730; (247)	581; (177)
Total Carb (g)	2250; (727)	1738; (505)
Total Fibre (g)	397; (179)	286; (93)
Total Calcium (mg)	8141; (2852)	6980; (2182)
Total Iron (mg)	105; (31)	94; (26)
Total Vitamin A (mg)	9255; (3055)	8226; (2570)
Total Vitamin B1 (mg)	10; (2.9)	8.9; (2.3)
Total Vitamin B2 (mg)	13.7; (4.5)	12; (3.65)
Total Vitamin B3 (mg)	266; (65.9)	226; (52)
Total Vitamin C (mg)	757; (346)	872; (386)
Total Sodium (mg)	19348; (6523)	14952; (4412)
Total Potassium (mg)	31852; (8144)	28795; (6594)
Total GL	1152; (411)	887; (280)