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Consumer Response to Computerised Nutritional Information at the Point-of-Purchase in Catering Establishments

by

Donna S. Balfour

A thesis submitted in partial fulfilment of the requirements of The Robert Gordon University for the Degree of Doctor of Philosophy

Copyright

To my Parents

and for

Robert, Grant and Lesley

for their support.

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Abstract

Increased scientific understanding of the links between nutrition and health has led to a demand for more nutrition information to be made available to consumers. Nutrition information is widely available on supermarket products but is rarely found in catering establishments. This research involved the provision of nutrition information in canteens and restaurants and studied the effect on consumer meal choices.

A study was designed to find the optimum visual method of displaying nutrition information. Eight nutritional formats were systematically tested on customers in a shopping centre food court. Graphical formats displaying nutrition information in relation to current dietary advice relayed the nutrition information significantly quicker than, and as accurately as, tabular displays.

A database system was developed to provide nutrition information on menu items making up a selected meal. A program suite was designed to enable the creation of recipes and menus. The nutritional breakdown of a selected meal was displayed to the customer who was then given the opportunity to change their meal before that meal was acquired. All initial choices and subsequent changes were recorded for analysis.

Surveys carried out in two canteen locations (n=694) revealed that a significant percentage of customers (16%) did make changes to their meal after viewing the nutritional information on their first choice. Those who did not change were, on average, making "healthy" choices of meal. Those who did change made second choices which were, on average, significantly lower in energy, saturated fatty acids and non-milk extrinsic sugars than their first selections. Overall "healthier" choices were made with the second selection which did not differ significantly from the nutritional content of the meals chosen by those respondents who had not wished to change.

Further research is necessary to determine whether the intention to change a selected meal as demonstrated by this research would be carried through by the respondents to the actual food selection.

Abbreviations

DRV - Dietary Reference Value

RDA - Recommended Daily Amount

RDI - Recommended Daily Intake

kcals - kilocalories

NSP - non-starch polysaccharides

SFA - saturated fatty acids

NMES - non-milk extrinsic sugars

PUFA - polyunsaturated fatty acids

Chapter 1

Nutrition Information, its Uses, Influence and Effects on Consumers

Introduction : Diet and Health.

Developments in nutritional science have revealed links between the nutritional content of the foods we eat and our health. In developed countries a high incidence of many diet related diseases are found, for example cardiovascular disease and cancer (Bingham, 1991). Forty percent of deaths in Britain today are due to heart attacks and strokes (Wheelock, 1992). Mortality from coronary heart disease in the UK is amongst the highest in the world (DHSS, 1984). There is an increased risk of death from coronary heart disease with increasing serum cholesterol, a major determinant of this being the diet. Deaths from coronary heart disease are associated with consumption of saturated fatty acids (Keys, 1980).

Overweight men and women are more at risk from a number of diseases. A study by the American Cancer Society (Lew & Garfunkel, 1979) found that those who were 30 to 40 percent heavier than the average suffered a 50 percent higher mortality rate. Diabetes and diseases of the digestive tract were also found to be much higher in overweight men and women. Obesity is a major problem in the UK also, this again being attributed to poor dietary habits (Royal College of Physicians, 1983).

Scotland is often seen as having one of the unhealthiest diets in the Western world which goes a long way in explaining why Scotland has such a high mortality rate from Coronary Heart Disease (CHD) and Cancer, these being the two principal causes of premature death in Scotland (Scottish Office, 1993). Scotland has the highest mortality rate from CHD in the world for both men and women (Scottish Office, 1993). In comparison death rates from CHD in southern Mediterranean countries are one third of that in Scotland while China suffers from a CHD mortality rate one tenth of that found in Scotland (Junshi *et al.*, 1990). Overall life

expectancy in Scotland is relatively poor, even by national standards, 71.1 years for males born in 1990 and 76.9 years for females (Scottish Office, 1992), compared to a national figure of 73 for males and 78 for females (Department of Health, 1991a). For all deaths under the age of 65 in Scotland in 1990 a third could be attributed to heart disease, stroke and circulatory diseases, another third to cancers. Scotland has the worst record for deaths from these diseases in both females and males. There has also been a progressive increase in the proportion of overweight adults between the ages of 35 and 55. Over half the middle aged men in Scotland are overweight and just under half of the middle aged women (Scottish Office, 1993).

The average UK household diet in 1992 provided 1860 kcals per adult (MAFF, 1993a). Food energy shortage is not a problem for the vast majority of individuals in the United Kingdom.

On average men consume 42 grams of saturated fatty acids per day and women 31 grams; intakes do not vary greatly with age (Gregory *et al.*, 1990). Total fat intake remained unchanged between 1990 and 1992 but intakes of SFAs fell and PUFAs rose. SFAs contribute an average 16% of total food energy in the United Kingdom diet (MAFF, 1993a).

In 1992 the average diet was estimated to provide 55 grams of non-milk extrinsic sugars per day, derived mainly from sugars added during food processing, table sugar and honey (MAFF, 1993a). This is 11.4% of food energy but excludes sugars in alcohol and confectionery which are all extrinsic. In an earlier survey total sugars were found to contribute to 18% of energy with NMES usually providing anything from 45 to 73% of total sugar intake (Gregory *et al.*, 1990).

The average intake of non-starch polysaccharide in 1990 was 11.2 grams per day in men and 12.5 grams in women (Bingham *et al.*, 1990). Measured over a period of 7 days NSP intake was found to range from 4.6

grams to 24.7 grams per day with the majority of individuals consuming between 7.5 and 15 grams of NSP per day. Recent figures show this to be virtually unchanged with the average intake per person per day being 12 grams (MAFF, 1993a).

An increased awareness of health and nutrition followed the publication of the NACNE (1983) and COMA (1984) reports. After the publication of the COMA report the government finally committed themselves to a health and nutrition policy which would allow consumers to have the means with which to implement dietary recommendations if they so wished. More recently the government published its Green Paper on the "Health of the Nation" (Department of Health, 1992), a consultative document aimed at improving the health of the population in England and Wales. This report built upon a earlier green paper (Department of Health, 1991a) setting targets to be achieved by the years 2000 or 2005 in a number of areas including nutrition and health. Firstly the reduction of saturated fatty acid intake and total fat intake and secondly to lower obesity rates in men and women between the ages 16 and 64 to no more than 6 and 8 percent respectively. The government also undertook to reduce death rates for coronary heart disease and stroke by 40 percent for those under 65. Likewise targets have been set for reductions in mortality due to breast, cervical and lung cancer. A five year strategy by the Department of Health and the Health Education Authority (Health Education Authority, 1992) aims to provide people with the information which will help tackle coronary heart disease. Through this strategy the government has expressed a desire to seek ways of improving information provision on nutritional content of foods and has stated that it will provide nutritional guidelines to catering outlets.

Nutrition labelling is seen as playing an important part in this drive to improve the nations health (CA, MAFF & NCC, 1985). This increased scientific knowledge of nutrition and health links has led to a growing interest in the nutritional content of foodstuffs by many health conscious consumers in the last ten years. Consumers want to know more about the content of the foods they are eating and how this contributes to their diet and how adapting the type of foods they eat can ensure they are eating a healthy, well-balanced diet. Many independent agencies provide literature and advice on how the public can adapt their eating habits and incorporate the appropriate foods to give their diets that healthy balance, and hopefully reduce the risk of many diet-related disorders and diseases. (World Health Organisation, 1982; Health Education Authority, 1992; Health Education Council, 1983).

Consumer Psychology

In order to improve people's diets we must first acknowledge the factors which influence food choice. Foods are not merely chosen due to personal taste, many other influences will be involved in the decision (Anon, 1990).

There is a large number of factors which determine the selection of foods. Sensory attributes such as flavour, texture and the appearance of the food are perhaps the most obvious factors which influence a person's liking for a particular food. Nutritional knowledge and beliefs are other important considerations.

Yudkin (1956) listed the factors which may influence food choice. These he put under three general headings:

Physical	**Social**	**Physiological**
Geography	Religion &	Hereditary
Season	social custom	Allergy
Economics	Social class	Therapeutic diets
Food technology	Education in Nutrition	Acceptability
	Advertising	Nutritional needs

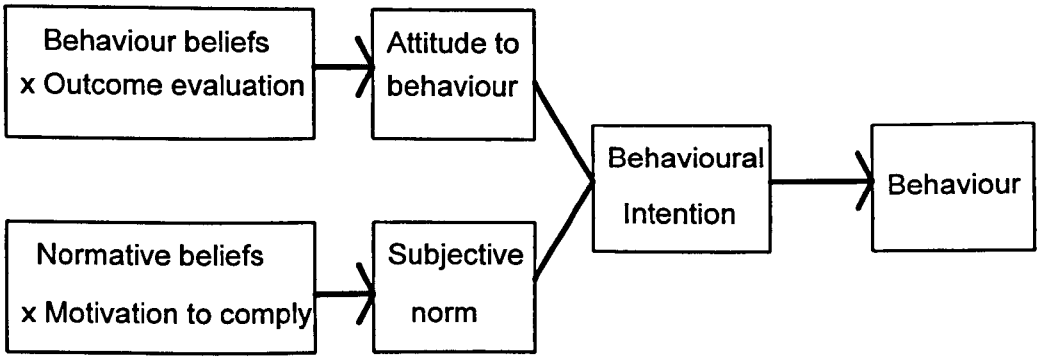
No attempt was made to illustrate how these factors may be related to one another or their relative importance to food choice. This basic model has however provided a basis for subsequent models (Shepherd, 1985; Booth & Shepherd, 1988), which summarise some of the processes influencing and resulting from food acceptance.

Studies have attempted to determine which factors influence dietary choice. Schafer (1978) found husbands rated taste above nutrition as the most important determinant in food choice yet wives put nutrition first.

Shepherd (1988) suggests that nutritional knowledge does relate to attitudes and behaviour but only in the area of general dietary practice and that this relationship breaks down when consumption of specific foods is considered.

Azjen and Fishbein's Theory of Reasoned Action (Azjen & Fishbein, 1980) states that intention is the best predictor of behaviour and that this is influenced by attitudes, including the belief that a behaviour will result in a certain outcome, the evaluation of that outcome, and what the person believes other people will think about his or her actions. Thus behavioural intention is predicted by two factors, attitude to the behaviour and the subjective norm (Figure 1.1).

Figure 1.1 Factors influencing behaviour



Source: Shepherd, (1989).

In some studies the sensory attributes of a food have been found to be more important for food choice (Shepherd & Farleigh, 1986a & 1986b) whereas in studies concerning only single items of food the nutritional beliefs held by the individual were found to be more important than beliefs about sensory attributes (Shepherd & Stockley, 1987).

Nutrition and how it affects food choice can be viewed from different perspectives. Firstly, the chemical properties of the food in regard to the levels of nutrients it contains will have physiological effects following ingestion and may therefore have an influence on subsequent action. Similarly, nutritional knowledge about foods can lead to different food use. Linked to this are nutritional beliefs, that is, what the individual believes that food will or will not provide nutritionally, and whether this is seen as a desirable or an undesirable effect. These variables are all interrelated.

The nutritional beliefs that influence the choice of food may not necessarily be factually correct, but if the person who holds them believes them to be true he or she will act on them accordingly. Knowledge can be distinguished from beliefs in that it is information that comes from specialist quarters, e.g. nutritionists or dietitians. Knowledge is seen as affecting attitudes and beliefs which in turn influence behaviour, therefore a change in behaviour can be brought about through increasing knowledge. Jacoby *et al.* (1974) suggested that consumers do not actively seek nutrition information when making food choices, nor do they comprehend such information once it has been received. Russo (1974) disputes this in his re-evaluation of the Jacoby study, suggesting that consumers both want and benefit from increased information. Baker (1972) had found that there were no significant changes made to the diets of fourth and fifth grade students after they had received training through a nutrition education program. Charney and Lewis (1987) tested nutritional knowledge in relation to attitudes and behaviour. They found that those intending to change their diet for health reasons displayed a greater nutritional knowledge. They concluded that there is an association between healthy behaviour and nutritional knowledge.

The amount of information provided can also be seen to affect the consumers behaviour. Providing the consumer with too much information can have a detrimental effect on this process (Malhorta, 1982). Alternatively, oversimplified information can leave some consumers with feelings of dissatisfaction and a desire for more information (Scammon, 1977). Scammon concludes that any provision of nutrition information would be useless unless it was accompanied by a nutrition education program.

Missing information, that is, what is not presented is similarly important within the decision making process. Johnson & Levin (1985) found that respondents made inferences about the missing information. This in turn influenced any decisions made. The greater the amount of missing information the less favourable was the evaluation made.

The method employed to present information can also have an impact on identification and on response. The use of different formats of labels by consumers and their attitudes towards them were also studied by Lenahan *et al.* (1973). Results showed that consumers had shown a preference for formats displaying information as a percentage of the Recommended Daily Amount.

An increase in knowledge requires the provision of information, but the information has to be presented in an understandable and usable form so that it can be assimilated by the user and acted upon accordingly.

Dietary Reference Values and Choice of Nutrients

In 1969 the Department of Health and Social Security (DHSS, 1969) published its Recommended Intakes for Nutrients, later these were replaced by the Recommended Daily Amounts (DHSS, 1979). However, it has not always been clearly stated as to how these figures were derived. RDIs and RDAs were deliberately set at high levels to ensure they were sufficient for people with very high needs of a nutrient. Most people, however, need considerably less than these levels. Consequently the figures were often wrongly used as targets for individuals to reach and maintain. The figures were originally intended not to assess an individuals diet but for the provision of foods to groups of the population.

In the 1990's the Committee on Medical Aspects of Food Policy (COMA) set up a Panel to update this information and they attempted to overcome the anomalies of the RDA system. The resulting document (Department of Health, 1991b) set out exactly how the figures were derived, what they meant and how they should be used. The panel found no single criterion to define requirements for all nutrients so in the process came up with four complementary sets of figures:

Estimated Average Requirements (EARs) are estimates of the average requirement for food energy or a nutrient. The Panel stressed that some people would need more than the average while others would require less.

Reference Nutrient Intake (RNI) illustrates the amount of nutrient that is sufficient for almost all individuals. Therefore the level is, in general, 30% higher than the average.

Lower Reference Nutrient Intake (LRNI) is the amount of a nutrient that is enough for only those with very low needs, almost all people needing more than this.

Safe Intake is the term used to indicate the intake of a nutrient for which there is not enough information to estimate requirements.

Dietary Reference Values (DRVs) is a general term to cover all the figures produced, i.e. EARs, LRNIs, RNIs, safe intakes.

These figures are intended to apply to healthy people and do not make allowances for nutrient needs imposed by certain diseases. In the case of nutritional labelling the Panel recommended that nutrient content should be expressed as a percentage of the EAR. For the benefits of this study EARs for Energy and DRVs for NSP, SFA and NMES have been used as set out in the COMA document (Department of Health, 1991b).

A few reservations have been expressed within the food industry concerning the COMA report (Nichols, 1992) but generally the report has been welcomed (Wiseman, 1992).

To allow direct comparison to dietary goals when evaluating foods the Dietary Reference Values formulated by COMA in 1991 were to be used as the basis of the nutrition information system. The rationale for displaying each nutrient in the governments recommended format (MAFF, 1988; EC, 1990) was, however, closely examined.

The government guidelines set down formats which may be used when nutrition information is given on a product. The standard format specifies energy, protein, carbohydrate and fat, often referred to as the 'Big Four'. Provision for the breakdown of carbohydrate and fat into constituent parts and for including NSP and sodium is also laid down.

Providing as much nutrition information as possible to the consumer is not necessarily the best way to get the message of healthy eating across.

The Coronary Prevention Group (1992) found that respondents reacted more quickly to a listing of five nutrients when compared to a listing of seven. Freckleton (1987) noted that consumers prefer 'plain English' to be used on food labels and although many respondents claimed to favour labels with a range of nutrients they were mainly drawn to labels which were simple and offered some form of assistance.

It has been shown that consumers do indeed prefer labels where the information is set out in plain, simple terms (CA, MAFF & NCC, 1985) and can be seen and interpreted at a glance. It was therefore decided in this study to keep the number of nutrients to a minimum to avoid information overload, yet to provide adequate information to allow the consumer to make an informed judgment on a food or dish.

Energy in the form of kilojoules or kilocalories is perhaps the one piece of nutrition information that most people look at first. Those on slimming diets may concentrate on calorific value alone. Energy is derived from all macro-nutrients. For this reason any nutrition information system should not exclude energy in its presentation.

In its calculations for an EAR for energy the Panel (Department of Health, 1991b) took into account basal metabolic rate and level of physical activity. Five different age brackets for both males and females were devised, based on relatively little physical activity at work or in leisure time, since a sedentary lifestyle is applicable to most people in the UK (Table 1.1).

Table 1.1 Estimated Average Requirements for Energy - Adults (assuming low activity levels at work).

Age in years	EAR - kcals per day	
	Male	Female
19-49	2250	1940
50-59	2550	1900
60-64	2380	1900
65-74	2330	1900
75+	2100	1810

(Source : Department of Health, 1991b)

Energy as a term is often found to be confusing (CA, MAFF & NCC, 1985). Some people assume energy is something you must have a lot of, the more the better for you. It has been suggested that the term 'calories' should be adopted to help nutrition labelling to be more readable and useful to consumers (Anon, 1985b). The use of the term 'calories', although better understood, where it is more often thought that high amounts are bad for you, is however often confused with kilojoules (CA, MAFF & NCC, 1985).

The figure for fat in the 'Big Four' nutrients includes saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids. The general message being given to the consumer is to cut down on their total fat intake while paying particular attention to SFAs. A food that is low in SFA may appear as 'unhealthy' as one that is high in other fatty acids when only the figure for total fat is given. The solution may then be to give the figures for each type of fat. The last ten years however have seen little change in the average contribution made by fat to energy intake (Department of Health, 1991b). This figure has stayed fairly constant at

42%; the maximum suggested by COMA is 35%. The consumption of SFA has fallen however from 19% of food energy in 1980 to 16% in 1990, the recommended is 11%.

This may be partly attributed to the advertising campaigns used for some products which emphasise a nutritional content low in saturates and high in polyunsaturates. Thus many consumers may be replacing their SFA intake with PUFA instead of lowering fat intake overall. What is desirable is a reduction of all fats with particular attention being made to lower SFA. Apart from essential fatty acids (EFAs), there is no absolute need for fat by humans. In order to get the correct message across, the figure for saturated fatty acids could be displayed alone, thus allowing consumers to concentrate on minimising their intake rather than substituting with another fat type.

The figure for carbohydrate includes sugars and starches together. As with fats, foods high in starch and comparatively low in sugar might reflect badly when grouped under the term carbohydrate. Consumers do appear to have some problems understanding precisely what is meant by the term carbohydrate (CA, MAFF & NCC, 1985) whereas the term sugar is regarded as being among the 'important' nutrients to be displayed. There appears to be a general misconception that carbohydrates are starchy and therefore bad for you. High intakes of starch are in fact recommended to take the place of sugar and fat, therefore this figure should be treated separately from the sugar component of carbohydrate (Department of Health, 1991b). High or very high intakes of starch do not have any known detrimental effects but some forms of sugar do; it therefore seems wise to concentrate on lowering sugar intake. Within sugars there are three identifiable groups: intrinsic sugars (fructose, glucose and sucrose), milk sugar (lactose) and extrinsic sugars (mostly sucrose). Extrinsic non-milk

sugars are non-milk derived sugars which unlike intrinsic sugars are not contained within the cell walls of foods, the best examples of these are table sugar and honey. NMES are a major cause of tooth decay. Lactose and intrinsic sugars are generally thought to have less detrimental effects on dental health and are present in foods that are beneficial as providers of essential nutrients such as calcium, in milk, and vitamin C, in fruit (Department of Health, 1989).

The Panel on DRVs gave a separate figure for NMES (11% of energy intake), suggesting it is a nutrient that people should be aware of and reduce their intake of. The term non-milk extrinsic sugar itself is rather complex and was given a pseudonym of 'Added Sugar' for the benefit of the consumer surveys in this research.

Dietary Fibre is a term recognised by most people today. This however is a simple term for a complex set of polymers. The complete analysis of dietary fibre is a complicated procedure. Important sources of dietary fibre are cereals, fruits and vegetables.

In an attempt to standardise what exactly the term fibre refers to, the DRV Panel used the term non-starch polysaccharides, (Englyst & Cummings, 1988).

Evidence suggests that NSP has important roles in gastrointestinal function (Royal College of Physicians, 1983); it may help to lower blood cholesterol and reduce the risks of disorders such as gall stones and bowel cancer. It was therefore decided that NSP should be included in the nutritional layout to be used in the surveys in this research.

The Panel proposed a DRV for NSP lower than that derived from the Southgate analysis of dietary fibre, which included lignins and resistant starch (Paul & Southgate, 1978). The figure proposed was 18 grams per day for an adult.

It was decided to display NSP rather than protein, as used in the 'Big Four', during the course of this study. The reason for doing so lies in the fact that the average UK diet provides ample protein. The DRV Panel suggested a RNI of protein considerably lower than that used in the 1979 recommendations. Since people in the UK are not deficient in protein there could be no obvious benefit in presenting the figure for protein.

Nutrition Labelling Legislation.

Within the UK legislative system the Ministry of Agriculture, Fisheries and Food has the responsibility for dealing with labelling (Morris, 1991; Kirk & Arens, 1988; Jukes, 1988).

General labelling requirements are set out in the Food Labelling Regulations, 1984, which require that most food labels should provide such items of information as the name of the food, the country of origin and a list of the ingredients. The provision of nutrition labelling was not provided for under this Act. Until recently control and food law enforcement was provided under a number of separate Acts; the Food Act, 1984 for England and Wales, the Food and Drugs (Scotland) Act, 1956 and the Food and Drugs (Northern Ireland) Act, 1958. Recent initiatives in response to EC legislation have superseded these Acts (EC, 1990 & Scottish Office, 1994).

British Food Law is derived mainly from European initiatives, when national food law is being devised it is necessary to firstly examine the European Community Law within that particular area. Alternatively EC food legislation must consider and incorporate aspects of British Food Law and that of the other member states. Some European countries have been promoting uniform labelling of foods for quite some time (Anon, 1985a). The basic principle of the EC is to attempt to harmonise all member countries' legislation under one umbrella. This however has been very slow to come about, especially in the area of food legislation. The completion of the internal market has sought to speed up this process.

When devising controls in the area of food law the European Parliament seeks expert advice from a number of bodies which are specifically convened for this purpose. The Scientific Committee for Foods, the Advisory Committee on Foodstuffs and the Standing Committee

for Foodstuffs exist to advise and provide recommendations to those responsible for decisions relating to food quality and safety.

Four basic frameworks serve as a basis for controlling this sector: labelling; packaging; additives & flavourings; foods for particular nutritional uses.

The labelling framework covers the listing of ingredients, declarations of nutrients, irradiation, country of origin, quantities used, additives and *E* numbers.

Kendall (1989) pointed out that harmonisation of the labelling requirements must succeed to ensure that adequate information is supplied to the consumer and also to ensure there is no unfair competition between food manufacturers.

The Food Labelling Directive (79/112/EEC) (European Community, 1978) was devised by making large concessions to all the different member states. This directive laid down the principles of labelling but stated that labelling was not compulsory and if nutritional information was stated on a product it could take any form that the manufacturing company so wished. Nutritional information has been generally seen as optional and only compulsory when a nutritional claim was being made in the labelling or advertising of the food.

On October 1988 a common position was reached by the Council with the publication of a number of proposals. These were sent to the European Parliament for their first reading. One proposal covered "the compulsory nutrition labelling of foodstuffs intended for sale to the ultimate consumer" another concerned the "nutrition labelling rules for foodstuffs intended for sale to the ultimate consumer".

The Proposed Directive on Compulsory Nutrition Labelling (EC, 1988) was drawn up with the view that some aspects of nutrition labelling may at some future date require to be made compulsory. This view was

adopted for a number of reasons. Nutrition labelling was seen as a way of informing consumers of the nutritional content of the foods they consume. By providing nutritional information consumers are empowered to make an informed choice. The aim is to enable those who wish to, to achieve a balanced diet by providing them with the necessary information.

The mandatory labelling of certain nutrients was proposed if there was seen to be sufficient evidence of the need. To evaluate this need the European Commission consider:

1. epidemiological evidence linking causation of nutrient to specific diseases;

2. the need to improve the nutritional status of the population or substantial sub-groups within the population.

Consideration will also be given as to whether the same goals could be achieved through other means.

The second proposal, now a Directive on Nutrition Labelling Rules (European Commission, 1990), set down the format that would have to be used for the provision of nutritional information.

The directive proposed one of two formats:

1. energy in kilojoules or in kilocalories, and
protein, carbohydrate and fat in grams.

2. energy in kilojoules or kilocalories and
protein, carbohydrates, sugars, fat, saturated fatty acids, dietary fibre and sodium, in grams and in that order.

Certain optional information may also be given including; starch, sugar alcohols, monounsaturates, polyunsaturates, all in grams. Also any of the following: Vitamins A, D, E, C, Thiamin, Niacin, B6, Folacin, B12, Biotin, Pantothenic Acid, Calcium, Phosphorus, Iron, Magnesium, Zinc, Iodine, all to be declared in milligrams or micrograms and only if the food in question contains at least five percent of the recommended daily intakes.

The first reading of the two proposals by the European Parliament was in May 1989. At this time they were considered to be unsatisfactory. The first proposal was seen by many member states to give excessive power to the Commission. The second was considered as being likely to restrict the use of nutrition labels by discouraging manufacturers from introducing nutritional labelling on their products. In general little support was gained from the member states for either of the proposed directives although consumer groups tended to welcome the proposals (NCC, 1989).

In December 1989 a common position was eventually reached by the Council over the matter of the second proposed directive. Nutritional labelling remains voluntary except where a nutrition claim is made, then a detailed declaration of nutrients must be made in a specified form. The Directive (EC, 1990) covers all foods where a claim is made, this extends to prepackaged foods delivered to the retailer, foods packed for direct sale, and unwrapped foods, e.g. fruit, vegetable, take away goods and meals for immediate consumption on the premises. Persisting differences between the member states are likely to be regulated further in the future (EC, 1992). The second proposed Directive (EC, 1988) which will require selected nutrients to be displayed as compulsory labelling requirements has support in principle but the current legislative programme will be monitored before this is considered further.

As a consequence of EC directives UK legislation governing nutrition labelling now comprises two distinct yet interrelated areas: voluntary nutrition labelling and nutrition labelling claims. The government actively encourages nutrition labelling to be adopted on all packaged foodstuffs but the decision to provide it lies with the food manufacturer concerned. Nutrition labelling is entirely optional but becomes compulsory when nutrition claims are made. This means any statement, suggestion or implication that a food has particular nutritional properties. In such a case nutrition labelling must be provided in one of the formats prescribed.

Historical Perspective of Nutrition Labelling

In response to changes in consumer demand during the 1960's, many manufacturers began to provide nutritional information on their products and to launch new products which reflected this trend. From as early as 1969 many American food manufacturers provided a comprehensive system of nutrition labelling on their products (Geiger *et al.*, 1991). This displayed a very large amount of detailed information on nutrients and vitamins. However, this method was often accused of being too difficult to understand (Salmon, 1984). The concept of nutritional labelling in the United Kingdom first appeared in the early 1970's (Freckleton, 1985). Prior to the COMA (1984) report few products displayed their nutritional composition. With some exceptions most of the nutritional labelling that was provided was done for promotional purposes and therefore tended to be found on products which were already perceived as healthy. Birds Eye Limited were one of the first food manufacturers in the UK to label their products with nutrition information (Freckleton, 1985). The retail sector have been instigators in introducing nutrition information on food products, although this has largely been restricted to the larger supermarket chains (Evans, 1987). In 1985 Tesco launched its *"Healthy Eating Programme"* to give customers information on nutrition, thus enabling them to choose foods in accordance with dietary needs and current advice on health and diet. Other companies have followed suit (Safeway, Sainsburys, Cooperative Wholesale Society). Most have tended to adopt quite comprehensive labelling systems displaying not only the "Big Four" but also dietary fibre, polyunsaturated fatty acids, saturated fatty acids, added sugar and salt as well as mineral and vitamin content. This information has generally been supplied in a tabular format with figures per 100 grams and occasionally supplementary information on per serving. Most large

supermarkets produce additional literature on healthy eating which contain information on the nutritional content of loose and un-packaged own label goods and products available in their stores (Tesco, 1991; Safeway, 1990; Scobie & Firth, 1989). In supermarkets today messages, posters and leaflets are available to advise on what is good or bad for you, what you should or should not be eating or how much of this or that you should have in your diet in order to remain healthy and *'enjoy life'*. The number of products displaying nutritional information has continued to grow and nutritional labelling is no longer found only on products traditionally perceived as "healthy". The information itself often extends beyond the "Big Four". This trend has also filtered down to smaller food chains, eg. Spar. The type and amount of information supplied however, does vary considerably and is often determined by the nature of the product being labelled, nutritional labelling still being, essentially, a promotional exercise.

Despite the legislation and guidelines which exist to standardise the form nutrition information can take on a food label, reality has shown that in the past many manufacturers merely adopted that format which shows their product in a more favourable light (Kirk, 1988). Lack of standardisation in nutrition labelling merely caused confusion for the consumer. Many products do not show all the information required to make a healthy food choice and comparison between products is very difficult (Wheelock, 1992).

The result has been an array of labels, some containing large amounts of nutrition information in a variety of formats while others provide little or no specific information on nutritional content. This is all very confusing to the average shopper.

The trend towards increased information on food and the demand for nutritional information has been the subject of many investigations and reports attempting to evaluate the level of consumer interest in and understanding of nutrition.

Studies have shown that consumers are turning to nutritional data as a source of information which they can use to modify their diet. Consumers do claim to have modified their diet in some way to help maintain a more healthy balanced diet (CA, MAFF & NCC, 1985). The methods adopted by consumers range from a reduction in intake of meats, sugars, and "sweet things" to an increased intake of vegetables, wholemeal and brown bread. Although many consumers now claim to look at the nutrition information presented on food labels (MAFF, 1990a) there still seems to be very few who use this information to make comparisons between products (Consumer Association, 1990).

This may, in part, be due to the wide variety of formats used to display nutrition information and also the fact that only a small number of products actually display nutritional information (Consumer Association, 1990).

Another problem would appear to be the number of misleading and often confusing terms used on food labels (Which, 1986 & 1989). Many consumers express confusion over the terms kilojoules and kilocalories (MAFF, 1990a) while the use of the simpler term energy is a concept often equated to vitality (CA, MAFF & NCC, 1985). The breakdown of fat into its constituent parts is often confusing for consumers as can be the use of metric measures (MAFF, 1990a).

Some health messages do appear to have been absorbed however. A majority of those questioned in the joint survey carried out by the Consumer Association, the Ministry of Agriculture, Fisheries and Food and the National Consumer Council (1985) believed the intake of salt, fat,

sugars, cholesterol and saturated fatty acids should be reduced and that dietary fibre, protein and vitamins should be increased.

The Consumers' Association (1990) found the inclusion of nutrition information on products was generally favoured by respondents, with the majority considering its presence to be either fairly or very important. Although this indicates there is a willingness to use nutrition information and people are attempting to follow nutritional advice when planning their diet, it is clear that an enhanced nutrition education programme is required.

Consumers expressed a wish for labels they can read and understand at a moments glance, labels which encourage assessment of the product allowing comparison with other products. Some feel there is also a need for more information to be provided on foods served in restaurants and catering establishments (MAFF, 1990a) where information could be provided on the menu, at the counter, or near the point of sale.

While there has been a huge increase in the provision of nutritional labelling on packaged products, there has been little or no provision of nutrition information on loose products or on the foods provided in restaurants and cafeterias.

Menu Labelling

Numbers of midday meals consumed outwith the home have steadily increased in the last ten years (MAFF, 1990b & 1991). Approximately 25% of total foods sold comprises foods eaten outwith the home (Moody, 1992). The trend for eating out is growing with the percentage of meals eaten out rising between 1987 and 1989. Nearly 40% of meals eaten outwith the home are consumed in canteens and public sector institutions. On average men consume a greater proportion of their total energy out of the home than women with 34% of their energy intake including alcohol being consumed outside the home compared to 24% for women (Gregory *et al.*, 1990). On average almost a third of food energy obtained is from meals and foods eaten outside the home. From a nutritional aspect the 25% of foods consumed outside the home provide poorer nutritional value than those consumed within the home. These foods tend to contain more sugars but less fibre, protein and iron per unit of energy than all foods consumed. In terms of the total diet over a third of food energy is provided, therefore, by a less healthy diet, a diet which must be greatly improved to meet current recommendations (Department of Health, 1991b).

A recent survey found that a third of all consumers questioned, ate lunch out once or more in a week (MAFF, 1993b). The majority of these respondents were consuming meals in either works, college or school canteens. A quarter of the respondents expressed a desire to know the nutritional content of the foods they were consuming in these establishments. When asked what type of information was required 1 in 4 respondents stated fat content and type, while energy content came a close second. Vitamins, protein and sugar content were also mentioned by many respondents. It is interesting to note that sugar content was mentioned more frequently by respondents than was carbohydrates. The menu was

the most favoured location for nutrition information to appear with over 60% of respondents preferring this method rather than receiving the information by a separate sheet or through the canteen staff. Because of the high percentage of meals being consumed outwith the home it is important that nutrition education programmes target these areas to successfully influence the total diet of consumers.

Studies in the United States have found that restaurant customers changed their nutritional related concerns when presented with nutritional information in restaurants (Tougas, 1987). These surveys confirm that the attitudes of American consumers are changing with regard to the nutritional quality of foods consumed in restaurants (Backas, 1988). In consequence many restaurants in the United States are having to respond to consumer demand by providing "healthy" menu items and by promoting their nutritional benefits (National Restaurant Association, 1989).

Interest in the provision of nutrition in restaurants has long been an issue in the United States and many nutrition education programmes and healthy eating promotions have featured in studies (Anderson & Haas, 1990; ADA, 1991; Kubena & Carson, 1988). Many studies have focused on consumer attitudes to, and the need for, nutrition information in restaurants (Carlson, 1984; Carlson & Tabacchi, 1986)

Most recently in the United Kingdom a report on the information needs of the consumer on catering outlets highlighted consumer concerns over menu labelling (MAFF, 1993b). The report dealt with all forms of menu labelling from food description and preparation to ingredient and nutritional labelling. Although nutrition information on menus was considered to be secondary in importance to the nutritional labelling in groceries, 25% of the sample did wish to see nutrition information on menus in canteens and restaurants.

In response caterers are being encouraged to provide more detailed information on the menu items they present to their customers (MAFF, 1993b). Just what form this additional information should take, however, is to be decided by the individual caterer in terms of what is most relevant for the foods they offer to the consumer.

At present, foodstuffs sold in restaurants and canteens do not have to be labelled with the ingredients or with their nutritional information except where there is a health or nutrition claim made about that food or the contents/ingredients of that food. However, the EC proposal to introduce compulsory labelling of all foodstuffs sold to the consumer at these outlets, as outlined previously, presents restaurateurs with the dilemma of how to provide such information. From the customer's stance, particularly diabetics, weight watchers, etc, it is usually a problem of how to select the right foods to suit their needs and diet.

Many caterers do promote healthy eating practices although there is a lack of any effective vehicle to communicate nutrition information in catering establishments (Kirk & Daly, 1992). Ultimately it is important that the nutrition information is presented in a form that the consumer wants, understands and can use when making food choices in a restaurant (De Bekker, 1991; EC, 1990; CA, MAFF & NCC, 1985; COMA, 1984).

The food industry claims that the nutritional labelling of all foods is not possible (Freckleton, 1985; Simpson, 1992). Fears have been expressed over the possible threat of prosecutions arising from inaccurate data being provided on food labels. The nutritional content of many foods change during the year, therefore completely accurate analysis is difficult without increased sampling and analysis which inevitably forces costs higher. Fears have been expressed over the possible effect of the provision of nutrition information on sales of existing products and on future product development (Richardson, 1987). Questions have also been raised over the

practical constraints such as product size and therefore label space on products which already have to state, name of product, list of ingredients, date mark, storage instructions, directions for use, manufacturers name and place of origin. On unwrapped foods the problems are clearly even greater.

Menu labelling has progressed slowly despite recent initiatives from the European Community (EC, 1990). Few large catering firms have attempted any form of menu labelling, yet there is a need for consumers to know the nutritional value of the meals they eat outwith the home (Wheelock, 1992). Many catering firms are firmly set against menu labelling, believing it to be unworkable. Reasons used in the argument against the introduction of compulsory menu labelling range from *"chefs don't weigh ingredients"* to statements that 98% of the eating-out public have no wish for detailed nutrition information (McDermid, 1992).

However most catering outlets, particularly the large contract caterers, operate strict portion control systems which facilitate the nutritional analysis of meals. Some of the fast food chains already operate menu labelling systems (McDonalds, 1991; Pizzaland, 1990; Pizza Hut, 1990). Some workplace restaurants and canteens have adopted schemes to give their employees nutrition information on the foods they are eating. In response to requests from hospital catering departments the Riverside Health Authority introduced a scheme called 'Star Struck' where foods were rated using stars to indicate fat and fibre content. General advice was also given on sugar and salt intakes. Information was displayed on menu boards and at the point of sale. Additional information explaining aspects of healthy eating was distributed using leaflets and table cards (Cole-Hamilton, 1986; Williams & Poulter, 1991).

Other labelling strategies offering healthy eating advice have been found to be successful in promoting more nutritious food selections in restaurants (Mayer *et al.*, 1989).

Customers do not require a complex set of figures detailing the nutritional information of their meal, merely the correct information displayed in such a manner that it allows them to make a healthy food choice.

It is clear from the literature that there is growing consumer interest in the nutritional content of foodstuffs, yet this information is not available on the majority of food consumed by the public and when it is provided it is often patchy and incomplete.

The studies reviewed earlier show an interest in healthy eating expressed by a large number of people which needs to be encouraged and promoted. The problem is one of providing accurate and understandable information to the customer before they make their food selection and providing it as quickly as possible so as to avoid service delay. Methods of promoting nutrition information in restaurants have tended to make use of posters, games and incentives to encourage participation (Sneed & Burkhalter, 1991). Energy and fat tend to be the nutrients focused upon in initiatives with often only a limited number of menu items being targeted (Cincirpini, 1984; Davis-Chervin *et al.*, 1985; Dubbert *et al.*, 1984; Mayer *et al.*, 1986 & 1987; Wagner & Winett, 1988; Zifferblatt *et al.*, 1980). Many of these studies have concentrated on using sales figures for particular items to determine consumer response. None of these studies considered the "whole" meal. Customers may, in response to certain schemes, select a low fat starter or omit a sweet but could have over compensated for the nutrient loss in other unrecorded selections. Programmes and studies in this country have focussed more on the logistics of such schemes rather than the actual or perceived response. Consumer attitudes rather than actions have been used as measures for analysis (Hancock, 1992; Marks, 1986). The present study aimed to measure the

consumer's actual response when presented with nutritional information on an entire meal.

To enable menu labelling to influence consumer food choice an effective vehicle to communicate the nutrition information is required. Providing nutrient analysis on any diet requires a series of complex calculations which are time consuming and laborious. Large quantities of data on foods and their nutrients have to stored and manipulated. A computerised system is obviously of great benefit in these circumstances. Database systems have long been used for nutritional analysis (Mareric, 1993; Seaman, 1992 & 1993; Smithers, 1993) and some have been successfully adapted for restaurant use. Douglas and De Pietro (1992) at the University of Connecticut made use of a computer system to provide nutritional analysis of menu items offered in the University dining hall. The study tested to see if there were significant differences among dishes on offer in terms of energy, fat and cholesterol content. Although the system was also used to provide information to students in the form of a manual containing all the dishes and the associated nutritional content, the effect of providing such information was not studied. The system was viewed as a method of promoting healthy eating and demonstrated how computers could be used in the provision of nutrition information. Software packages to deal with dietary analysis are already widely available (Seaman, 1992 & 1993). Such database systems have, however, mainly been seen only in terms of their training value and have been restricted to the use of specialists in the field of nutrition and dietetics (Hertzler & Hoover, 1977; Schaum *et al.*, 1973).

The database system enables large quantities of data to be stored and processed through the use of specialist application programs. There is no reason why the concept of specialist systems could not be adapted to provide menu labelling. The food service industry already generates and

uses large amount of data which lends itself to computerization. Database systems are already used to store nutritional data on foods (Smithers, 1993). Computer systems are widely used by the food sector in the areas of ordering, stock control, pricing and quality control. This could be extended to provide nutrition information on foods served in restaurants and canteens. Nutrient analysis programs typically produce large quantities of data on a large number of nutrients, vitamins and minerals. In any menu labelling scheme this could be reduced to cover only those nutrients required for a "healthy" food choice to be made.

A database system could hold all the data, enabling information to be supplied on the spot before the customer makes their food purchase. The computerised system not only allows access to the data but can be used to present that data in a variety of mediums and formats.

The database system developed in this study allowed interaction through a series of user interfaces. This enabled the user to devise recipes, menus, select meals and view nutrition information in relation to current dietary advice (Department of Health, 1991b).

Aims and Plan of Work

The aim of this research was to develop and evaluate a computerised nutrition information system which could be used to provide nutrition information on menu items in catering outlets, thereby permitting the effect on consumer food choice, of providing such information, to be measured.

A feasibility study was carried out to identify the user requirements. This established the type of information the system would be expected to produce and helped form hypotheses on how it should be produced. The next stage involved the identification of the raw data required as input in order to produce the identified output. This data was collated and transcribed into appropriate database files.

The design stage involved software programming to manipulate the data files and to allow user interfaces. System testing with test data revealed any programming and design faults. In house tests which took place within the Robert Gordon University Training Restaurant helped assess the speed of access.

Methods of providing nutrition information in catering establishment and consumer response to such information was examined and summarised. A separate study focused upon the presentation of nutrition information and the type and quantity of information. A number of different nutritional layouts were evaluated through consumer tests to identify the format to be used to present the nutritional data produced by the computer system.

Pilot tests of the complete menu analysis system took place within the University Training Restaurant. Two separate staff restaurants agreed to be used as study locations. The system was then put into operation within these catering outlets. On the spot nutrition information was provided to customers before they purchased their meal. Customers were able to enquire as to the nutritional content of their selections before

deciding to choose that meal or not. This allowed the customer the opportunity to change their intended selection. During the test stage valuable data was collected on initial food selections and any subsequent changes made once the customer appraised the nutritional breakdown of the chosen meal.

Analysis of this data and the testing of hypothesis followed to establish whether consumer food choice patterns had been influenced by the provision of computerised nutrition information at the point of purchase.

Chapter 2

The Development of the Menu Analysis System

Introduction

The design and implementation of this computerised system had to be carefully planned and controlled using the systems design approach (Clifton, 1990; Daniels & Yeates, 1989; Howe, 1989: Ozkarahan, 1990). Use of a system model gives the process a structured approach through the employment of standard methods and procedures.

This approach is known as the system life cycle which can be split into five distinct parts or phases :

1. analysis; 2. design; 3. implementation; 4. testing; 5. maintenance (Pomberger, 1986).

All documentation and outcomes resulting from each of these phases are numbered accordingly thus allowing for future reference or adjustments.

Although these are distinct phases, the life cycle phases should not be seen as isolated tasks, this is an ongoing process where each phase can be subdivided into a range of activities which may have a number of end results and repercussions for preceding or subsequent phases in the cycle.

1. Analysis

The analysis phase of this project was carried out to enable precise description of the information content of the proposed database system and to determine what demands would be placed upon the system. This analysis led to a specification of the requirements which included a detailed description of the structure of the database system, its functions and its user interfaces.

1.1 Statement of Requirements

The system requirements had to be clearly stated before any design phase could proceed. The system requirements can be split into four categories:

1.1.1 *Operational Requirements*.

To be functional the system must perform a number of defined tasks:

a: Recipe compilation to allow recipes to be devised and stored for future use.

b: Menu compilation to allow menus to be devised from the recipes and stored for future use.

c: All customer details entered and menu choices made to be stored in database file for later analysis.

d: Nutrient breakdown to be provided on any dish or combination of dishes from a menu.

e: Requested information to be supplied in a clear and easy to understand format that allows customers to make informed choices regarding the foods they are consuming.

f: Information extracted from the database intended for use by

consumers to evaluate the nutritional content of foods available on a menu, which allows choice between dishes, selecting that which bests meets dietary needs.

From the statement of operational requirements the system inputs and outputs can be identified and summarised (Table 2.1), this clearly states the information required by the system to produce the required results.

Table 2.1 Summary table of the identified system inputs and outputs.

Input:
Ingredient/recipe names and amounts
Nutrient Information
Customer details
Menu choices made by customers
Output:
Nutrient Analysis
Menus
System usage data

1.1.2 ***Information Requirements***. These were concerned with the quality of the information to be provided and the information which had to be processed to produce the output information. It was important to establish for whom the information was being provided and for what purpose and how up-to-date and accurate the information should be. The initial stages of the system analysis stage involved deciding what information the computer system was expected to supply and what type and quantity of

data it must store in order to be able to provide this information (Mallof & Zears, 1979). These specifications were laid down so that the size of fields, records and files were known before the program design stage began.

1.1.3 ***Volume Requirements.*** The volume of data to be processed and stored determines the hardware requirements and storage capacity. The raw data for the database system included the nutritional information on over 1000 foods taken from McCance and Widdowson (Holland *et al.*. 1991), standard food tables.

1.1.4 ***System Requirements***. These involve identifying the equipment, i.e., computers and peripherals required, and development, i.e., software needs. It was decided that any system developed would have to be relatively simple to operate and be able to be run on the average micro-computer. If the purchase of sophisticated, expensive equipment was a necessary part of the system then its attractiveness in being a comprehensive database information system would decline.

Hardware limitations were initially outlined as being an IBM compatible micro-computer with hard disc storage and a floppy disc drive, supporting line, dot-matrix or laser printer. These specifications were later extended to incorporate the use of a hand held device and a data transfer link between the micro-computer and the hand held computer.

1.1.4.1 Software Review

The database is a collection of interrelated data stored so that the data are shared among users and applications (Hughes, 1988). Database systems can be split into three types : relational, network or hierarchical

(Date, 1990). The relational model was used here since it can search interrelated data through the use of two dimensional tables.

Many software packages exist which can be used to develop a relational database system. Database software consists of three areas: languages used to create and maintain the database system; utilities to support facilities such as report generation, graphical output and statistical operations; and operational routines for run-time management.

A review of a number of database development software packages helped identify a suitable package for the research requirements (Beard, 1992; Edmunds, 1992; Lang, 1992; Townsend, 1986). Clipper 5.0 was chosen for this project because it is a database development tool with its own programming language. It also provides a number of development tools including a compiler, linker, program editor, report and label utility, program maintenance and a database utility which enables files to be built, data added, accessed and browsed and the attachment of index files to these data files (Mueller, 1991). Clipper is capable of holding and processing the large quantities of data required for a menu analysis system, on a standard IBM compatible PC.

Unfortunately the program editor within Clipper 5.0 was somewhat limited, therefore a word-processing package, Wordstar.5.5, was used as a program editor for creating and maintaining all programs, this provided specialised control commands and functions not present in the Clipper program editor.

2. Database Design

The design of the database system essentially involved the identification of file and data requirements and the creation of the database storage files.

2.1 The Data Dictionary

The creation of the database files was aided by the generation of a data dictionary. Data Flow Diagrams were used to identify the data flows, stores and processes which would make up the database system. From these a data dictionary was devised which would help in the creation of the database files (see Appendix I). In the data dictionary every piece of data required is identified, its source and its destination known. The data dictionary was used to collect together all identified and defined data items. The data dictionary also contained a standard definition of all terms used in the system and would later allow for program design. It was from the data flow diagrams and the information contained within the data dictionary that the design stage of the project began.

2.2 Database Development

The design of the database system was derived from the functional specifications outlined in the systems analysis phase. The design process is concerned with outputs, inputs, files and procedures.

Outputs can be identified as the results demanded by the user, inputs can be seen as the raw data required to produce the outputs and the procedures are the programs which manipulate the data to produce the end results. The files store the data that is either required or produced by the

procedures. The statement of requirements clearly specified what outputs were required from the database system. This could therefore be used to identify the required raw data.

2.2.1 The Database Files

The food file stored all the raw data which consisted of 1084 individual records containing information on individual foods. Not all the foods in the food tables (Holland *et al.*. 1991), were required in the food file. Ready made meals were omitted because recipes were used to devise the meals used in the study; herbs and spices which did not contain significant amounts of the four nutrients were also omitted, likewise human milk which would not be required.

Each record consisted of six attributes: ***food name, code number, energy (in kilocalories), fibre (NSP), saturated fats (SFA), added sugar (NMES)*** *these being in grams per 100 grams.*

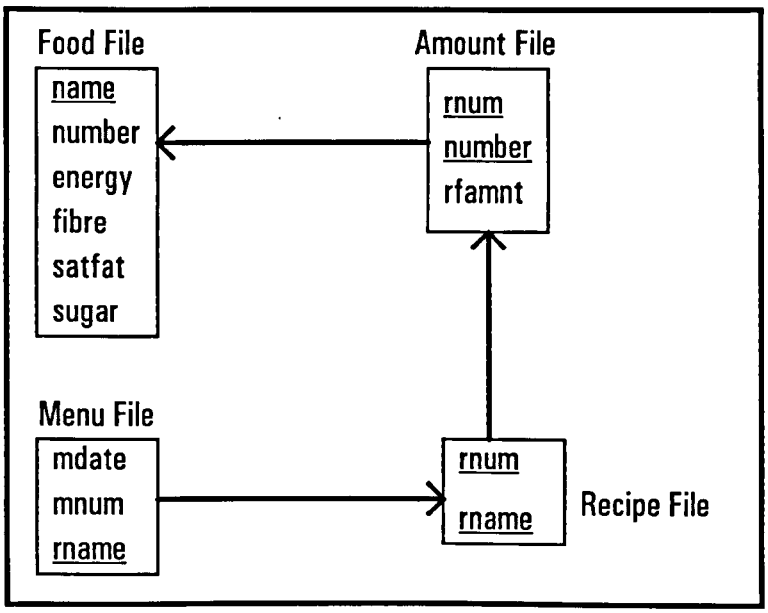
Estimations had to be made for the NMES because figures do not exist for any foods in the standard food tables. The Englyst and Cummings (1988) figures for NSP were used where available; if these did not exist then the Southgate (1981) figure for dietary fibre was substituted.

The recipe file contained a code number and the name of each recipe.

These two files were related by an amount file in which the recipe code and food code both appeared with the amount of that ingredient used in the recipe.

The menu file contained, for each record, a date field (i.e. when the menu was created), the menu number and the recipe name. Figure 2.1 illustrates the relationship between these files. The specifications for each file are to be found in Appendix II.

Figure 2.1 Relationship of the database files



Key to abbreviations:

fnum : food code number

rnum : recipe code number

mnum : menu code number

fname : food name

rname : recipe or dish name

rfamnt : amount of food in grams in particular recipe

mdate : date menu was created

satfat : saturated fatty acids

sugar : added sugar

Those fields which are underlined are the key fields used for searching. From the menu file a dish is selected by using its' name, the recipe file is then searched and the corresponding number for this dish obtained. The amount file is accessed and all occurrences of this dish number are located so that each food in the food file that appears in that

particular dish's recipe can be located and the energy, fibre, saturated fat and added sugar content of that dish can be calculated.

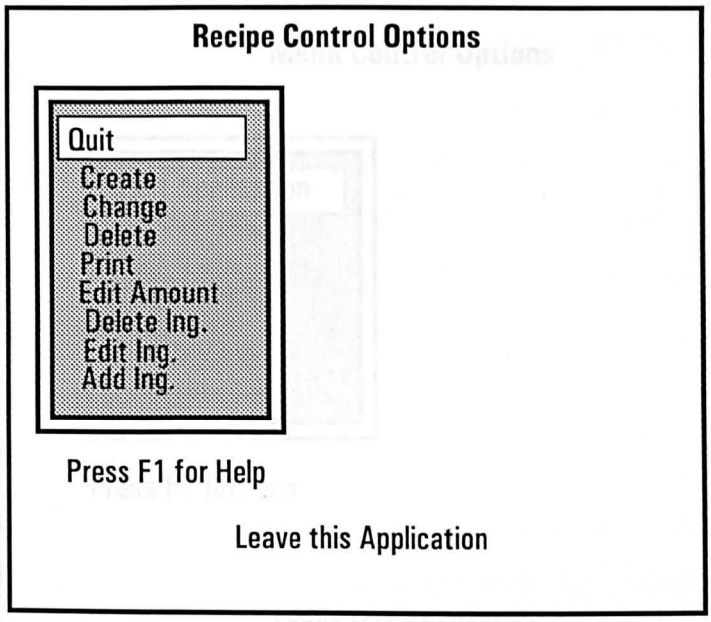
The programming stage of the design process then took place. To allow for searches and the creation and control of recipes and menus, software programming was necessary using the Clipper programming facility.

Three programs were designed. One program was used to create and edit recipes, a second to create and edit menus and the third extracted the nutrient information on one or more dishes and displayed this information as the nutritional breakdown of a meal.

2.2.2 The Recipe Program.

New recipes could be created through a series of user interface screens (see Figure 2.2). The recipe creation process involved typing in the ingredient names so that a search process could begin. All corresponding choices were then displayed on-screen for selection by a light bar which could be moved up and down the list of choices using the arrow keys on the keyboard. If any food requested did not exist in the food tables a suitable alternative had to substituted. Once a food had been selected the amount in grams was then keyed in and the next ingredient could be searched for. Recipes could also be printed, deleted, recipe names changed, amounts of ingredients adjusted, ingredients changed, deleted or added.

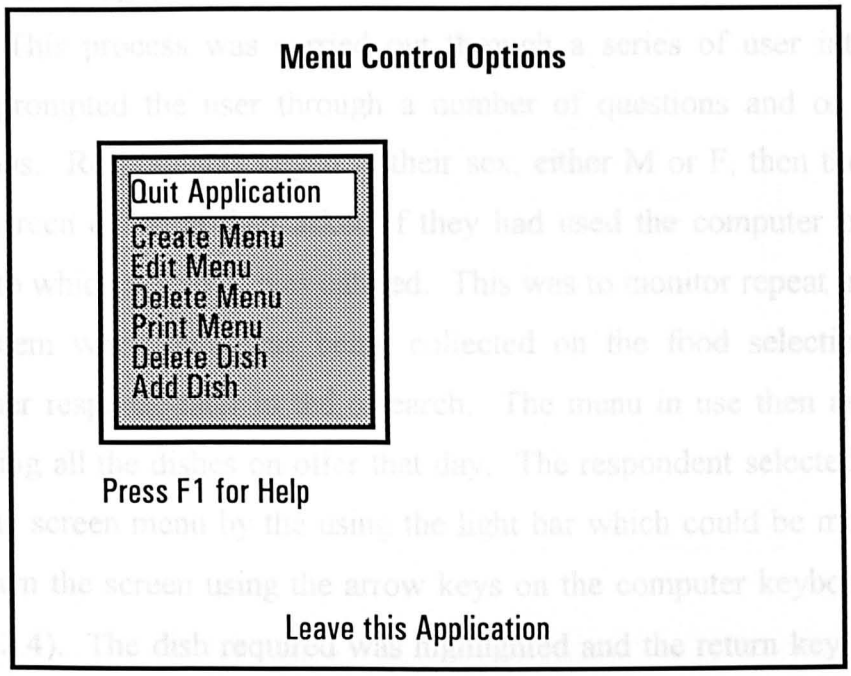
Figure 2.2 Opening screen or user interface for the recipe maintenance program.



2.2.3 The Menu Program

The menu program was used to create menus. Each menu was assigned a code number and a date, this being the date the menu was entered onto the computer. Each dish to appear on the menu was keyed in then corresponding dishes were searched for and displayed by the computer for selection by using the light bar as in the Recipe program. Menus could be deleted or printed and dishes appearing on a menu to be changed, added or erased (see Figure 2.3).

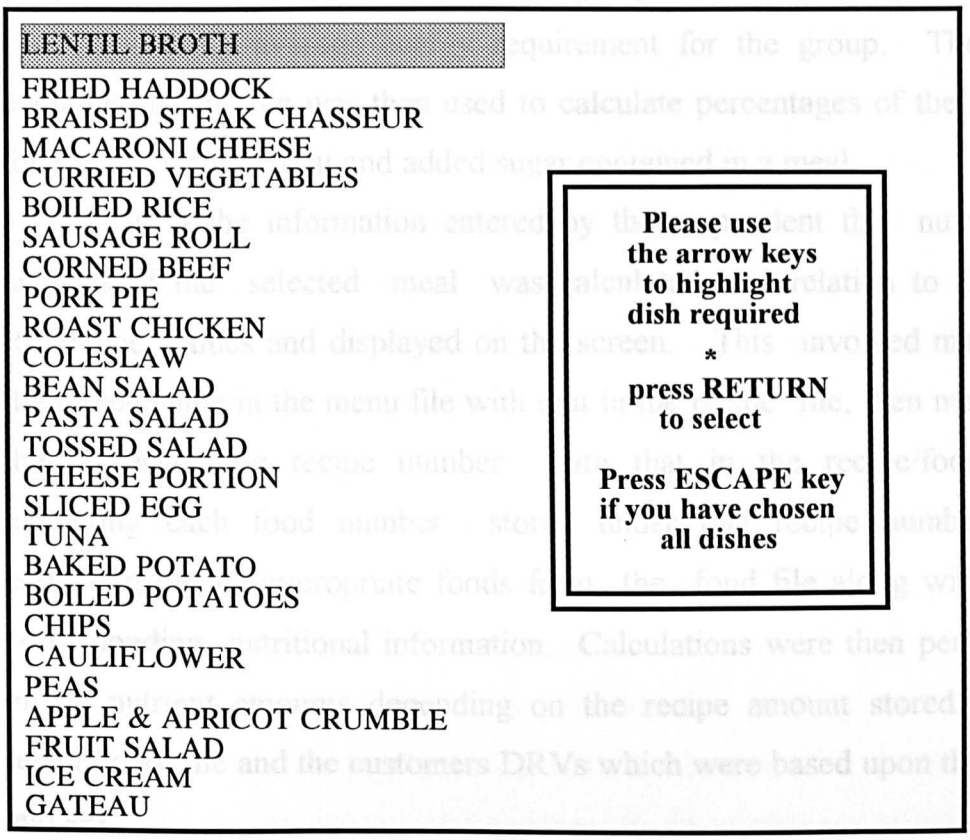
Figure 2.3 *Opening screen or user interface for the menu maintenance program.*



2.2.4 The Nutrient Analysis Program

To provide nutritional information on a meal the respondents approximate age, their sex and their food selections were required as input. This process was carried out through a series of user interfaces which prompted the user through a number of questions and on screen selections. Respondents keyed in their sex, either M or F, then their age. An onscreen question then asked if they had used the computer program before to which a Y or N was entered. This was to monitor repeat usage of the system when data was being collected on the food selections and consumer response later in the research. The menu in use then appeared displaying all the dishes on offer that day. The respondent selected dishes from the screen menu by the using the light bar which could be moved up and down the screen using the arrow keys on the computer keyboard (see Figure 2.4). The dish required was highlighted and the return key pressed to select that dish. This process could then be repeated allowing a number of dishes to be selected from a menu.

Figure 2.4 User interface used to select dishes from on screen menu



A file containing the Dietary Reference Values for energy (Department of Health, 1991b) for age groups of males and females was used to identify average energy requirement for the group. The data contained in this file was then used to calculate percentages of the DRVs for energy, saturated fat and added sugar contained in a meal.

Using the information entered by the respondent the nutritional analysis of the selected meal was calculated in relation to Dietary Reference Values and displayed on the screen. This involved matching the recipe name in the menu file with that in the recipe file, then matching the corresponding recipe number with that in the recipe/food file, extracting each food number stored under that recipe number and extracting all the appropriate foods from the food file along with their corresponding nutritional information. Calculations were then performed on the nutrient amounts depending on the recipe amount stored in the recipe/food file and the customers DRVs which were based upon their age and sex.

This schema cut down on the duplication of data and worked well when run with the test data of only 40 foods. However when all the food data was used the response time slowed considerably. An Amstrad 1640 personal computer could not process the large amounts of data quickly enough. Dish searches could last up to 30 seconds depending upon their location in the files.

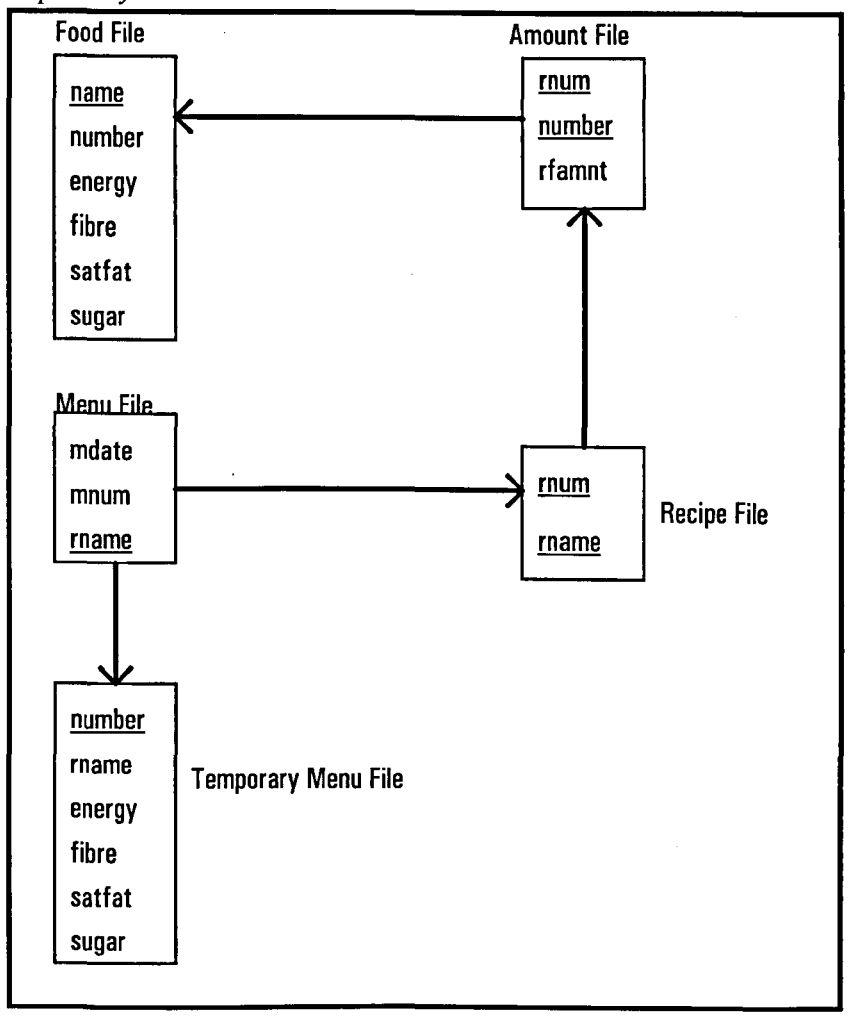
A DCS 386 personal computer was obtained which decreased the process time, searches now taking an average of 14 seconds per dish search. This meant however that a meal consisting of 8 dish choices could result in a process time of more than two minutes. When a dish was selected from a menu of approximately thirty dishes the entire contents of the recipe file had to be searched even though it was known that the majority of these dishes did not appear on the particular menu in use.

At this point it was decided to introduce a temporary file (Figure 2.5) which speeded up the access time considerably. This reduced the search time to approximately 1 to 2 seconds.

Information held in the temporary file comprised the complete data for one menu, that is, all dish names and attached nutrition information. This information was calculated using the data contained in all the other four files and invoked when a certain previously collated menu was selected for use. When a user selected a dish from a menu, the information was extracted from the file; this meant only one file had to be searched and therefore information retrieval was faster. The only requirement being, before a menu could be used for menu analysis on a particular day, a temporary file had to be created in advance containing the dishes from the menu with their corresponding nutrients.

The nutritional information provided by the system initially comprised of a simple output listing each nutrient and its corresponding amount. Simple adjustments and additions to the program controlling this output meant the information format could be changed to include graphical outputs and the inclusion of other items of information such as Dietary Reference Values (Department of Health, 1991b).

Figure 2.5 Relationship of the database files with the introduction of the Temporary File.



Key to abbreviations:

fnum : food code number
rnum : recipe code number
mnum : menu code number
fname : food name
rname : recipe or dish name
rfamnt : amount of food in grams in particular recipe
mdate : date menu was created
satfat : saturated fatty acids
sugar : added sugar
number : recipe number in temporary file

3. Testing the System

It is important to test any system before it is implemented in a real situation to ensure it will perform as expected and will complete the tasks it has been designed to carry out. The test phase will discover errors which may have arisen during programming or data transcribing. This stage also helps to ascertain whether the system meets the requirements of the application programs and the demands of the user.

The *alpha-test* is a dynamic test of the whole system which is used to show that the system is usable and capable of modification (Macro & Buxton, 1987). Both valid and invalid inputs and usages are tested to mimic the user. Known errors are included in test data to evaluate the reliability of the system.

Test data is used to test out all conditions that may arise therefore it includes data which is known to be invalid. The effect of oversize field items, zero and negative amounts, missing data, invalid combinations are a few of the errors tested for (Appendix III). The software programs should detect these errors as they happen. In most cases only valid responses are accepted from the keyboard and the program will not proceed until a valid response has been entered. For example only an M or an F can be entered into the Sex field, or an N or a Y in the Repeat field. Likewise the program can check for invalid ages or blanks. This process is known as error handling.

Test data were run through the programs quite successfully (*alpha-test*) but to be able to identify any operational problems the system had to be put to the test in a restaurant situation (*beta-test*). The *beta-test* succeeds the *alpha-test*. These tests determine the compliance of the

software system such as the "user friendliness" features, the speed of access and the comprehension of end data. System timing is another important feature of the *beta-tests*. Customers would soon become impatient in a restaurant if food service was delayed due to the menu analysis procedure, therefore it was necessary to calculate elapsed time for each routine. A number of timings had to be taken into consideration when calculating the processing time, including the physical keying in of customer details, dish selection from the on screen menu, hardware capabilities and software processing time.

Tests were carried out in the student Training Restaurant at The Robert Gordon University. The Training Restaurant is run by Hospitality Management students and is open to all University staff, students and the general public.

The *beta* system tests involved the use of a portable computer, a Toshiba 1200 80C86-1 microprocessor, linked to a line printer, an IBM pro-printer. This equipment was located behind the cash counter within the Training Restaurant.

The objectives of the tests were to help identify any operational problems with the equipment used, errors in the running of the software and problems in providing the nutrition information to the customers.

The temporary database file containing one days' menu was fed into the portable computer. Average portion sizes were used for establishing each dish's nutritional value. For nutrition information to be provided accurately on a dish or a meal requires the exercise of strict portion control. The Training Restaurant, like most commercial catering outlets, adheres closely to the use of standard portion sizes.

Small cards on each table explained to the customers that nutrition information was being provided on the meals being served.

Information about the customers choice of meal was conveyed to the researcher by an undergraduate student who were acting as a waiter or waitress in the Training Restaurant. Several different students were involved in this exercise.

This information was keyed into the computer along with the customer's gender and the student's estimate of the customers approximate age. This is in line with the criteria required to select age and gender group for the determination of the appropriate Dietary Reference Values (Department of Health, 1991b). Using this information the full nutritional analysis of the customer's meal was printed out for the customer's perusal.

The satisfactory outcome of both the *alpha* and the *beta-tests* should be sufficient to classify the system as "valid" (Macro & Buxton, 1987).

The *beta-tests* highlighted certain limitations in the provision of the information, mainly in the equipment used. The portable computer was located, with the printer, near the cash desk in the Training Restaurant, this meant travelling between computer and customer to collect details and deliver nutrition information. Clearly this all resulted in time delay and if the customer wished to change their mind on a food choice they had to request another printout, thus delaying the ordering process even further.

Using the information that had been generated by the testing of the system, further steps were taken to enhance the computer system. This consisted of two stages. Firstly the P.C. system was further enhanced by the creation of a self-prompt system, while a further development included the use of a hand-held computer.

It was thought that the development and use of a hand held device could provide the on-the-spot information needed in such a situation. Customers could therefore make a selection from the menu, be shown,

there and then, the nutritional breakdown of that selection and be able to confirm their choice or change to a different selection. Time delay in retrieving the nutrition information would be restricted to how long it would take to key in the dishes selected and for the information to be retrieved and displayed on the screen. Therefore the next stage of the project was the further development of the computer system which included the use of a hand held computer to provide the nutrition information.

The hand held system is intended to be operated by a waiter or waitress and information is displayed to the customer. The self prompt system is used by the customer to extract information for themselves. Both systems operate in the same way, displaying and collecting data an identical manner.

4. The Menu Analysis Computer System.

Using the P.C. based nutrition information system the customer is welcomed to the self prompt system by means of an opening screen. He or she then enters age and sex as requested. The customer is then asked if they have used this program before. The menu in use that day then appears on the computer screen. Using the arrow keys the customer can move a light bar over the foods available (see Figure 2.4) and select by pressing the return key. The computer retains the menu on-screen until all dish selections have been made by the customer. The customer can, in this way, select as many dishes as he or she wishes. Once completed the escape key is pressed to terminate the dish selection procedure and the nutrition information corresponding to that meal is displayed on the screen. The customer is then asked if they wish to change their selected meal. If they wish to do so, the process is repeated as before. If not the computer prepares itself for the next respondent.

The hand held version is a variation of the P.C. based system providing the same end information to the consumer.

The Psion Series 3 is a pocket sized programmable computer using its own powerful graphics programming language (OPL/W). The programming language was used to devise a number of programs which would display nutrition information in a number of formats, both graphical and tabular. The information required to produce the nutrition information on one meal was contained in one file which was down-loaded from the database onto the P.C. using the Temporary file. This file contained details of each dish on a menu with corresponding nutritional values for the dishes.

Nutritional information could be extracted by the use of a number of short programs and output presented in a variety of formats. Respondents age and sex were entered as before and meals were selected by entering the corresponding number of dish. Tabular and graphical presentation of the data could both be produced. Shading and blocking made the graphs more readable although the size of the screen on the Psion, 97mm by 39mm, did limit the amount of information shown at any one time.

Both systems could therefore present nutrition information on any meal in a variety of layouts. It had now to be determined which method of presentation the nutrition information should take to allow consumers to effectively comprehend and utilise that information.

Chapter 3

The Nutritional Formats

Introduction

The provision of nutritional declarations on foods is voluntary although the government encourage the food industry to provide nutrition information on their products and have published guidelines to be followed (MAFF, 1988). Information has generally been presented on food labels in the form of a table with amounts of nutrients given per 100 grams of the product, with additional information on amounts per serving and per pack also occasionally being displayed.

Government guidelines and EC regulations specify the use of the "Big Four" (energy, protein, fat and carbohydrate) when nutrition information is being displayed on the label of a food (MAFF, 1988; EC, 1990). Other items can be displayed on the label as additional information, including the breakdowns of fat and carbohydrates to show saturates and sugars respectively; sodium and fibre may then also be given. Some people have criticised this as being an insufficient amount of data which could be misleading (London Food Commission, 1991); even the relevance of the information given has been questioned (Coronary Prevention Group, 1992). Nutritional composition means little to many consumers who do not have the technical expertise to perform the calculation required to interpret it. It is clear from previous studies (Hackleman, 1980) that people do require additional information to be able to make any kind of judgment on their choice of foods. The supply of data on the foods consumers eat will only be considered useful if that data is in an understandable form (Russo, 1975). Display of nutrition information as recommended by the Government guidelines involves displaying eight figures, two of which are components of another two. Information is presented per 100 grams of a food. Since few products come in 100 gram packages consumers have to be able to calculate for

themselves how much of a nutrient is in a product as a whole or is present in an average serving of that product as such information is not always readily obtainable.

Some labels do provide information on average servings but do not relate to daily recommendations of nutrients therefore the customer cannot gauge how nutritionally well balanced that meal may be. All this is likely to be confusing to many people.

A joint survey of the Consumer's Association, the Ministry of Agriculture, Fisheries and Food and the National Consumer Council, (1985) attempted to identify the best method of presenting nutrition information on foodstuffs. Results indicated that consumers wanted a visual label they could understand quickly and which would allow them to compare similar products.

By interviewing consumers, their opinions, beliefs and ability to understand nutrition information on labels was assessed. Six label formats were tested on consumers. Each label showed a minimum of four figures, these being the energy (kcals and kilojoules), fat, carbohydrate and protein. Label A broke fat down into saturates and polyunsaturates. Labels B and F used barcharts to illustrate amounts. Label C made use of a pie chart for illustrating percentage of energy derived from fat. Label D showed the least information, tabular format with gram amounts for nutrients and kcals and kilojoules for energy, but did include the amount of saturated fatty acids. Label E used high, medium and low bandings as additional information. Each label differed quite considerably from each other in the use of terminology, positioning and the amount, and presentation of, information. Information was presented per 100 grams of the product and did not relate to portion size. Respondents were questioned on their ease of understanding of the labelling formats,

their preferences and reasons for these preferences. The study found there was a difference in what people say they like and what they can use. People were visually attracted to the graphical formats yet performed more accurate calculations using the tabular presentations. Many of the technical terms used on the labels, e.g. kilojoules, kcals and polyunsaturates were found to be confusing. The variations in the formats would make it difficult to pin-point exactly why one format may have appeared to perform better than another. The report suggests further testing of nutritional formats is required. Consumer responses to nutrition information need to be more closely examined.

The Consumers Association (1990) reported on consumer uses of, awareness of, and attitudes to nutrition information. The survey of 686 shoppers concluded that many find nutritional labelling misleading and complicated although 44% of the sample group said they used nutrition labels. It was generally felt that the information being given does not always allow for comparison between products and that certain terms used were not understood. The main items looked for were saturated fat, sugar and 'calories', however some of these were not always displayed on the nutritional labels of products.

A Food Labelling Survey carried out in England and Wales (MAFF, 1990a) attempted to identify what people looked for on labels and what they claimed to use. The study undertook to quantify precisely what people found confusing about food labels and why. A total sample size of 1028 people were interviewed. When asked what they looked for on labels, 22% answered nutrition information when unprompted; this rose to 44% when prompted. Eight percent of the total sample said they found nutrition information confusing, this confusion being caused mainly by

calorific values, terms used and a general lack of relevant information on the labels.

Scouller (1992) endeavoured to determine if the format proposed by the EC was really the most useful design for the consumer to use. Three label designs were tested on 120 respondents: the EC tabular format; a barchart layout; and a piechart design. No significant differences were found in ease of understanding or usefulness. Dietary recommendations were not displayed on the labels but Scouller suggested that these should be included for the nutrition information to be of any use to consumers. She found that most respondents did not know what their RDAs for nutrients were. When tested on average portion weights it was found that significant differences occurred between the average portion weights of the foods and the respondents estimated weights. Scouller suggested any label format should indicate nutrition information per portion.

There have been a few studies into the methods of presenting nutrition information in restaurants. One of the major problems in the provision of nutrition information in catering outlets is how to present all the necessary information to the consumer, allowing them to make a healthy food selection, without overloading them with information.

The Riverside Health Authority introduced a scheme called "Star Struck" into hospital catering departments (Hancock, 1992). Coloured stars were used on menu boards and at point of sale next to the foods. Leaflets also gave general information on healthy eating. The system was tested out in two sites, the staff restaurant in the Westminster Hospital, London, and the National Grid Company's staff restaurant, also in London, for a period of four weeks during March 1990.

Questionnaires were used to collect the data combined with interviews at the tables during lunch periods. Data collected comprised of what the customers thought of the scheme and the information provided. Respondents were also asked whether the information would influence their food choice. From a sample size of 368, 90% were positive about menu labelling and 65% found the scheme useful. Doubts were expressed as to whether the information provided was accurate and detailed enough. Only 16% said the star struck scheme had influenced their choice of food. The researchers suggested that further studies should investigate sales figures to determine whether consumer food selection was indeed being influenced by the introduction of nutritional information (Williams & Poulter, 1991).

One other method used to present nutrition information is the Traffic Light system. Foods are colour coded using red to signify foods high in fat and/or sugar, amber for foods which should be chosen only with care and green for "healthy choices". In tests carried out in a school canteen, food sales were found to change to reflect the healthy messages being put across by the Traffic Light scheme (Marks, 1986).

The Coronary Prevention Group put forward Nutrition Banding as the solution on how to provide nutrition information in an easy to understand form (Coronary Prevention Group, 1987 & 1990). The scheme provides four bandings from high to low, focusing on fat, saturated fat, sugar, salt and fibre. Dietary targets are set and the band ranges specified. Although the system is clearer than many others, it does not directly link dietary recommendations to consumption. The system would also require a large public education program before implementation to help people understand and use the information being provided.

Similar suggested schemes include the use of "Face" labels, sad versus smiling faces or the use of coloured, half coloured and blank squares to show high, moderate or low levels of the nutrient in question (Anon, 1984).

These methods of presentation take away the need for any form of calculations on behalf of the consumer by making the judgment for them. However such banding systems have been questioned as being too simplistic in their approach (Finch, 1986). Cut off points for the classifications in these banding methods are arbitrary.

Above all it is still difficult for the consumer to establish whether or not their nutrient intakes are most suited to their daily needs.

It is clear from the above studies that further research is required into how best nutrition information can be visually presented to the consumer to allow ease of interpretation and comparison between products. The next stage of the research aimed to find out whether consumers can use certain nutritional formats with more ease than others and if an optimum method for displaying nutrition information could be identified.

Method

Eight formats for presenting nutrition information were devised comprising tabular and graphical designs (Appendix IV). Each format differed in only one aspect from another to allow the effect of each difference to be investigated. (Table 3.1).

Table 3.1 The design of the nutritional formats.

	Type of Format	Individual Dishes shown	DRVs stated in	X-axis title & features
1	Tabular	yes	amounts	n/a
2	Tabular	no	amounts	n/a
3	Tabular	no	%	n/a
4	Barchart	no	%	numerical scale
5	Barchart	no	%	as four with 3 meals division
6	Barchart	no	%	"What you should eat each day"
7	Barchart	no	%	as four with arrows to suggest a lower or higher intake
8	Barchart	yes	%	as four

Dishes were named A, B or C when used to make up a meal. The energy content for each meal was constant at 650 kcals. The other three nutrients were present in the meal at 50% of the DRV (high) or 10% of the DRV (low). This results in all the possible combinations as shown in Table 3.2.

Table 3.2 The combination of the three nutrients in the meals.

Meal Code	SFA	NSP	NMES	Score*
a	L	H	L	4
b	L	H	H	3
c	H	H	L	3
d	L	L	L	3
e	H	L	L	2
f	L	L	H	2
g	H	H	H	2
h	H	L	H	1

Simulated meals were created to incorporate high (H) or low (L) amounts of saturated fatty acids (SFA), non-starch polysaccharide (NSP), and non-milk extrinsic sugars (NMES) and were scored for healthiness.

** Each meal was given a rating on its "healthiness" based on the following scale of how frequently the meal should be eaten by the respondent :*

1 Try to avoid

2 Eat occasionally

3 Eat quite often

4 Eat frequently

The rating or score is the response expected from the respondent for that nutrient combination. Using this four point scale the respondent was asked to give each meal shown to them a score of one to four according to which of the four categories they felt that meal should be placed. To measure the effectiveness of a format the following equation was calculated:

$$\text{Score} = \text{Absolute } (x - y)$$

x = the proposed rating for that meal.
y = the rating given to the meal by the respondent.

The randomised testing of the eight formats and the nutrient combinations was controlled by the use of a Graeco-Latin square (Cox, 1958). The use of the Graeco-Latin square (Table 3.3) ensures that each nutrient combination (a-h) appears only once with each nutrition format (1-8). In this way 64 laminated cards were printed to be used in the pilot and subsequent tests.

Table 3.3 Graeco-Latin Square used to test out the nutritional formats.

1a	2h	3g	4f	5b	6c	7d	8e
2b	1g	4h	3e	6a	5d	8c	7f
3c	8f	5a	2d	7h	4e	1b	6g
4d	7e	6b	1c	8g	3f	2a	5h
5e	6d	7c	8b	1f	2g	3h	4a
6f	5c	8d	7a	2e	1h	4g	3b
7g	4b	1e	6h	3d	8a	5f	2c
8h	3a	2f	5g	4c	7b	6e	1d

Numbers 1 to 8 represents the layout format or presentation (Table 3.1). The letters a to h represents the nutrient combination of high and low amounts (Table 3.2).

Pilot Study.

A pilot study was carried out as an operational exercise to assess how well the testing of the nutritional formats had been designed and to identify any further changes required in the method. The study was carried out within Norco Superstore, Aberdeen, a large supermarket. Customers were approached at random, by either the author or her assistant, within the main foyer of the store as they entered and asked to help in a research project.

Respondents examined eight nutrition information formats individually and rated each meal displayed using the one to four scale depending upon how frequently they would choose the meal displayed. The decision was based on their own nutritional knowledge and the information with which they were being presented. No further guidance was given.

Main Survey.

The next stage of tests incorporated some features which would allow the collection of additional forms of data.

Customers at the food court in the Bon Accord shopping mall in Aberdeen, who appeared to have finished their meal were chosen at random so as to cause as little disruption as possible. While respondents were asked preliminary questions their sex and approximate age was noted by the assistant.

Firstly respondents were asked three simple questions about general nutrition to estimate their basic nutritional knowledge.

1. Would increasing your intake of saturated fats be good or bad for you?

2. Should you try to increase or decrease the amount of fibre you eat?

3. Is decreasing the amount of sugar you take good or bad for you?

The three questions did not have the same format, in this way respondents could not give stock answers and had to interpret the question before answering.

Having answered these questions the respondent was awarded a score out of three.

The eight formats were then shown to the customer in the order controlled by the Graeco-Latin square. The time respondents took to answer was recorded by the assistant who used a small digital stop-watch that was unseen by the respondent. Response time was recorded to the nearest second.

Respondents were then asked, in which order they looked at the four nutrients when making their judgment.

Next the respondents were asked approximately how frequently they ate out in restaurants, canteens, bars, and similar places.

Finally, respondents were asked if they would like to see nutrition information provided in restaurant and canteens.

Statistical Techniques

The following statistical techniques were used to analyse the data collected (Ryan *et al.*, 1985).

Friedman's Two-Way Analysis of Variance by Rank was used to analyse the scores data (Porkess, 1988). This is a non-parametric test of the null hypothesis, i.e. the test makes no assumptions about the parent distribution, e.g. if it were normally distributed or not. All tests involving the ranks of data are non-parametric.

The correlation coefficient was calculated to measure any association between the ratings and the timings taken for the formats.

The timings taken were analysed using a Two Way Analysis of Variance to investigate how much variability in the observations could be ascribed to different variables, i.e. the respondent and the format.

Least Significant Difference Analysis was then used to find any differences that occurred between pairs of formats.

Data obtained on the preferred order of nutrients was analysed by totalling the number of times a nutrient was mentioned first, second, third or fourth. A weighting of one to four was then attached to each of these totals.

Results

Pilot Study

During the pilot study a total of 262 respondents' answers were collected over a two week period. Table 3.4 shows the difference between the expected scores and the actual or observed scores allocated by the respondents.

Table 3.4 Difference between expected and actual scores to eight different formats in the Pilot Study.

Format	Mean difference	Standard Deviation
1	0.83	0.80
2	1.02	0.83
3	0.85	0.67
4	0.76	0.63
5	0.74	0.67
6	0.89	0.68
7	0.82	0.66
8	0.81	0.75

Subjects (n = 262) were asked to score the 'healthiness' of meals presented in 8 different formats. The mean difference between their score and that assigned by the author was calculated.

Main Survey

A total of 271 customers were approached in the Food Court, of these 55 refused to take part in the survey. Of the 216 successful completions 93% of the respondents answered all the nutritional knowledge questions correctly, the remaining 7% correctly answered two out of the three. None of the respondents scored less than two out of three.

The distribution of ages comprised 18% at 25 years or under, 52% aged 26 to 45, 25% were 46 to 64 and 5% were aged 65 or older. Overall the gender split was 39% male and 61% female.

The order of nutrients obtained was as follows: saturated fat was looked at first most often with a weighting of 581 then fibre with 572, thirdly calories with 552 and finally added sugar with 455 as a weighting.

Only 1% of respondents claimed they did not eat away from home, others were divided as follows: 22% of the respondents claimed to eat away from home more than three times a week, 45% one to three times a week and 32% less than once per week.

When asked their opinion about the provision of nutrition information in restaurants and canteens, 80% said it should be provided, 18% said it should not, 1% of the sample was unsure and a further 1% said that nutrition information should be provided in places such as canteens but not in restaurants.

Table 3.5 Comparison of differences between expected scores and the actual scores obtained for the label formats in main study.

Format	Mean difference	Standard Deviation
1	0.79	0.68
2	0.85	0.79
3	0.78	0.70
4	0.75	0.67
5	0.77	0.65
6	0.86	0.62
7	0.75	0.64
8	0.68	0.65

Subjects (N = 216) were asked to score meals presented in 8 different formats. The mean difference between their score and that assigned by the author was calculated.

The Friedman's Two-Way Analysis of Variance by Rank resulted in M = 6.82. At the 5% level of significance the critical value is 14.07 therefore the null hypotheses, i.e. there was no significant difference between the formats, was accepted.

Table 3.6 Number of people giving each score for each meal.

Meal Code	1	2	3	4
a	10	31	94	81*
b	38	103	63*	12
c	47	109	43*	17
d	39	103	62*	12
e	121	61*	27	7
f	106	69*	29	12
g	87	90*	35	4
h	142*	51	14	9

The meal code (type of meal) is explained in Table 3.2. The score suggested by the author as "correct" is shown by an asterisk.

Table 3.7 shows the results between pairs of formats when one difference occurred in the combination of nutrients. In the first case where saturated fat is lowered, secondly where fibre increases and thirdly where sugar is decreased. The means are displayed for the two formats being compared along with the mean difference and the result of a Chi-squared test.

Table 3.7 Comparison between pairs of formats to illustrate effect of one difference in the combination of nutrients.

SFA	NSP	NMES	Means	Mean Difference	X^2
V	L	L	1.63->2.22	0.59	67.9
V	H	L	2.14->3.14	1.00	128.3
V	H	H	1.80->2.22	0.42	32.1
V	L	H	1.49->1.75	0.26	13.6
Mean of Mean Differences				0.59	
L	Λ	L	2.22->3.14	0.92	113.6
H	Λ	L	1.63->2.14	0.51	54.0
L	Λ	H	1.75->2.22	0.47	51.4
H	Λ	H	1.49->1.80	0.31	34.9
Mean of Mean Differences				0.55	
L	L	V	1.75->2.22	0.47	49.7
H	L	V	1.49->1.63	0.14	6.94
L	H	V	2.22->3.14	0.92	112.3
H	H	V	1.80->2.14	0.34	22.6
Mean of Mean Differences				0.47	

Λ indicates the nutrient level rose from a Low amount to a High amount from one format to the next. V indicates the nutrient level dropped from a High to a Low amount.

The analysis of the scores provided no basis upon which to prefer one format over the rest, but the analysis of the times taken by each respondent to react to each format showed distinct differences. (See Table 3.8).

Table 3.8 Comparison of average response times taken by respondents to select a score for each format.

	Time (seconds)	
Format	Mean	Median
1	28.4	23
2	19.2[b]	15
3	15.7	12
4	10.7[a]	8
5	11.1[a]	9
6	10.7[a]	9
7	9.5[a]	7
8	22.3[b]	15

The time taken by the subjects to interpret and respond to the formats was tested for significance after log transformation and formats without a common letter (a and b) are significantly different at $P < 0.05$.

According to this data format 1 appeared to be the most difficult format to use and decipher, followed by format 8. The format which the respondents reacted to quickest was format 7, with formats 4 and 6 following in that order.

Since the mean is higher than the median the data is clearly skewed. When log transformed it approximated a normal distribution

and was analysed using a Two Way Analysis of Variance; the two factors being the people and the formats (Table 3.9).

Table 3.9 Analysis of Variance for timings

SOURCE	DF	SS	MS	F-Test	
PERSON	215	41.91	0.1949	2.58	P<0.01
FORMAT	7	53.44	7.6347	101.8	P<0.01
ERROR	1505	113.43	0.0754		
TOTAL	1727	208.79			

SS (sum of squares) when divided by the DF (degrees of freedom) gives an estimate of the variability (MS) being due to the treatments (person and format) and the random error. (Data log transformed).

This shows that significant differences occurred between the groups, that is the person and the format both affected the times collected.

The total scores for each person were correlated with the total times taken by each respondent with a coefficient of only 0.096, which shows no relationship between the time taken and the score.

Discussion

The names of the actual dishes were not used on the formats because the inclusion of a food name could falsely influence the respondents reaction to the information being presented. Presentation therefore was anonymous i.e. no dish names were shown, instead Dish A, Dish B, etc were used where appropriate.

Originally the meals used were based on actual meals and reflected their nutritional breakdown. However varying amounts of nutrients might influence differently, resulting in respondents looking at individual pieces of information rather than at the nutritional breakdown of the meal as a whole. To reduce any bias the high and low levels for each nutrient were devised. 50% of the DRV set down by COMA (Department of Health, 1991b) was used as a high amount while 10% of the DRVs was set as the low amount. While it is possible for foods and meals to have greater than fifty percent of the DRV for SFA and for NMES, the same does not easily apply for NSP intake. Fifty percent of the DRV for NSP is nine grams per day, and while a few meals may contain more than this there is only a limited number and the desire was to reflect every day types of foods that might make up a meal. The ten percent level for the low value was seen to be sufficiently low to be judged as a low intake of that nutrient.

Energy content was set at a third of daily suggested intake and remained the same for all eight formats so that respondents were not unduly influenced by number of calories alone, as may happen in the case of those on calorie controlled diets. The four categories used by the

respondents to rate the formats were quite broad in interpretation and not technical in nature.

As a number of factors influenced the way respondents would perceive each nutritional breakdown, i.e. an individual's knowledge and conceptions about nutrition as well as their own personal eating habits, a precise scoring system of either right or wrong could not be achieved. The study attempted to determine whether people could obtain the correct message from the nutritional layouts and which one achieved this best. In theory the lower the difference between the respondents rating and the perceived rating the more effective the format in relaying the nutritional information it represented, the higher the result then the less effective the format.

The randomised testing of the eight formats and the nutrient combinations was controlled by the use of a Graeco-Latin square. A Latin square is used to eliminate the effect of two sources of uncontrolled variation. A Graeco-Latin square arises from the need to introduce a further classification. It is arranged so that each treatment occurs once in each row and column and once with each of the other treatments.

The pilot test was carried out to provide feedback for the main test stage of the nutritional formats. The main aim was to disclose any operational problems in showing people the nutritional formats and asking them to respond to the formats.

A number of conclusions were drawn from the pilot study. Firstly the use of a supermarket was considered to be an inappropriate environment in which to stage the tests. Since the project was primarily concerned with the provision of nutrition information in catering outlets

this sort of environment was thought to be more appropriate for future tests. It was noted that people took varying amounts of time to assess each format and respond to it.

Consequently the next stage of tests measured how long each respondent took to answer when looking at the nutrition information formats. The order that the four nutrients appear in could also have some significance. The author was interested to find out if people looked for one or two particular nutrients above any others and if presenting in this preferred order would be more helpful to consumers. The study aimed to find this preferred order for the nutrients which could then be used in the future. The main survey incorporated all of the features that were missing from the pilot study, with both quantitative and qualitative data about subjects being collected.

The subjects had been asked for a decision based on frequency of consumption of the meal rather than a yes/no answer because many would expect to consume "unhealthy" meals as a treat in a restaurant, but not necessarily at home. There is a clear understanding that lowering saturated fat and added sugar and increasing dietary fibre improve the diet, as shown by the increase in score, and the subjects apparently did not give greater weight to any one of them.

Analysis revealed there were only slight differences between the performance of the eight formats and these differences were not significant. This provided no solid basis to decide whether one format performed better than any other. The comparison between the mean scores given by the respondents and the *"correct"* mean score helped to identify how *"correct"* or *"wrong"* the respondent's thinking was. The majority answer from the respondents and the correct answer did not

always coincide but there was never more than a difference of one between the two. It could therefore be said that the majority of respondents were reacting correctly to the nutrient combinations being displayed. This feature, along with the data on the respondents basic nutritional knowledge did seem to indicate that the majority of the respondents had a basic knowledge of nutrition.

It appeared that comparison between the subjects' scores and those expected would be a reasonable way to compare the labelling formats, with the expectation that formats leading to lesser differences would be permitting superior decisions to be made. Using this criterion, no differences between formats could be detected, but some formats were associated with decision times almost 3 times those of other formats. Formats one and eight produced the largest average response times overall. This could be attributed to their shared feature of showing each dish's separate nutrition information as well as an overall figure for the meal, thus providing the consumer with more data to interpret before coming to any decision. With the exception of format eight large differences in average response times were found between the tabular and the graphical formats. It is suggested that this could be attributed to the fact that respondents had to work with figures when looking at the tabular formats, thereby taking longer to assimilate the information. The graphical formats were more visual in their effect and could therefore be easier to assimilate and understand. It appeared that graphical formats provided information for quicker decision making and that the addition of data for individual dishes was counter-productive.

The Coronary Prevention Group (1992) also timed people, but did not score their decisions, and the number of people in their study was

limited to 8 per group. They showed that the time people took to make decisions using numeric analytical data on 8 nutrients was 30 seconds and this was not improved by giving them the information as 'high' , 'medium' or 'low' (29 seconds). In another of their studies, changing from 7 to 5 nutrients on the label reduced the time taken from 31 to 23 seconds. When they gave the numeric information supplemented by their verbal banding of 5 of the foods the time was 16 seconds. When the words were incorporated into bars, this improved to 14 seconds. Due to the small numbers involved in their study, definite conclusions can not be made, but the times found in this study are similar to their findings, and, in both cases, it appears that when the amount of data provided is reduced, so is the processing time.

It was concluded that all formats provided information sufficient to permit the sample of the public questioned to make sensible decisions about the frequency of consumption of meals, but that the time taken could be used to differentiate between formats. Generally there were small improvements in timing when formats were presented graphically and as percentages of the DRVs rather than as tables of analytical data with the DRVs, and also the time was lengthened by providing additional data on each dish in the meal. Overall format 7 had the lowest average response time and also the joint lowest mean difference for the ratings collected. On the basis of the analysis carried out format seven appeared to be the most obvious format to select for use in the computerised nutrition information system which was to be used to provide nutritional analysis on meals in restaurant and canteens in the next stage of the project.

Chapter 4

Consumer Response to the Menu Analysis System

Introduction

The nutritional formats tested in the food court study had enabled the identification of a format which could be successfully interpreted and understood by the customers of a food service outlet. The identified format was integrated into the computerised menu analysis system, the development of which was described in Chapter 2. This integration allowed the nutritional breakdown of any selected meal to be displayed to the customer in a graphical manner (Appendix VI : attached disc).

The aim of the next part of the study was to determine what effect, if any, the provision of the computerised nutrition information had on consumer food choice in a restaurant or canteen. Customers made selections from the menu and the corresponding nutritional profiles of the meals selected were displayed using the identified format. Respondents were given the opportunity to change their selected meal. The menu analysis system recorded all initial meal choices and any subsequent changes made to that selected meal. The meal choices made by the respondents who changed and by those who did not change were then compared and analysed to determine what changes had occurred, thereby establishing the effects the nutrition information had on the customers' meal choice.

A pilot study was designed to allow for evaluation of the menu analysis system.

Pilot Survey

Method

The Psion Series 3 hand held computer was used to collect consumer response to computerised nutrition information within the Training Restaurant at The Robert Gordon University where the customers comprised staff, students and members of the public. Data were collected over a seven week period. Menus and recipes were obtained for every Tuesday, Wednesday and Thursday, the days the Training Restaurant was in operation. Recipes were entered into the database and daily menus devised. Data for one lunchtime menu was down loaded onto the Psion hand held computer from the database files stored on the P.C. These data consisted of the dish name, energy amount in kilocalories, dietary fibre (Southgate, 1981), saturated fatty acids and added sugar, all in grams per portion.

Notices were posted outside the restaurant entrance, and in prominent positions within the bar service area, informing customers about the research project in progress (Appendix VA).

Undergraduate students, operating as table waiting staff in the restaurant, operated the hand held computer. All students were instructed on the procedure to follow:

- Customers to be approached before the order is taken by the waiter or waitress.
- Ask customer if they had taken part in the research before.
- Key in customer's response plus customer's gender and approximate age.
- Ask customer to select dishes from the menu (starter, main course and accompanying vegetables), and key all choices into computer.

- Show the displayed nutritional information to the customer. When doing so say to the customer "*This is the nutrition information on your meal*", (pause) "*would you like to change?*" If response is yes repeat dish choice operation.
- Thank customer for taking part in the project.
- Note that no other help or advice is to be given to the customer.

All data collected from the respondents was automatically recorded and stored by the hand held device for later data analysis.

Respondents were classified as either single choice or double choice depending on whether any changes were made to the meal once the nutrition information had been viewed. Other classifications used to subdivide the data consisted of first time users and repeats, i.e. had the respondent used the system previously.

T-tests and paired t-tests (Ryan *et al.*, 1985) were used, as appropriate to assess whether differences in the average nutrient amounts of the meals being chosen were significant.

Results

Responses from 128 customers were collected. A total of 19 respondents (14%) changed their initial meal selection by making a double choice of meal. A total of 27 (22%) respondents were repeats, that is, those who had used the menu analysis system before. The respondents comprised 74% females and 26% males.

Table 4.1 Average meal choices made by double choice respondents in the pilot study.

	1st meal selection	2nd meal selection
Energy (kcals)	1031	1025
Fibre (grams)	9.6	10.8
Saturated Fat (grams)	20.4 *(18%)*	20.3 *(18%)*
Added Sugar (grams)	16.7 *(6.5%)*	17.8 *(6.9%)*

N.B. The figures in brackets represent percentage of energy from SFA and NMES.

No differences were found to occur between the mean nutrient values of the two meal choices made by the double choice respondents (Table 4.1).

Table 4.2 shows the average first meal selection made by the double choice respondents compared with the single choice respondents. Once again no differences were found to occur between the means of the selections made. Comparisons were also made between the repeat users of the system and first time users. No significant differences were found to occur between the average choices of these groups of respondents.

Table 4.2 Average first meal choices made by single and double choice respondents in the pilot study.

	Single Choice	Double Choice (1st meal choice)
Energy (kcals)	1020	1031
Fibre (grams)	8.9	9.6
Saturated Fat (grams)	20.7 (18%)	20.4 (18%)
Added Sugar (grams)	14.8 (5.8%)	16.7 (6.5%)

N.B. The figures in brackets represent percentage of energy from SFA and NMES.

Discussion

The pilot study, carried out in the University's training restaurant, allowed for the evaluation of the effectiveness of the computer system as well as the identification and subsequent correction of operational problems. The use of the hand held computer allowed the customer to quickly view the nutritional composition of any meal selected while seated at their table. This also eliminated the need for producing time-consuming printouts. Due to the nature of the table service responses were collected from all customers, who were not given the option to refuse involvement and were essentially a captive audience. Although a portion of the respondents collected in the pilot survey did change their initial meal selection after viewing the nutritional status of that meal, no significant differences were found to occur in the comparison of average first selections with second selections. Likewise no differences were found between the average choices made by those who did not re-select their meal and those who did re-select.

The average meal choices made by the respondents in the restaurant were relatively high in saturated fat with 18% of energy being derived from saturated fatty acids. This is well above the DRV for saturated fatty acids of 11% of energy. Added sugar content was relatively low in the selections made, approximately 6% of energy being derived from NMES. However the sweet courses did not contribute to the total nutritional figures obtained in the pilot survey because only the starter and main course choices were taken by the waiter at that stage. Sweet courses were ordered at a later point in the meal and were not included in the meal analysis. For the purposes of a pilot it was decided that the sweet courses could be omitted from the study. This should therefore be borne in mind when viewing the data collected in the pilot study.

It must be noted that scope for change in using a table d'hote menu system was limited to two or three starters, three main dishes and four vegetable dishes, therefore those customers who wished to change their initial selection may have been prevented from doing so by the lack of suitable alternatives. Those who did re-select their meal were limited as to how "healthy" they could make their second choice. Meals served in the training restaurant are mainly table d'hote and tend to be high in fat content thus allowing little scope for reducing energy or saturated fat in the meal. Respondents might have compensated for high fat levels in main courses when making their sweet selections, however the study design precludes analysis of this possibility.

The introduction of new food tables (Holland *et al.*, 1991) allowed for the update of the database before the main study began. This essentially meant that NSP figures for foods replaced the Southgate (1981) figures used in the pilot study. This brought the study in line with the nutrients prescribed in the Department of Health report (Department of Health, 1991b).

The pilot study looked mainly at operational matters but the results obtained led to a change in the design of the main study. The feasibility of using a computerised system in a restaurant environment was established by the pilot study, however the use of the PC based system prior to entry to the canteen would gain an overall picture of the total meal profile, all courses included. Despite lack of significant results from the pilot study, it was considered worthwhile to continue with the main survey with these enhancements.

Main Survey

Method

A number of catering establishments were contacted in order to find suitable locations within which the menu analysis system could be set up and used to collect consumer food choice data. Two outlets responded positively to this request: Kelvin Catering International which operates the staff restaurant within Shell UK, Altens, Aberdeen, (Restaurant A); and the catering unit within Aberdeen Royal Infirmary, (Restaurant B), which operates the staff canteens and produces patient meals.

Initial visits were made to each location to assess suitability for the study, throughput of customers and possible siting of computer equipment.

Dates and times in which it would be appropriate to carry out the study were also discussed with the Catering Managers.

Both outlets operate self-service systems with a number of service stations, some manned by catering staff, offering a selection of hot and cold dishes, sandwiches, snacks and beverages. The staff restaurant at Shell, Restaurant A, is fully subsidised by the company and all employees may use the restaurant free of charge. The canteen within the hospital, Restaurant B, charges staff for meals, each dish or item being individually priced. Both outlets operate menu cycles, Restaurant A using a twelve week cycle and Restaurant B a four week menu cycle.

Lunchtime menus and corresponding recipes were obtained and entered into the database. Two Olivetti 640K Personal Computers were loaded with the menu analysis program. At Restaurant A the computers were placed just outside the restaurant service area beside the menu boards (Figure 4.1). At Restaurant B the two computers were located in a similar position beside the entrance to the service area just within the restaurant

main entrance where the daily menu was displayed along with the prices for each item (Figure 4.2). In both cases, interviewing of customers took place before the foods on offer were viewed, that is, before the customer entered the food service area.

Figure 4.1 Plan of Restaurant A showing location of computer equipment.

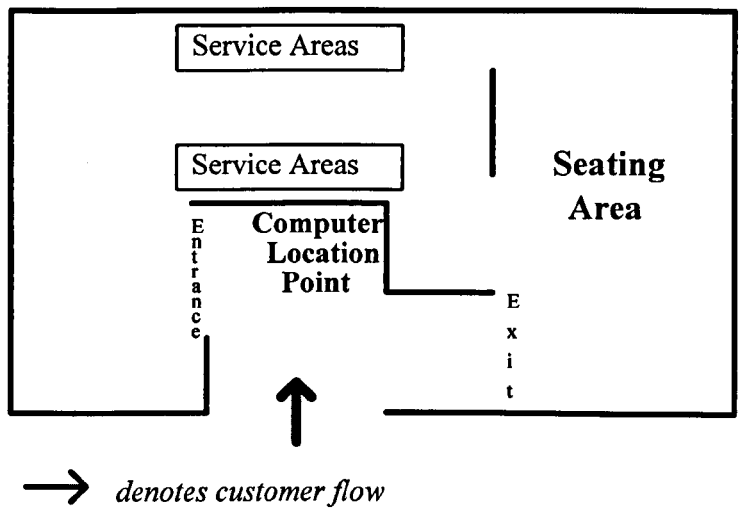
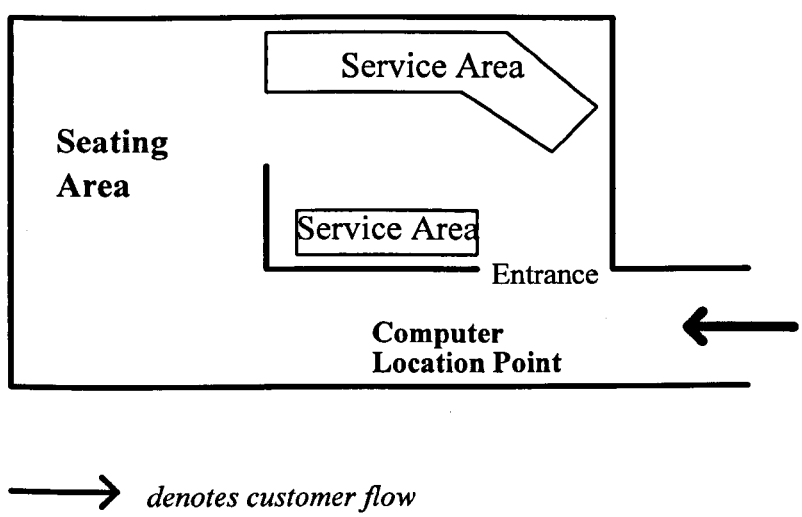


Figure 4.2 Plan of Restaurant B showing location of computer equipment.



Each day's menu, with corresponding nutritional information of the dishes appearing on the menu was down-loaded and transferred onto the two computers. For the first two days of the tests, customers were handed flyers as they passed in or out of the restaurant; these explained the nature of the project (see Appendix VB). These flyers were also left on permanent display beside the computers for customer perusal when the computers were not manned. On the days when the tests were carried out, a notice was positioned at the entrance to the restaurants explaining what was taking place and introducing the two researchers carrying out the study that day (see Appendix VC).

The lunchtime period at both locations lasted from 12.00pm to 1.30pm. A period of four weeks was selected for data collection to take place at each location. The study at Restaurant A lasted from the 28th April to the 20th May 1993, and the study at Restaurant B from the 17th June to the 20th July 1993. At each location, a total of eleven lunchtimes were targeted thus allowing additional time for downloading and collating gathered data and entering new recipes and menus into the database.

During the lunchtime period the author and an assistant selected customers as they entered the restaurant area. Customers were approached and asked if they would like some nutrition information on the meal they were about to choose. All negative responses were recorded on hand-held counters. If the customer was willing to participate in the research they were directed towards one of the two computers and instructed on the use of the menu analysis system. Customers entered details of their age, sex and whether they had used the program before. The program used the customer's age and sex to relate the nutritional value of the meal selected to the appropriate DRVs (Department of Health, 1991b). Dishes from the menu that day were then selected from the screen by means of a light bar

moved up and down the screen to highlight the dishes as explained in Chapter 2. When all dishes making up the customers preferred meal had been selected, nutritional information was displayed on the screen using the graphical layout identified in the study of nutritional formats (see Chapter 3). A short explanation of the screen information was given, i.e., that the amounts for the four nutrients shown were displayed as a percentage of the DRV corresponding with the customers age and sex. No information other than that displayed on the screen was given to the customer.

After viewing the information on the screen for a moment, the customer was then asked if they would like to change the meal they had selected. If they did, then the dish selection procedure was repeated and the revised nutritional information displayed.

The system recorded all menu choices made by the customer plus their age, sex, total nutrient content of the selected meals, and whether the customer had used the system previously.

Respondents were classified into groups, as in the pilot study, as single choice and double choice respondents, repeats and first time users. Other classifications used were males, females, and age. The male and female selection data was subdivided between five approximately equally proportioned age groups : 18-29, 30-39, 40-49, 50-59, and 60-65.

Analysis of variance tests were used to compare the foods on offer within each of the locations and to enable comparison between the two restaurants. For this purpose all dishes were classified according to type using one of the following categories :

1. starter course
2. main dish
3. accompanying vegetable dish
4. accompanying potato dish or rice
5. salad item
6. sweet or pudding dish
7. beverages
8. sandwiches and breads
9. other options including crisps, fruit, margarine and butter.

All menu items were defined as dishes e.g. vegetable dish, salad portion, sweet. More than one dish could be selected from the same category to make up an entire meal since the customers were not presented with this information.

The meal selections made by the double choice respondents were analysed using a scoring system. One point was awarded for a change in the 'correct' direction, i.e. a reduction in the amount of SFA or NMES or an increase in NSP; a minus point was given if a nutrient was changed in the 'wrong' direction.

All the collected observations were analysed using paired and students t-tests to measure for significance of difference between groups of respondents using the classifications outlined previously.

The collected data comprised the meal choices made by male and female respondents at two separate locations, the observations were therefore influenced by sex and location. It was assumed that these were additive and could be removed to convert all data to a standard form :

Observation = overall mean + gender effect + restaurant effect + other systematic effect + random effect

or

$$Yijk = \mu + gi + rj + k + Eijk$$

To determine sources of systematic effect it was necessary to carry out a standardisation process for sex and restaurant effect as follows:

$$Yijk - gi - rj = Yijk^{1} \quad , \quad i = 1 \text{ or } 2 \text{ and } j = 1 \text{ or } 2$$

where $g1$ = male effect = male mean - overall mean

$g2$ = female effect = female mean - overall mean

$r1$ = restaurant A effect = restaurant A mean - overall mean

$r2$ = restaurant B effect = restaurant B mean - overall mean

$Yijk^{1}$ may then be considered independent of gender and restaurant effects thus allowing values to be analysed for other sources of systematic variation.

Results

Restaurant A

A total of 830 customers were approached within the staff restaurant at Shell UK. Of this total, 387 participated and 443 refused, this represents a response rate of 47%. The positive responses comprised 272 males and 115 were females. A total of 65 out of the 387 made a double meal choice. This represents 17% of the total with 20% (n=42) of the male respondents making a second choice and 15% (n=23) of the females. A total of 61 (16%) of the respondents were repeats. Within the non-repeating or first time users group, 55 made a double meal choice, representing a 17% change within this group. Of the 61 respondents who were repeats, only 10 made a double choice, a change of 16% within this group.

The breakdown of the average nutrient amounts of the meal choices made by those respondents making one meal selection and for those making two selections are outlined in Table 4.3.

Table 4.3 Average nutrient content of the menu choices made by the single and double choice respondents at restaurant A.

	Mean	Median	Standard Deviation
Single Choice (n = 322)			
Energy (kcals)	709	698	265
NSP (grams)	7.5	7.3	3.7
SFA (%energy)	10.3	9.5	5.4
NMES (%energy)	10.5	9.0	7.4
Double Choice (n = 65)			
1st choice Energy (kcals)	711	664	297
2nd choice Energy (kcals)	606	614	262
1st choice NSP (grams)	7.2	6.6	4.3
2nd choice NSP (grams)	7.1	6.7	3.4
1st choice SFA (%energy)	13.8	12.9	6.3
2nd choice SFA (%energy)	10.2	8.9	5.9
1st choice NMES (%energy)	14.0	13.6	9.0
2nd choice NMES (%energy)	11.9	10.5	8.1

N.B. Figures shown are unadjusted for any gender effect.

Restaurant B

A total of 684 customers were approached within the hospital staff restaurant. Of this number 377 declined to participate in the survey and 307 responded positively, representing a response rate of 45%. The positive responses comprised 131 male and 176 female. A total of 47 respondents made a double meal choice. This represents 15.3% of the total with 14.5% of the male respondents making a double choice of meal and 15.9% of the females. A total of 55 (18%) of the respondents were repeats. Within the non-repeating or first time users group of respondents, 38 made a double meal choice, a change of 15.1% within this group. Of the 55 respondents who were repeats, only 9 made a double choice, representing a change of 16% within this group.

Table 4.4 compares the mean nutrient amounts for the meal selections made by the double choice respondents with that made by the single choice respondents.

Table 4.4 Average nutrient content of the menu choices made by the single and double choice respondents at restaurant B.

	Mean	Median	Standard Deviation
Single Choice (n = 260)			
Energy (kcals)	458	448	192
NSP (grams)	4.8	4.7	2.5
SFA (%energy)	10.6	9.9	6.5
NMES (%energy)	8.2	6.1	9.0
Double Choice (n = 47)			
1st choice Energy (kcals)	519	474	278
2nd choice Energy (kcals)	467	437	258
1st choice NSP (grams)	4.7	4.7	2.4
2nd choice NSP (grams)	4.9	5.2	3.0
1st choice SFA (%energy)	13.3	13.5	6.7
2nd choice SFA (%energy)	11.2	9.8	7.3
1st choice NMES (%energy)	8.5	6.7	6.5
2nd choice NMES (%energy)	7.0	5.0	7.7

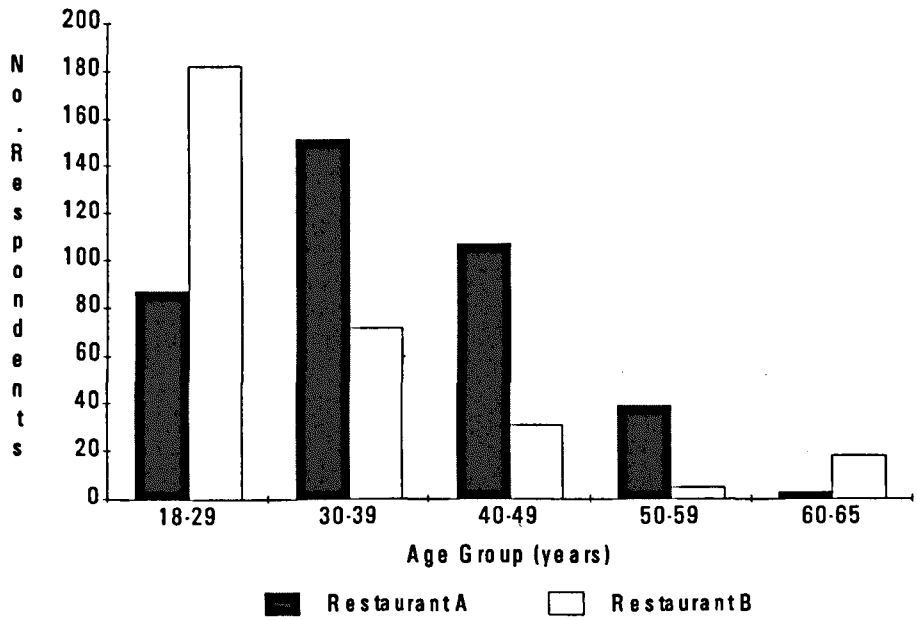
N.B. Figures shown are unadjusted for gender effect.

Comparison of Respondents from the Two Restaurants

Approximately the same percentage of repeats were collected at each location, 16% at Restaurant A and 18% at Restaurant B. At Restaurant A 17% of the respondents made a double choice of meal compared to 15% at Restaurant B.

The age distribution for all respondents in the pooled data from the two restaurants is displayed in Figure 4.3.

Figure 4.3 Number of respondents in each of the five age ranges in the pooled data from the two restaurants.

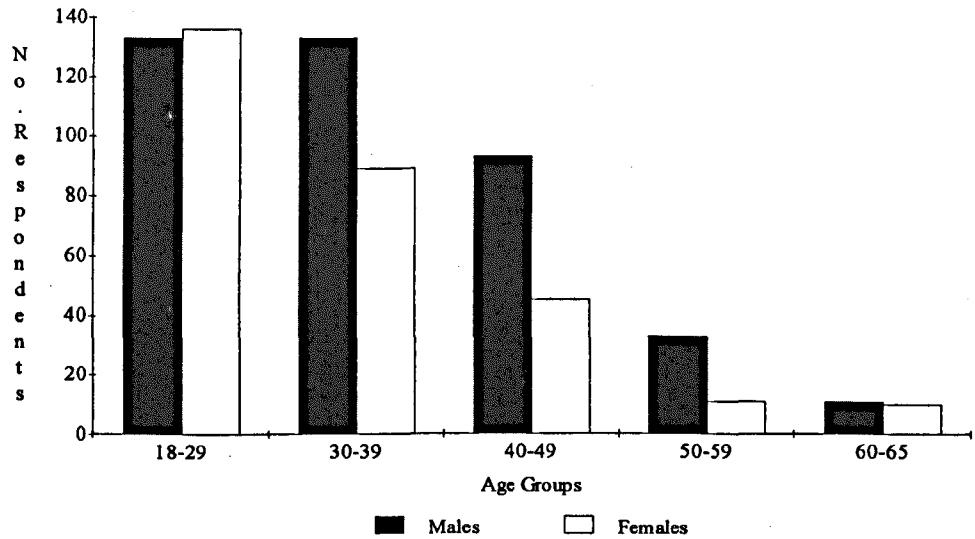


Total number of male respondents = 403

Total number of female respondents = 291

The distribution of male and female respondents differed between the two restaurants, with 70% of the sample being male at restaurant A in comparison with 43% at Restaurant B. Figure 4.4 gives a distribution of the age ranges of the respondents.

Figure 4.4 Age distribution of male and female respondents in restaurants A & B (total)



Average Meal Choices of all Respondents

The data collected from the two restaurants were combined for further analysis. The data were adjusted to eliminate gender and restaurant effects as described earlier. Significance tests were carried out on the average nutritional contents of the selections made by the double and single choice respondents (Table 4.5).

Table 4.5 Average nutrient content of the menu choices made by all single and double choice respondents.

		Single Choice (n= 582)		Double Choice (n=112)
Energy (kcals)	1st	596		630 ***
	2nd	-		547
NSP (grams)	1st	6.4		6.2
	2nd	-		6.3
SFA (% energy)	1st	10.3	+++	13.5 ***
	2nd	-		10.5
NMES (% energy)	1st	9.4	++	11.6 *
	2nd	-		9.8

*Significance of differences between the initial choices of double choice respondents from single choice respondents are indicated using + and differences between first and second choices by *;*

** or + indicate P<0.05, ** or ++ indicates P<0.01 and *** or +++ indicates P < 0.001.*

The pooled data was split into repeat users of the menu analysis system and first time users. Tables 4.4 and 4.5 show the nutrient amount data broken down into the average choices made by repeat users and first time users. The total number of repeat users (116) amounted to 17% of responses. Table 4.6 displays the data collected for the first time users and compares those within this group making a single meal choice with those who made a double choice. Similarly table 4.7 compares the average nutrient amounts within the repeat users data.

Table 4.6 Average nutrient content of the menu choices made by the single and double choice first time users.

		Single choice (n=485)		Double choice (n=93)
Energy (kcals)	1st choice	596		596
			♦	**
	2nd choice			535
NSP (grams)	1st choice	6.4		5.7
	2nd choice			6.1
SFA (% energy)	1st choice	10.2	+++	13.4
				***
	2nd choice			10.6
NMES (% energy)	1st choice	9.7	+	11.9
				*
	2nd choice			9.9

Data adjusted to account for any gender and restaurant effect.
*Significance of differences between the initial choices of double choice respondents from single choice respondents are indicated using + differences between single choice and second choice of double choice respondents are indicated by ♦ and differences between first and second choices by *;*
** or ♦ or + indicate P<0.05, ** or ♦♦ or ++ indicates P<0.01 and *** or ♦♦♦ or +++ indicates P < 0.001.*

Those respondents who were first time users (Table 4.6) making a double choice significantly lowered the average energy, SFA and NMES amounts from the first to the second meal selection. This is similar to the results obtained from the analysis of the complete data.

Analysis of the repeat users average choices (Table 4.7) followed a similar pattern with one difference. The average meal energy content of those making one meal selection was significantly lower than that of the first choice of those respondents making a double choice.

Table 4.7 Average nutrient content of the menu choices made by single and double choice repeat users.

		Single Choice (n=97)		Double Choice (n=19)
Energy (kcals)	1st choice	593	++	795 *
	2nd choice	-		604
NSP (grams)	1st choice	6.5		8.4
	2nd choice	-		7.0
SFA (% energy)	1st choice	10.8	+	13.6 *
	2nd choice	-		9.9
NMES (% energy)	1st choice	8.0	+	10.1
	2nd choice	-		9.2

Data adjusted to account for any gender and restaurant effect.

*Significance of differences between the initial choices of double choice respondents from single choice respondents are indicated using + and differences between first and second choices by *; * or + indicate P<0.05, ** or ++ indicates P<0.01 and *** or +++ indicates P < 0.001.*

A comparison was made between the average choices of the first time users and the repeat users for those making single and double selections (see Table 4.8). In the comparison of those in each group making a single choice only one significant differences occurs, between the NMES amounts. When the average first meal selected by the first time users and that selected by the repeat respondents were compared significant differences did occur. The repeat respondents were selecting meals which were, on average, significantly higher in energy and fibre content. In a comparison of the second choices of the repeat and first time users all average nutrient levels dropped to a level not significant from each other.

Table 4.8 Comparison of the average nutrient content of the menu choices made by all first time users with all repeat users.

		first time users (n = 578)		repeat users (n = 116)
Single Choice		(n = 485)		(n = 97)
	Energy (kcals)	596		593
	NSP (grams)	6.4		6.5
	SFA (% energy)	10.2		10.8
	NMES (% energy)	9.7	*	8.0
Double Choice		(n = 93)		(n = 19)
1st selection	Energy (kcals)	596	**	795
	NSP (grams)	5.7	*	8.4
	SFA (% energy)	13.4		13.6
	NMES (% energy)	11.9		10.1
2nd selection	Energy (kcals)	535		604
	NSP (grams)	6.1		7.0
	SFA (% energy)	10.6		9.9
	NMES (% energy)	9.9		9.2

Data adjusted to account for any gender and restaurant effect.

*Significance of difference between the average choices made at the two restaurants are indicated using *;*

** indicates P < 0.05, ** indicates P<0.01 and *** indicates P< 0.001.*

The pooled data was then split into males and females and the same significance tests carried out. Table 4.9 shows the average nutritional content of the meal choices made by male and female respondents with significant differences occurring between the SFA and NMES averages in both the male and female single choice users and the first selections made by the double choice users. Differences also occurred between the selections made by the double choice users. Females who made a second meal choice also lowered the average energy amount significantly with the second selection. Comparisons between the sexes could not be made since the data had been adjusted to remove gender effect.

Table 4.9 Comparison of the average nutrient content of the menu choices made by single and double choice male and female respondents.

		Females (n=291)			Males (n=403)		
		Single Choice (240)		Double Choice (51)	Single Choice (342)		Double Choice (61)
Energy (kcals)	1st choice	633	♦	674 ***	569		593
	2nd choice	-		561	-		535
NSP (grams)	1st choice	6.8		6.8	6.1		5.7
	2nd choice	-		6.8	-		5.8
SFA (%energy)	1st choice	10.1	+++	14.0 ***	10.5	++	13.0 *
	2nd choice	-		9.3	-		11.5
NMES (%energy)	1st choice	10.0		11.5	9.1	+	11.7 **
	2nd choice	-		10.6	-		9.2

Data adjusted to account for any gender and restaurant effect.

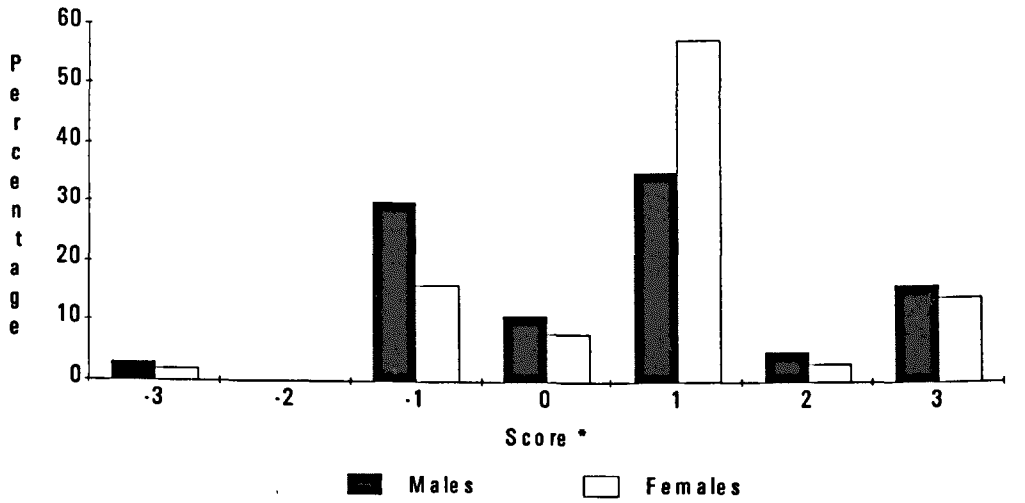
*Significance of differences between the initial choices of double choice respondents from single choice respondents are indicated using + differences between single choice and second choice of double choice respondents are indicated by ♦ and differences between first and second choices by *;*

** or ♦ or + indicate P<0.05, ** or ♦♦ or ++ indicates P<0.01 and *** or ♦♦♦ or +++ indicates P < 0.001.*

Scoring Meal Choices

The choices of all respondents making a double choice were analysed using a scoring system.

Figure 4.5 The scores of all double choice respondents (males and females) when making meal selections.*



* *One point was awarded for a change in the 'correct' direction, i.e. a reduction in the amount of SFA or NMES or an increase in NSP; a minus point was given if a nutrient was changed in the 'wrong' direction.*

Of the double choice respondents 64% scored either 1, 2 or 3 while the remaining respondents scored negatively or gained a zero score. It was found that 44% of the double choice male respondents and 26% of the double choice females made worse choices resulting in a negative or zero score. Over half of the male respondents scored between 1 and 3 compared to nearly three quarters of the female respondents. A Chi-squared test showed a value of $X^2 = 4.6$ at 2 degrees of freedom therefore there was no difference between males and females with regard to the scores attained ($P > 0.05$).

Overall 69% of the female respondents and 54% of the males reduced the energy amount from the first to second selections and the female respondents did so by a significant amount. Half of the male and 43% of the female respondents increased their fibre intake with the second selection, 44% male and 47% female respondents decreased the fibre amount. In total 72% of the female and 59% of the male respondents reduced the amount of saturated fat between first and second selections, 63% of the females and 59% of the males reduced the amount of added sugar in their meal choices.

Dominant Nutrient

The majority of significant differences in the average choices made were accounted for by SFA and NMES (see tables 4.5, 4.6, 4.7). In an attempt to identify if one of these two nutrients was dominant in the choice decision over the other, each of the 112 double choices of meal were analysed to see if one nutrient changed most often or if both nutrients were changed together and in which direction they were changed (Table 4.10).

Table 4.10 Type of change made by the double choice respondents to the SFA and NMES amounts in their food choices and the number of double choice respondents making each of the identified changes.

Type of Change	No. of Respondents	Percentage
Both nutrients decreased	*55*	*49*
Both nutrients increased	*20*	*18*
Saturated fatty acids decreased	*12*	*11*
Saturated fatty acids increased	*3*	*3*
Non-milk extrinsic sugars decreased	*4*	*4*
Non-milk extrinsic sugars increased	*4*	*4*
SFA increased while NMES decreased	*8*	*7*
SFA decreased while NMES increased	*5*	*4*
No change to nutrients	*1*	*1*

In the majority of cases (78%) both nutrients were changed together, either increasing or decreasing. Within these cases the majority involved decreasing both nutrients when the second choice of meal was made.

Levels of Saturated Fatty Acids and Non-Milk Extrinsic Sugars.

The dietary reference values for SFA and NMES are both 11% of energy intake (Department of Health, 1991). It is therefore reasonable to assume that the majority of people, if eating a healthy diet, should be consuming meals either just above or below this level, the 11% of energy intake for both nutrients being an average figure for the population.

Using this criterion it was found that 64% of the single meal choice respondents were either achieving 11% or less of their energy intake from SFA and 69% achieved similar from NMES. Overall 42% of the single choice respondents were choosing a meal that was both low in SFA and NMES, i.e. either at or below 11% of energy intake for both nutrients.

Analysis of the double choice respondents selections showed that 59% were exceeding the 11% of energy from SFA and 45% exceeding the level for NMES on the first meal choice; 21% of the double choice respondents were making a first choice that was high in both SFA and NMES. This actually rose to 25% of respondents with the second meal selection. However only 18% were making a "healthy" choice (less than 11% of energy for both SFA and NMES) with their first selection, rising to 45% of the double choice respondents on the second meal choice.

Of the male respondents who made a single meal choice, 67% made a selection that did not exceed the dietary reference value of 11% of energy from SFA, likewise for energy from NMES. For those males who did change their meal, 46% did not exceed the 11% for SFA on the first choice rising to 61% on the second choice. For NMES 52% of the double choice males were either on or below the 11% mark for their first meal choice rising to 66% with the second choice. Of the single choice females 60% made a choice which did not exceed the 11% of energy from SFA while 72% chose meals with 11% or less of energy coming from NMES.

For the females who made two meal selections 35% were either below or on 11% for SFA for the first meal choice rising to 63% with the second choice. Looking at NMES 59% of the double choice females did not exceed the 11% DRV with their first choice which rose to 74% with the second selected meal.

Levels of Non-Starch Polysaccharides

No significant differences were found to occur in the comparisons of average NSP intake for either those respondents making a single meal selection or those making a double choice.

The DRV suggested for NSP intake is 18 grams per day for an adult. Using this as a guide, 6 grams could be used as a level which should ideally be consumed in one meal if that were a main meal of the day. This was therefore used as a cut off point for further analysis. For those making a single meal choice (n = 582), 48% selected a meal which contained 6 grams of NSP or more. Of the double choice respondents (n = 112) 45% made a first selection which contained 6 grams or more of NSP, the remaining selecting first choice meals with less than 6 grams. This did not change significantly with the second choice of meal with 46% attaining or exceeding the 6 gram level.

In a comparison of the double choice respondents first meal selection against the second meal selection it was found that 47% increased their NSP intake overall, 46% actually decreased while 7% did not adjust the level of NSP between the two meal choices.

Meal Analysis

The menu choices made by the 112 respondents who made a double meal choice were examined in an attempt to reveal any trends occurring in the initial meal choices and subsequent changes. The nine categories of dishes were used to help identify the type of change occurring (see page 97). Four methods of change were identified : omitting dishes, adding dishes, making changes within a category and making changes from one category to another. Some of the respondents adopted more than one method of change.

Table 4.11 Type of change made to meal by the double choice respondents and percentage of respondents making that change.

Type of Change	% of double choice respondents
Omitting Dish/es	44
Adding Dish/es	19
Change within category *	46
Change between categories *	26

** Categories refer to the nine food categories set out in the methods section of this chapter (see page 97).*

Certain trends in the two most prevalent methods of change being made did emerge:

Change by Omission : The omission of a vegetable or potato dish from the second choice was made by 14% of the double choice respondents. While 9% made a change by omitting the sweet course from their second meal. Other less popular methods of change included the omission of *"additional"* items such as crisps, drinks, etc which had been

selected in the first course but were excluded from the second, 10% of all the double choice respondents made this change to their meal.

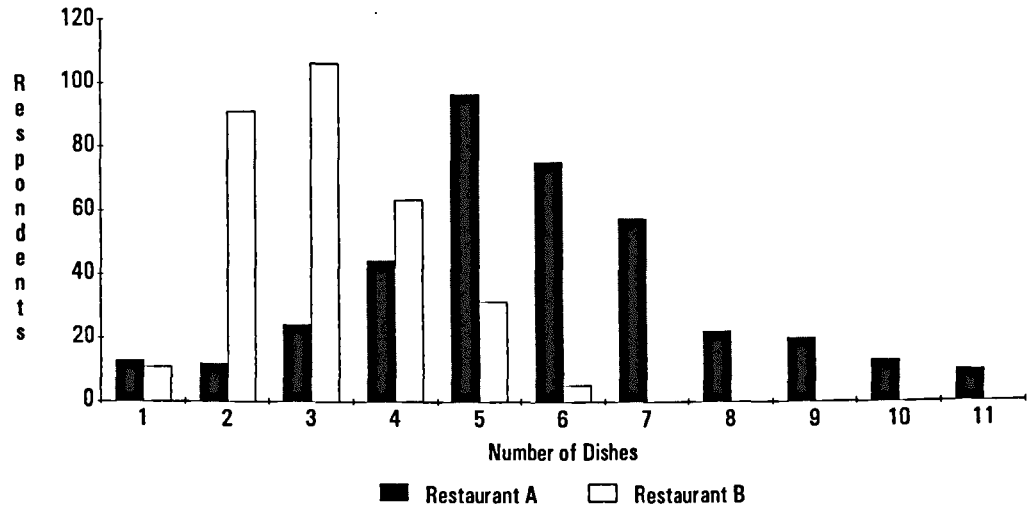
Changes within Categories : The most prevalent change was the selection of an alternative main course dish carried out by 26% of the double choice respondents. A change of sweet or pudding type was made by 13% of the double choice respondents while a change to the type of vegetable or potato dish selected was also common, with 20% of the double choice respondents making this change.

Comparison Between Restaurants.

The categorising of the dishes was used to analyse the format of meals the respondents were selecting. Variable sizes of meals were chosen by the respondents at the two restaurants as displayed in Figure 4.6.

An examination of the meal choices made at each of the two canteens reveals that only 26% of the respondents at restaurant A and 12% at restaurant B selected a starter course. Main courses were selected by 79% of the respondents at A and 63% at B. Vegetable dishes were selected by 46% of the respondents at Restaurant A and by only 21% of the respondents at Restaurant B. Potato dishes were selected by 57% and 62% respectively. One or more sweet courses were selected by 69% of the respondents at Restaurant A while only 13% of the respondents at B selected a sweet course (Figure 4.7).

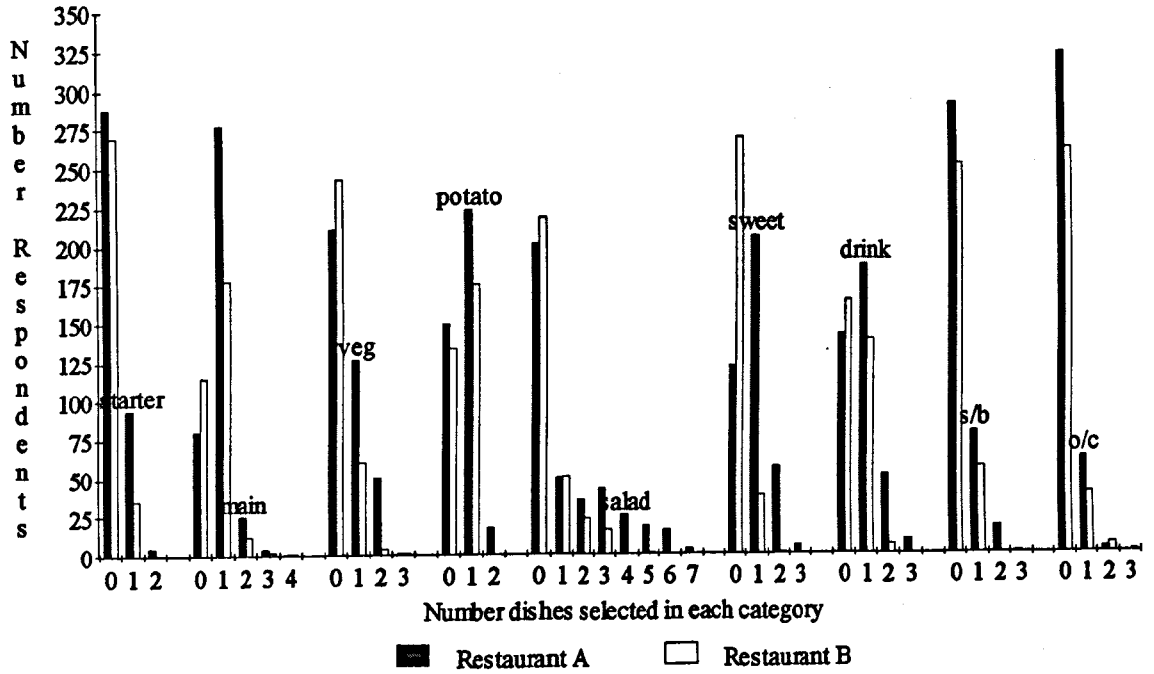
Figure 4.6 *Number of dishes* making up the meal choice of all respondents in Restaurants A and B with the number of respondents making that selection*



**Respondent did choose, in some cases, more than one dish from each of the nine dish categories.*
Number of respondents at restaurant A = 386, restaurant B = 307.
Number of dishes making up one meal selected at Restaurant A ranged between 1 and 11, between 1 and 6 at Restaurant B.

Mean number of dishes selected at Restaurant A = 5.7.
Standard Deviation of 2.1.
Mean number of dishes selected at Restaurant B = 3.1.
Standard Deviation of 1.09.

Figure 4.7 Number of dishes from each of the nine dish categories selected by respondents at Restaurants A and B.



Key *veg = accompanying vegetable dish*
pot = accompanying potato dish or rice
s/b = sandwiches and bread
o/c = other choice, e.g. crisps, fruit, drinks.

The X-axis is divided into the nine dish categories used to classify the foods being offered by the two restaurants.

Discussion of Method

The main obstacle to analysis of data from the pilot study is the omission of the sweet courses when the nutritional breakdown of the meal was given, providing an unbalanced profile of the total meal. This did not arise in the main study where the use of the self prompt menu analysis system before the respondents entered the service area of the restaurant allowed for all dish choices to be made and evaluated as an entire meal. The respondents could enter all dishes they wished to select from the menu including drinks and fruit items as well as starters, main dishes, vegetables, salad items and sweet courses, therefore a complete picture of the meal was portrayed to the customer, allowing for an informed judgement to be made on the meal choice.

The choice of restaurant location within the requirements of the main survey was largely dictated by availability. Two representative locations were obtained however. Both locations were staff canteens or restaurants, one sited within a large multinational oil company the other within an NHS Trust hospital complex. The restaurants were run on a largely self service and counter service basis therefore the stand alone P.C. version of the menu analysis system was suited for use in both.

The two restaurants selected for the main study were very similar in terms of the nature of service provided. They were both workplace canteens offering a wide variety of hot and cold main meals and snacks for company employees using a mainly self service style of operation.

The catering companies in each of the restaurants were operating under similar constraints also. Both had to compete with other catering companies to retain their contracts. The hospital catering department was

run by the internal catering team but only because they had won the contract when it was put out to bid in the private sector a year previously.

There was however one essential difference between the two restaurants. Restaurant A was fully subsidized by Shell UK oil company as an employee restaurant. Employees within the Shell complex could eat there free of charge. Restaurant B was not funded internally or subsidised in any way therefore all menu items were charged for.

This had one main effect on the data collected during the main study. The size of the meals chosen at restaurant A in terms of number of dishes making up a meal were far larger than those selected at restaurant B (Figure 4.6). The restaurant A respondents were choosing meals with almost twice as many dishes in their meal than the respondents at restaurant B. Perhaps some of the respondents at restaurant A viewed their lunchtime meal as their main meal of the day and were taking advantage of the free meal situation to exploit this. Cost may have made the restaurant B respondents more cautious of selecting large meals. It is quite possible that the number of dishes being selected by the customers was in some way influenced by the perceived cost of the meal.

In consequence the average nutritional value of the meal choices made at the two restaurants are very different (see Tables 4.1 and 4.2). It was found that, on average, the restaurant A respondents were making meal selections that were higher in all nutrients, this was true for both single and double choice respondents. Looking at the categories of dishes being selected in the two restaurants (Figure 4.7) displays that more dishes were selected from each of the nine categories at restaurant A than at B. In particular more sweet dishes were selected at restaurant A compared to numbers of dishes selected at B.

Although it is true that the respondents at restaurant A were, on average, choosing larger meals than the restaurant B respondents they

were still, in the main, making "healthy" selections (Table 4.3) with SFA and NMES both being between 10 and 12 percent of energy content.

The use of the single and double choice classifications enabled the meal choices of the respondents who had changed their first selected meal to be separated from the respondents making only one meal choice. This meant that comparisons could be made between the average single and double choice meals and between the two meal selections made by the double choice respondents. The standardisation process carried out meant the observations could be considered to be independent of gender and restaurant effects thus allowing for analysis of other sources of variation (see page 98). This is the underlying principle of the analysis of variance technique where gender and restaurant are considered as block effects.

The categorising of all dishes into nine categories allowed analysis to be carried out on the actual choices being made by the respondents and for a comparison between the two restaurants. These categories were designed after careful examination of the types and varieties of foods being offered by the two restaurants. The categories are, in the main, self explanatory, i.e. starter, main and sweet. Category five, the salad dishes, was used to enable identification of any substitution of main, vegetable and potato dishes by salad items. Each dish on a menu belonged to only one category, however a respondent may have selected a meal which comprised dishes from the same category, e.g. two vegetable dishes or a variety of salad dishes.

The scoring system used to analyse the double choice respondents selections attempted to identify if respondents were indeed making informed decisions on their meal choices by actively adjusting the levels

of nutrients in the meal. An arbitrary score of 1 or minus 1 was awarded for a change in the "right" or "wrong" direction. Clearly if the double choice respondents were making informed changes the majority would be scoring either 1, 2 or 3 on this scale. The scoring system was also used to compare male with female respondents to determine whether one made "better" choices than the other.

Questions often arise concerning the sampling technique. Was the sample taken in the study representative of the population as a whole and did it represent the sample of the population who eat in canteens and restaurants?

The sample obtained was comprised of a section of the population at each of the two locations. These work populations mainly comprised professional, skilled and semi-skilled individuals across a broad range of ages. Surveys show that most age groups frequent canteens at work, college and school at some time, with over half of those who use these places eating there more than three times a week (MAFF, 1993b). Social groups A and B are most likely to eat lunch out at least once a week followed by C1 and C2 in that order, with 15 to 24 year olds more likely to eat lunch out than other age groups. Social groups A, B and C1 are also more likely to use a canteen or inexpensive restaurant than other social groups. It therefore appears that this sample of the population was representative of the people who eat in canteens and restaurants as a whole.

Although the respondents in the study were drawn from a sample of both white and blue collar workers it must be realised that only those respondents who were in some way interested agreed to use the menu analysis system. Reasons for use of the computer system may be varied, ranging from a general curiosity or a reluctance to refuse participation, to

an interest in nutrition and healthy eating in general. It must therefore be realised that a somewhat biased sample was obtained purely because of the nature of the survey. This bias may also have resulted in a "healthier" or more "diet conscious" sample of respondents being obtained. This may be reflected in the nutritional values of the meal selections made where it was found that SFA and NMES levels either met or fell below DRV targets which are well below the recognised national average consumption levels of these nutrients. Similar bias may arise from a study awareness effect, that is, the participants may act differently simply because they are aware of being involved in a study. Despite these limitations the method was considered valid. The sample obtained was considered to be representative in that not everyone is interested in nutrition therefore one cannot expect everyone to use the menu analysis system. In addition the computer system would have been unable to cope with the large throughput entailed in everyone participating; logistically this would have caused too much delay with inadequate time allocated to allow for collection of all data, i.e. only the lunch hour was designated for the data collection period. It was therefore only possible to involve a sample of the customers in the survey.

Chapter 5

Discussion & Conclusions

Computerised Nutrition Information in Catering Establishments

Nutrition labelling has long been a familiar source of information on packaged goods and as additional leaflet information in many supermarkets (Freckleton, 1985; Scobie & Firth, 1989). Consumers are turning to nutritional data as an information source to use in the modification of their diet (MAFF, 1990a). The labelling of non-packaged goods has progressed far slower than the labelling on packaged foodstuffs. However, with the numbers of meals consumed outside the home increasing this area of food consumption has become a viable target for increased information (Moody, 1992). Along with the growth in the eating out sector it is clear that an increasing number of consumers desire to see nutrition information being provided in restaurants and canteens (MAFF, 1993b). Menu labelling can take a number of forms, the use of computers being one method of providing menu labelling. A computerised system has the advantage of being able to provide a composite analysis of an entire meal whereas a printed menu system is limited in that it can only present nutritional analysis of individual dishes on the menu, leaving the evaluation of the whole meal to the customer. The use of a computerised system also allows the meal to be placed within the context of the entire day's nutritional requirements. The information is presented quickly and at the most appropriate time, that is, when the meal is being selected and not once it has been consumed. Nutrition information lends itself to computerization in the form of a database system which can be used to store and manipulate large quantities of data. There are, however, cost implications involved with any computerised system. For the caterer these consist of equipment costs and staff training requirements.

The nutrition information system developed in this study was designed to be easy to operate. No indepth knowledge of computer applications or programming skills are required to be able to operate the system beyond the ability to follow a few simple instructions. The use of light bars and on-screen menus made the process of selecting dishes a relatively simple operation for the user. Likewise, the on-screen menus exist to allow the caterer to devise and maintain their own dishes, recipes and daily menus for the restaurant or canteen.

The menu analysis system has been used successfully to provide on the spot nutrition information to customers in a catering outlet. The two versions of the computer system allow it to be adapted for use in both self service and table service canteens and restaurants. Both versions of the system have been tested in restaurant environments. The nature of any computerised system must allow for expansion. Possibilities exist for linking into existing stock control and menu planning software systems thus providing an integrated system while also reducing hardware costs. Network systems can make software available to all users at any level desired. This gives a level of protection to the information stored in the database system, ensuring customers using the system only have access to nutritional information whilst the caterer can update existing data, add new information and manipulate recipe and menu information, thereby adjusting nutritional status of meals. The contract caterer could devise dishes and menus which would then be made available to the workplace customer as a nutrition information service at their office desk to be used at any time during the working day. It is therefore feasible that a meal ordering system to be operated prior to the mealtime period could be developed and supplied on a computerised system. This would allow the customer increased time to evaluate different meal choices, viewing the

nutrition information on a variety of possible options before a selection is made. Further enhancements may allow for the caterer to devise healthier meals by providing the nutritional information on a dish as it is being devised by the caterer thereby allowing alternative ingredients to be used changing the "healthiness" of that dish in terms of its nutritional value.

Nutritional messages, hints and suggestions could be incorporated, to be triggered by the meal selections being made by customers. Such messages could range from general nutrition education statements to suggestions relating to the meal choice made, perhaps for alternative dishes to be incorporated into the meal thus reducing or increasing the levels of nutrients present. This would not only provide the nutritional analysis of the meal but suggestions for changes to improve the nutritional status of the meal.

As an educational tool the computerised system has many possibilities for expansion and development. Information can easily be updated and adapted to suit changing needs and dietary advice. The presentation of information can take a variety of formats. The use of simple graphical formats to present nutrition information has proven to be successful. In this study it was established that graphical formats provided the information in such a manner as to allow for quicker assimilation of nutrition information than tabular or more detailed formats (see Chapter 3). Improvements in timing occurred when the information was presented as percentages of the DRVs. Likewise, when the level of information given was reduced from one displaying individual dishes making up the meal to showing only the analysis of the complete meal, the response time required fell. All formats tested were found to provide nutrition information to a sufficient degree to allow sensible decisions to be made,

by the sample of consumers, on the frequency of consumption of meals. It was, however, the use of graphics in the labelling formats in conjunction with a reduction in the amount of information given which proved to be the most successful of the formats tested in terms of relaying the nutrition information quickly and comprehensively.

Consumer Response to Computerised Nutrition Information

Using the format identified in the shopping mall study the computer system was used to provide nutrition information on meal choices made by customers in two canteens. Information collected on customers' meal selections was analysed to assess whether the provision of this computerised nutrition information could influence the food choices made, and what effect, if any, it had on the meal selections made.

The single meal choice respondents, that is, those who did not change their meal choice, appeared to be making choices which on average contained levels of SFA and NMES which were either at or below the DRV for these nutrients (Department of Health, 1991b). It could be concluded that since these respondents were already making apparently "healthy" choices of meal perhaps they did not perceive the need to change their meal. In addition the single choice respondents were, on average, making "healthier" choices than the first meal selections made by the double choice respondents, i.e. those who changed their meal. The single choice respondents were in fact making selections significantly lower in SFA and NMES than the first selections made by the double choice respondents.

Overall the respondents making a double choice made a "healthier" meal option when making their second selection (see Table 4.5). The average amounts of energy, SFA and NMES all dropped by a significant amount.

These double choice respondents made second meal selections which did not differ significantly from the choices made by those respondents who only made a single meal choice. Clearly the double

choice respondents changed the nutritional content of their meal, from one which was significantly higher in energy, SFA and NMES than the single choice respondents selections, to one which was not dissimilar in nutritional content.

Within the population sampled, a proportion of the results were gathered from repeat users of the system, that is, the selections made by respondents who had used the system more than once. These individuals were identified and separated from the rest of the results which could be classified as the choices made by the first time users of the system. Comparisons were then made between the repeat users and the first time users and between those who made a double meal choice and those making a single choice within each of these two groups of respondents.

Both first time and repeat single choice users were found to be making "healthier" choices than the first choices made by the double choice respondents, that is, their single choices were lower in energy, SFA and NMES.

It may have been anticipated that repeated use of the system would lead to some form of assimilation of the information and lead to improved meal choices being made. If this were the case some difference would have occurred in the average nutrient composition of the meals chosen by the repeat users when compared to that chosen by the first time users (see Table 4.8). However very few differences were found to occur. Of the single choice repeat respondents the first time users actually chose meals which on average contained less NMES than the selections made by the double choice repeat respondents. Within the double choice users overall, it was found that the repeat users were making first choices which

contained significantly more NSP and were also higher in energy content in comparison with the first time users (see Table 4.8). These differences had been eliminated when the second meal choices were compared. The repeat users therefore did not appear to be making "better" decisions than the first time users and indeed were actually making "worse" decisions in terms of some of the nutrient levels.

These results could not be considered surprising however, since the respondents were not taught anything about nutrition when using the computer system that could be implemented when making meal choices from the menu of a different day. The menu analysis system did not teach anything about nutrition in general but merely put meal choices within the context of the total diet. Although the respondents were given the nutrition information on their meal in the form of a percentage of current recommendations, that is, DRVs, they were not informed as to what these values were. Nor were they advised as to how the separate dishes they had chosen contributed to the total nutritional value of that meal. The system's effectiveness depended on the customers basic nutritional knowledge; respondents had to draw on their own knowledge base to enable them to make a decision about their meal choice. The menu analysis system merely facilitated that decision. The repeat users comprised only a small percentage of the respondents overall and even a smaller number were double choice repeat respondents, therefore differences in change decisions would be difficult to find, a larger sample may record different results.

Neither the first time users nor the repeat users could be said to be making unhealthy final choices; for both groups the average levels of SFA and NMES dropped.

The average choices made by the respondents in this study were below the national averages and in line with current DRV targets (Department of Health, 1991b; MAFF, 1993a). It was found that the majority of the single choice respondents made a selection which was either at or below 11% of energy from SFA and either at or below 11% energy from NMES. It is clear that these respondents were already making healthy choices and therefore did not require to change their meal selection.

Very few of the respondents in this study exceeded national average daily consumptions of SFA and NMES while the majority of respondents were selecting meals with far less SFA and NMES than the national averages (MAFF, 1993a). Possible reasons for this apparent discrepancy may lie in the fact that only one meal in the day, that being lunch, was included. No account was made for other meals and snacks in the day. High levels of SFA and NMES could have been obtained elsewhere in the diet, for example, snacks in between meals, beverages both alcoholic and non-alcoholic. Further research would be required to gain a complete picture of the entire day's diet. This would involve considering all foods consumed during the day. Clearly participation of respondents in such a study would be more difficult to engage.

The average intake of 18 grams of NSP per day for adults proposed as a DRV (Department of Health, 1991b) could not be used as a comparison here when only one meal was being targeted. It was therefore assumed that approximately 6 grams, a third of the total would be a ideal target to be achieved in one meal.

On average 6 grams of NSP were present in the meals selected by the respondents, far higher than might be expected from a national daily average of 11 to 13 grams per day. In a comparison with national average

intakes it might therefore be expected that the majority of respondents would be consuming approximately 4 grams of NSP in one meal. The majority of the respondents clearly exceeded this amount and chose what could be considered an adequate amount of NSP in one meal.

It was found that levels of SFA and NMES appeared to be the motivating factors in the change decision, this was evidently displayed by the significant changes made to the levels of these two nutrients by the double choice respondents in their first and second meal selections. It may be concluded that health campaigns regarding the levels of fat and sugar consumed in the diet have been successfully assimilated by some consumers. Less importance appeared to be attached to NSP, this being reflected in the lack of change to levels of NSP in the choices made, although clearly some of the respondents were consuming adequate amounts of NSP in this meal, perhaps therefore they did not see the need to increase their intake of this nutrient. This may also be due to lack of awareness of the need for NSP in the diet or increased emphasis or importance being attached to levels of SFA and NMES rather than NSP in the diet.

It is clear from these results that the sample population in this study were choosing meals which on average contained levels of nutrients which could be consider "healthier" than may have been expected using national averages.

In terms of influencing customer choice towards a "healthier" diet it is important to establish how the meal was changed by the double choice respondents for this is not only of interest to the dietician and nutritionist in terms of identifying the types of foods people select when making a

change to a meal but is also of interest to the caterer, who must respond to changing customer demands in order to retain existing contracts and acquire new ones.

It was found that the majority of double meal choice respondents, when making their second meal choice, changed their meal by omitting one or more of the dishes that had appeared in their first meal selection or changed to another dish in the same category thereby making some form of dish substitution. It appears that most respondents were making nutritionally informed decisions when changing their meal. This is important to the caterer who requires to know more about the types of changes being made. The catering company in charge of providing meals in a restaurant would presumably prefer any customer about to change their meal selection, in response to the nutritional content of that meal, to do so by selecting another option rather than simply omitting that dish from the meal they were about to acquire particularly if this would result in a reduction in sales. The caterer has a commercial interest in responding to customer demand by providing alternatives for the customer to select from. It is important therefore for alternatives not only to be available, but the right kind of alternatives to be offered. It is clearly useful to be able to identify the areas where alternatives are sought. It was found that respondents were reluctant to change to a new category of dishes when making a change and were more likely to select another dish in the same category as the dish they were changing. This was found to be particularly true for main courses, potato and vegetable dishes and sweet courses. It would therefore be advisable for the caterer to concentrate on providing "healthy" substitutions or alternatives in these categories.

Conclusions

It is apparent from the results obtained that the computerised nutrition information presented did influence a significant proportion of respondents to change their mind and re-select their meal and that the majority of those respondents possessed an adequate knowledge of nutrition to be able to make a "healthier" choice of meal. This corresponds with the findings in the nutritional formats study (see Chapter 3) where the respondents were found to possess a basic knowledge of nutrition which gave them the ability to correctly identify "healthy" and "unhealthy" nutritional options.

Those respondents in the main study who chose to re-select their menu had initially chosen meals which were not as "healthy" as the selections made by those who were satisfied with their original choice. After re-selecting their meal, the nutritional content of the meals reflected that chosen by those who had decided not to alter their meal. This research clearly indicates that people were able to successfully interpret and use the graphical format presented by the computer system.

Nutrition information and education at the point-of-purchase within canteens and restaurants clearly has important potential impact on eating behaviour although further research is required to establish the extent of influence on eating behaviour over a sustained period of time.

Providing nutrition information can increase a person's knowledge of nutrition and thereby change a person's nutritional beliefs, this being an important factor influencing the food choice decision. However there are many other factors contributing to the food choice decision as reviewed in

Chapter 1. The research carried out here recorded consumer response to the graphical nutrition information provided, establishing the level of intention to change in a sample of respondents, it did not measure customer behaviour. In order to demonstrate further whether the strategy of using computer generated information at the point of sale influences the customers diets beneficially it would be necessary to show whether they alter their actual behaviour as well as their stated intention to do so. Previous studies, however, have shown that menu labelling strategies can be effective in promoting more nutritious food selections (Davis-Chervin, 1985; Mayer *et al.*, 1989). Clearly this type of study would have to be expanded to target the total meal comparing sales figures for all food selections made; only then would it be possible to determine whether those who expressed a desire or intention to change their meal did actually obtain and consume the foods they selected from the computer screen.

The nutrition information system provided a guide towards healthy eating allowing the entire meal to be placed in the context of the total daily diet, relaying the information using current dietary targets (Department of Health, 1991b). However, the computer system should not be viewed as the only solution to encouraging healthy eating. It is one method of providing menu labelling to consumers and should be seen rather as part of an overall education strategy and dissemination of information. An important factor here is not only the success of any information system which encourages changes to occur in food selections towards more "healthy" eating practices but that this should lead to a sustained behaviour change in the longer term. Questions arise as to whether customers in a canteen or restaurant would repeatedly use an information system over a sustained period of time. Could levels of use and interest be sustained and would the system maintain a consistent level of influence over the food

choices being made? Repeated use of the system may lead to demands for increased levels of information which would have implications for the processing time required by the computer system. There may be limitations regarding the amount of information that could realistically be displayed on a computer screen and usefully assimilated by the consumer. Future research would establish the extent to which menu choices made in front of a computer screen relate to actual behaviour, the reasons for any discrepancies and how the effectiveness of the computer generated information could be enhanced to promote "healthy" eating in restaurant and canteen customers. Changing the eating habits of consumers and maintaining this change could lead to improvements in long term health.

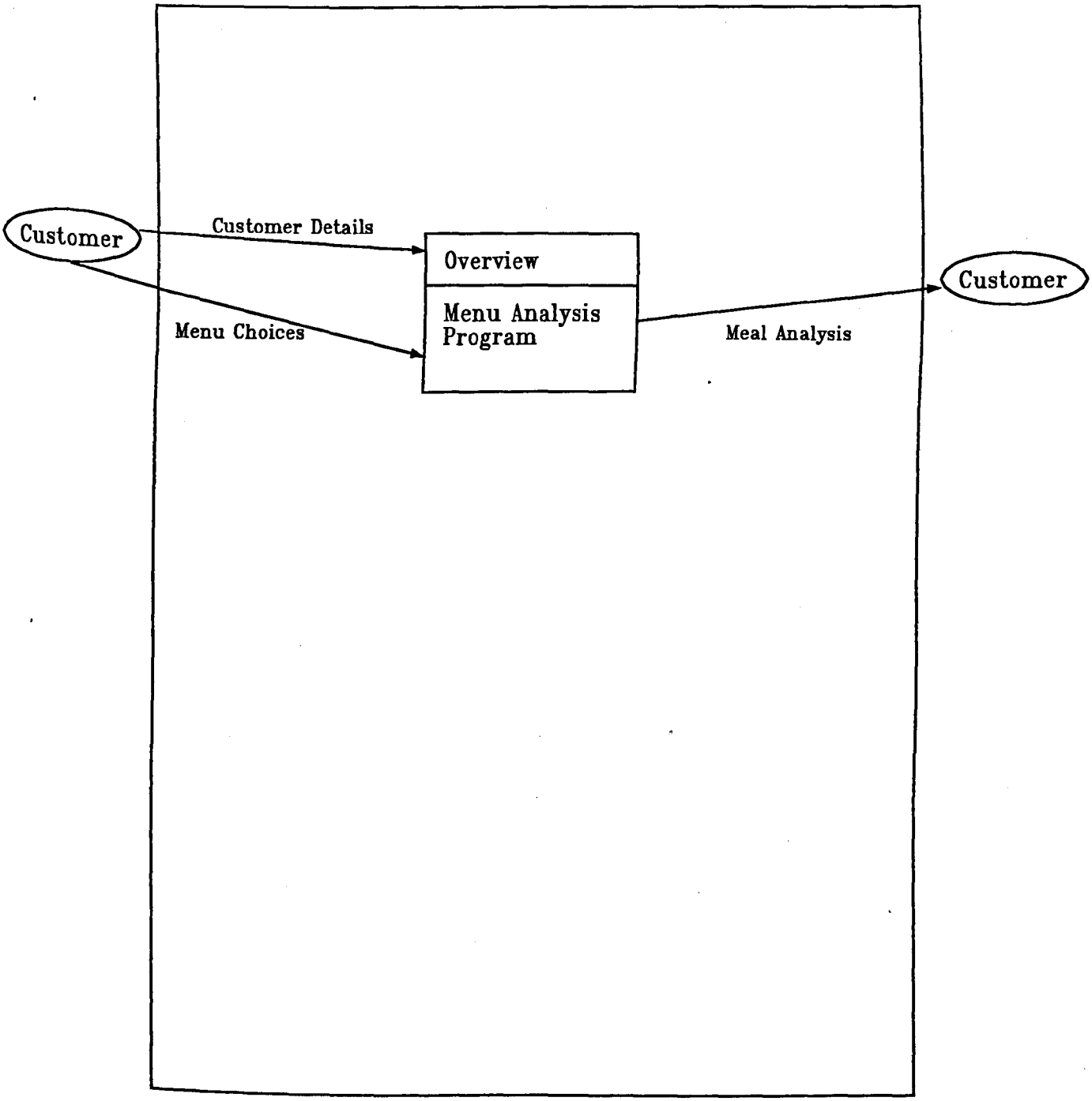
The influence of nutrition information provision on eating behaviour is limited and needs to be compounded with education programmes to widen nutritional knowledge in general and to encourage the adoption of new beliefs and social customs. Likewise the influence of any nutrition information system is limited in so far as sensory attributes of a food will always determine a person's liking for individual foods, but in the wider sense a nutrition information system can encourage "healthy" eating practices to be adopted which may have implications for the nation's health in the long term.

Computerised nutrition information evidently has a beneficial effect on consumer meal choices, allowing the customer to appraise their selected meal, evaluating it in terms of the contribution it makes to the total daily diet. There is clearly scope for the future development of computerised menu labelling with the intention of convincing people to take a larger interest in nutrition information and to make use of this information when making food choices in canteens and restaurants.

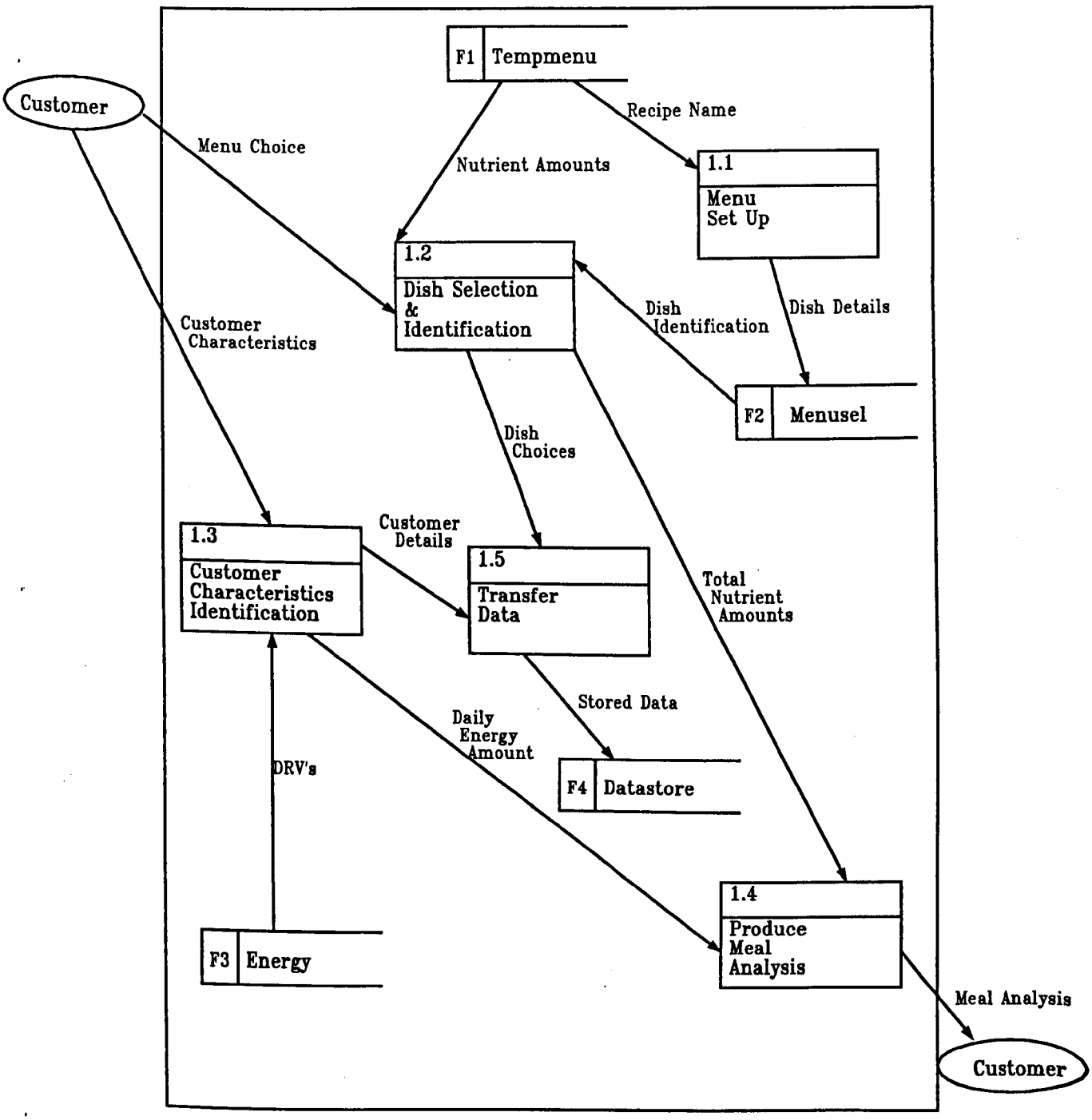
Appendix I

The Data Dictionary

Overview of the Menu Analysis Process



Data Flow Diagram to illustrate the Menu Analysis Process



PROCESS NAME Menu Set Up DESCRIPTION _____

INPUTS	LOGIC	OUTPUTS
Recipe Name	Select Tempmen go top do while not end of file name = dish name number = number + 1 select Menusel replace Menusel->num with number replace Menusel->rname with name select Tempmenu skip enddo	Dish Number Dish Name

COMMENTS

PROCESS NAME: Dish Selection & Identification

DESCRIPTION:

INPUTS

Menu Choices

Nutrient Amounts

Dish ID

LOGIC

```
use Menusel
display Dish Names
get Dish Choice
locate for Dish Number = Dish Choice
if found
   Dish = Dish Name
   select Tempmenu
   locate for Recipe Name = Dish
   if found
      C = Energy
      F = Fibre
      SF = Saturated Fat
      AS = Added Sugar
      Total Calories=Total Calories+C
      Total Fibre=Total Fibre+F
      Total Satfat=Total Satfat + SF
      Total Sugar= Total Sugar + AS
   endif
endif
```

OUTPUTS

Total Nutrient Amounts

Dish Choices

COMMENTS

PROCESS NAME Customer Characteristics Identification

DESCRIPTION

INPUTS	LOGIC	OUTPUTS
Customer Characteristics DRV's	PIN = PIN + 1 get Custsex read get Custage read if Custage < 51 Group = 1 elseif Custage < 59 Group = 2 elseif Custage < 64 Group = 3 elseif Custage < 74 Group = 4 endif select Energy locate for Sex=Custsex and Age= Group if found Energy = DRV endif get Repeat read	Customer Details Daily Energy Amount

COMMENTS

PROCESS NAME Produce Meal Analysis DESCRIPTION _____

INPUTS	LOGIC	OUTPUTS
Total Nutrient Amounts Daily Energy Amount	Total Calories = Total Calories/Energy * 100 Total Fibre = Total Fibre/18 * 100 Total Sat.Fat = Total Sat.Fat/(11/900 * Energy) * 100 Total Sugar = Total Sugar/(11/375 * Energy) * 100 Display final screen	Meal Analysis

COMMENTS

PROCESS NAME Transfer Data DESCRIPTION

INPUTS	LOGIC	OUTPUTS
Dish Choices Customer Details	use Datastore append blank replace PIN with PIN replace Date with System Date replace AGE with Custage replace SEX with Custsex replace CH(1-11) with Dish Name(1-11) replace CAL1 with Total Calories replace FIB1 with Total Fibre replace SF1 with Total SatFat replace AS1 with Total Sugar replace CH2(1-11) with Dish Name(1-11) replace CAL2 with Total Calories replace FIB2 with Total Fibre replace SF2 with Total SatFat replace AS2 with Total Sugar replace REP with Repeat	Stored Data

COMMENTS

DATA FLOW NAME : Recipe Name

SOURCE REF: F1 DESCRIPTION Tempmenu File

DESTN REF: 1.1 DESCRIPTION Menu Set Up

DATA FLOW DESCRIPTION Recipe name to be used in the creation of screen readable file for selection process

CONTENT

Dish Name

VOLUME INFORMATION

COMMENTS

Names of all dishes in Tempmenu File transferred to Menusel via Process 1.1

DATA FLOW NAME : Nutrient Amounts

SOURCE REF: F1 DESCRIPTION Tempmenu File

DESTN REF: 1.2 DESCRIPTION Dish Selection & ID

DATA FLOW DESCRIPTION Nutrient amounts associated with the selected dish

CONTENT

Recipe Name

Energy

Fibre

Saturated Fat

Added Sugar

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Menu Choice

SOURCE REF: Entity DESCRIPTION Customer

DESTN REF: 1.2 DESCRIPTION Dish Selection & ID

DATA FLOW DESCRIPTION Number of dish selected by customer

CONTENT

Dish Name

VOLUME INFORMATION

1 to 11 choices, first & second selections

COMMENTS

DATA FLOW NAME : Customer Characteristics

SOURCE REF: Entity DESCRIPTION Customer

DESTN REF: 1.3 DESCRIPTION Cust. Char. ID

DATA FLOW DESCRIPTION Additional information on customer

to be stored in Datastore File

CONTENT

Customer Age

Customer Sex

Repeat

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Dish Details

SOURCE REF: 1.1 DESCRIPTION Menu Set Up

DESTN REF: F2 DESCRIPTION Menusel

DATA FLOW DESCRIPTION Dish name plus identifying number created for use in selection process

CONTENT

Dish Number

Dish Name

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Dish Identification

SOURCE REF: F2 DESCRIPTION Menusel File

DESTN REF: 1.2 DESCRIPTION Dish Sel. & ID

DATA FLOW DESCRIPTION Identifying number and name of dish selected from screen

CONTENT

Dish Number

Dish Name

VOLUME INFORMATION

COMMENTS

Numeric position of screen choice used to identify number of dish in Menusel File

DATA FLOW NAME : Total Nutrient Amounts

SOURCE REF: 1.2 DESCRIPTION Dish Sel. & ID

DESTN REF: 1.4 DESCRIPTION Produce Meal Analysis

DATA FLOW DESCRIPTION Collective amounts of nutrient in the selected meal

CONTENT

Dish Name

Total Calories

Total Fibre

Total Saturated Fat

Total Added Sugar

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Dish Choices

SOURCE REF: 1.2 DESCRIPTION Dish Sel. & ID

DESTN REF: 1.5 DESCRIPTION Transfer Data

DATA FLOW DESCRIPTION

CONTENT

Dish Name (choices 1 to 11)

Total Calories

Total Fibre

Total Saturated Fat

Total Added Sugar

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : DRV's

SOURCE REF: F3 DESCRIPTION Energy File

DESTN REF: 1.3 DESCRIPTION Cust. Char. & ID

DATA FLOW DESCRIPTION Dietary Reference Values

for kilocalories

CONTENT

Calorific DRV

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Daily Energy Amount

SOURCE REF: 1.3 DESCRIPTION Cust. Char. & ID

DESTN REF: 1.4 DESCRIPTION Produce Meal Ana.

DATA FLOW DESCRIPTION Suggested daily calorific intake corresponding to the individual cusomers age & sex

CONTENT

Daily Energy

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Customer Details

SOURCE REF: 1.3 DESCRIPTION Cust. Char. & ID

DESTN REF: 1.5 DESCRIPTION Transfer Data

DATA FLOW DESCRIPTION Details of customers age, sex and status

CONTENT

Personal Identification Number

Customers Age

Customers Sex

Repeat

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Stored Data

SOURCE REF: 1.5 DESCRIPTION Transfer Data

DESTN REF: F4 DESCRIPTION Datastore File

DATA FLOW DESCRIPTION All data on customer characteristics and choices

CONTENT

Personal Identification Number
Date
Age
Sex
First Choices (1 to 11)
Total Calorific Amount
Total Fibre
Total Saturated Fat
Total Added Sugar
SecondChoices (1 to 11)
2nd Calorific Total
2nd Fibre Total
2nd SFA Total
2nd AS Total
Repeat

VOLUME INFORMATION

COMMENTS

DATA FLOW NAME : Meal Analysis

SOURCE REF: 1.4 DESCRIPTION Produce Meal Ana.

DESTN REF: Entity DESCRIPTION Customer

DATA FLOW DESCRIPTION Breakdown of selected meal displayed in graphical format for the customer

CONTENT

Dish Names (choices 1-11)

Percentage of DRV for Calories

Percentage of DRV for Fibre

Percentage of DRV for SFA

Percentage of DRV for Added Sugar

VOLUME INFORMATION

COMMENTS

Appendix II

File Specifications

FOOD.DBF

Field Name	Type	Width	Decimal
NAME	Character	66	-
NUMBER	Numeric	4	0
ENERGY	Numeric	5	0
FIBRE	Numeric	5	2
SATFAT	Numeric	5	2
SUGAR	Numeric	5	2

ENERGY.DBF

Field Name	Type	Width	Decimal
SEX	Character	1	-
AGE	Numeric	1	0
EAR	Numeric	4	0

MENU.DBF

Field Name	Type	Width	Decimal
MDATE	Date	8	-
MNUM	Numeric	2	0
RNAME	Character	55	-

RECIPE.DBF

Field Name	Type	Width	Decimal
RNUM	Numeric	5	0
RNAME	Character	55	-

RECFOOD.DBF

Field Name	Type	Width	Decimal
RNUM	Numeric	5	0
NUMBER	Numeric	5	0
RFAMNT	Numeric	10	0

TEMPMEN.DBF

Field Name	Type	Width	Decimal
NUMBER	Numeric	5	0
RNAME	Character	55	-
ENERGY	Numeric	5	0
FIBRE	Numeric	5	2
SATFAT	Numeric	5	2
SUGAR	Numeric	5	2

DATASTOR.DBF

Field Name	Type	Width	Decimal
PIN	Numeric	2	0
DATE	Date	8	-
AGE	Numeric	2	0
SEX	Character	1	-
SEL1	Numeric	2	0
SEL2	Numeric	2	0
SEL3	Numeric	2	0
SEL4	Numeric	2	0
SEL5	Numeric	2	0
SEL6	Numeric	2	0
SEL7	Numeric	2	0
SEL8	Numeric	2	0
SEL9	Numeric	2	0
SEL10	Numeric	2	0
SEL11	Numeric	2	0
CAL1	Numeric	4	0
FIB1	Numeric	5	2
SF1	Numeric	5	2
AS1	Numeric	5	2
CH1	Numeric	2	0
CH2	Numeric	2	0
CH3	Numeric	2	0
CH4	Numeric	2	0
CH5	Numeric	2	0
CH6	Numeric	2	0
CH7	Numeric	2	0
CH8	Numeric	2	0
CH9	Numeric	2	0
CH10	Numeric	2	0
CH11	Numeric	2	0
CAL2	Numeric	4	0
FIB2	Numeric	5	2
SF2	Numeric	5	2
AS2	Numeric	5	2
REP	Character	1	-

Appendix III

Test Data

Test Data

AGE	SEX	REPEAT	1ST CHOICES	2ND CHOICES
25	M	N	1,4,6,8	
33	M	N	1,3,5,7	2,5,6,7
-	F	N	2,4	
45	M	N	1,3,6	1,3,6,8,9,10,11,14,15,16,18,***32***
29	F	Y	1,6,7	2,3,5,6
21	F	N	2,3,4	
54	F	N	1,2,3,10,15,16,17,20,21	
32	M	Y	-	
321	M	N	1,5,8	2,5,7
27	F	N	1,2,5,6,9	1,2,5,6,8
35	***S***	N	3,5,6,7,11,12,15,16,21,23	3,11,12,15,21,23
49	F	***M***	1,3	1
0	F	Y	5,2	
51	M	N	1,3,6,11,12,15,16,17,18,21,23,***30***	
22	-	N	4	4
48	M	Y	1,5,8,7	1,5,7,9
50	M	-	2,4,6	
52	F	N	1,2,5,6	1,2,5,8
-36	F	N	3,9,20	
20	M	N	5,15,16,18,25	5,15,16,19,24

N.B. all errors in the test data are displayed in **boldface** *italics*.

Appendix IV

The Eight Nutritional Formats

1.

Your meal contains :				
	Energy (calories)	Saturated Fat (grams)	Fibre (grams)	Added Sugar (grams)
Dish A	150	2	2	5.5
Dish B	300	6	4	12.5
Dish C	200	4	3	9.5
Totals :	650	12	9	27.5
Suggested Daily Intakes:	2000	24	18	55

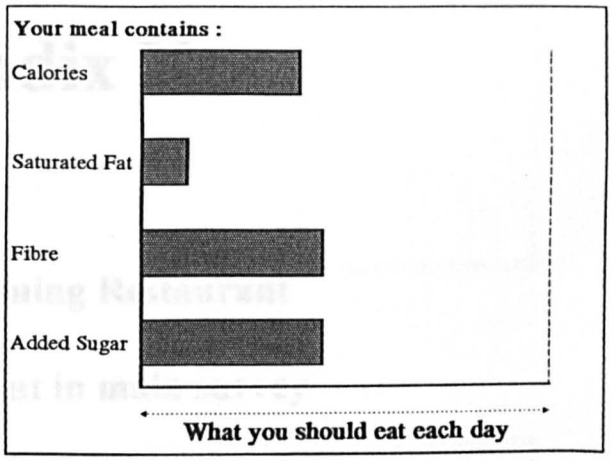
2.

Your meal contains :				
	Energy (calories)	Saturated Fat (grams)	Fibre (grams)	Added Sugar (grams)
Totals:	650	12	9	5.5
Suggested Daily Intakes:	2000	24	18	55

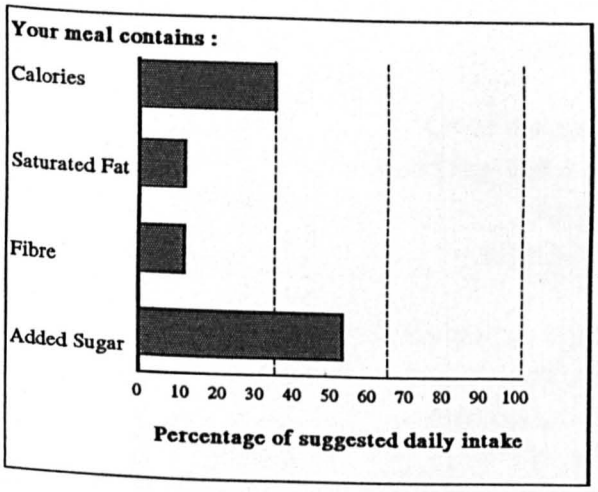
3.

Your meal contains :				
	Calories	Saturated Fat	Fibre	Added Sugar
Percentage of suggested daily intake:	33	50	10	10

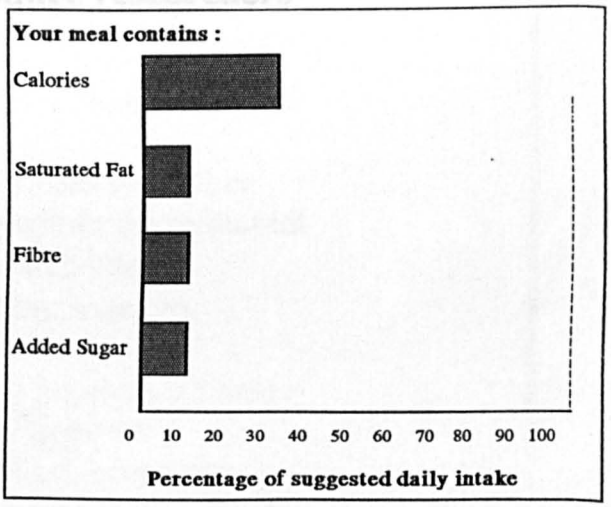
4.



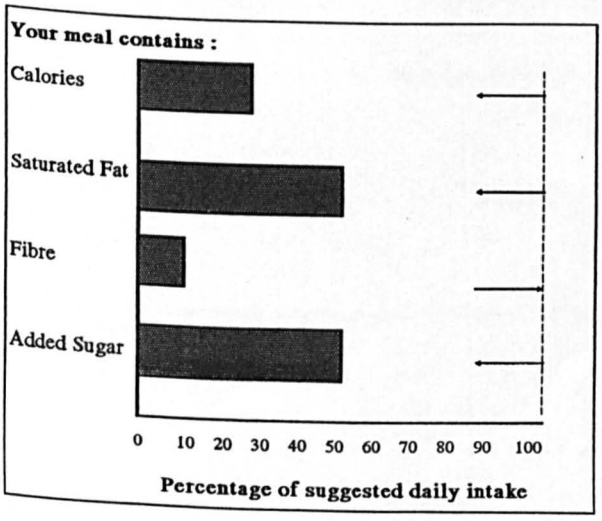
5.



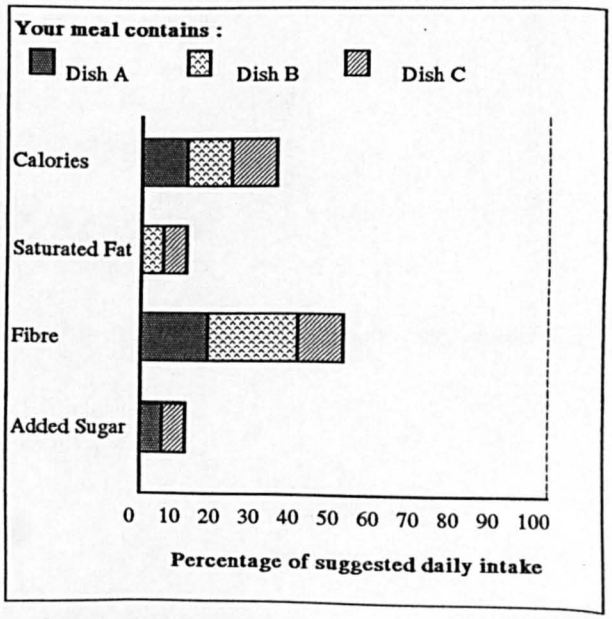
6.



7.



8.



Appendix V

A. Notice for Training Restaurant

B. Flyers handed out in main survey

C. Notice to introduce researchers

A

As part of a research project
nutrition information will be given
to some customers today.
Your co-operation in this would be appreciated.
Thank You.

B

I am a research student at
The Robert Gordon University
studying for a PhD.

Over the next few weeks we will be
carrying out a project within the restaurant
as part research into
nutrition labelling schemes.

By using one of the computers situated
outside the restaurant
you can view nutrition information
on your choice of meal
before entering the service area.

We hope you will try our labelling system
when using the restaurant.

Thank you for taking the time
to read this notice.

C

The Robert Gordon University

As part of a PhD. research project
into Nutrition Labelling Schemes
nutrition information is being provided
on the meals served in the restaurant today.

Research being carried out by
Donna Balfour
and
Jill Smith

Your assistance in this project would be appreciated.

Thank you

References

ADA Reports (1991). *Position of the American Dietetic Association: Nutrition in food service establishments.* Journal of the American Dietetic Association 4 480-482.

Anderson, J. and Haas, M. H. (1990). *Impact of a Nutrition Education Program on Food Sales in Restaurants.* Journal of Nutrition Education 22 5.

Anon. (1984). *Shopper's Guide.* Nutrition and Food Science 91 11.

Anon. (1985a). *Nutrition Labelling in the Netherlands.* Nutrition and Food Science 95 8-9.

Anon. (1985b). *What consumers want to see on food labels.* Nutrition and Food Science 96 16-17.

Anon. (1990). *Factors Influencing Food Choice in Humans.* Nutrition Reviews 48 442-444.

Azjen, I. and Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behaviour.* Englewood Cliffs, NJ: Prentice-Hall.

Backas, N. (1988). *Nutrition Report : healthful can be flavorful.* Restaurant Institutions 98 46-63.

Baker, M. J. (1972). *Influence of Nutrition Education on 4th and 5th Graders.* Journal of Nutrition Education Spring 55-58.

Beard, M. (1992). *Good Relations.* Personal Computer World May 242-316.

Bingham, S., Pett, S. and Day, K. (1990). *Non-starch polysaccharide intake of a representative sample of British adults.* Journal of Human Nutrition and Dietetics 3 333-337.

Bingham, S. (1991). *Dietary aspects of a health strategy for England.* in : The Health of the Nation: The BMJ View. London : British Medical Journal 19-26.

Booth, D.A. and Shepherd, R. (1988). *Sensory influences on food acceptance : the neglected approach to nutritional promotion.* British Nutrition Foundation Nutrition Bulletin 13 39-54.

Carlson, B. L. (1984). *Demand for Nutritional Information by the Consumer in Food Service Operations.* Proceedings of the 4th Conference: The Society for Advancement of Food Service Research. 112-118.

Carlson, B. L. and Tabacchi, M. H. (1986). *Meeting Consumer Nutrition Information Need in Restaurants.* Journal of Nutrition Education 18 211-214.

Charney, M. and Lewis, P. A. (1987) *Does health knowledge affect eating habits?* Health Education Journal 46 172-176.

Cincirpini, P.M. (1984). *Changing food selections in a public cafeteria.* Behaviour Modification 8 520-539.

Clifton, H.D. (1990). *Business Data Systems : a practical guide to systems analysis and data processing.* New York : Prentice Hall International.

Cole-Hamilton, I. (1986). *Star-Rated Menus.* London : The London Food Commission.

Committee on Medical Aspects of Food Policy. (1984). *Diet and Cardiovascular Disease.* Report on Health and Social Subjects 28. London : HMSO.

Consumers' Association. (1990) *Nutrition Labelling* Consumer Report Jan.

Consumers' Association, Ministry Agriculture, Fisheries and Food, National Consumer Council. (1985). *Consumer Attitudes to and Understanding of Nutrition Labelling.* London : HMSO.

Coronary Prevention Group. (1987). *Nutrition Labelling of Foods : a rational approach to banding.* London : Nutrition Advisory Committee.

Coronary Prevention Group. (1990). *Nutrition Banding : A scientific system for labelling the nutrient content of foods.* London : The Coronary Prevention Group.

Coronary Prevention Group. (1992). *Just Read The Label - understanding nutrition information in numeric, verbal and graphic formats.* London : HMSO.

Cox, D. R. (1958). *Planning of Experiments.* New York : Wiley International Edition.

Daniels, A. and Yeates, D. (1989). *Basic Systems Analysis.* London : Pitman.

Date, C. J. (1990). *Introduction to Database Systems.* 5th Edition Vol I. Reading, MA : Addison-Wesley.

Davis-Chervin, D., Rogers, T. and Clark, M. (1985). *Influencing food Selection with Point-of-Choice Nutrition Information.* Journal of Nutrition Education 17 1.

De Bekker, G. J. P. M. (1991). *Food and Nutrition Labelling : The Position of the Food and Drink Industry.* European Journal of Clinical Nutrition 45 supp. 2 92-95.

Department of Health. (1989). *Dietary Sugar and Human Disease.* London : HMSO.

Department of Health. (1991a). *The Health of the Nation. A Consultative Document for Health in England.* London : HMSO.

Department of Health. (1991b). *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom.* London : HMSO.

Department of Health. (1992). *The Health of the Nation : A Strategy for Health in England.* London : HMSO.

Department of Health and Social Security. (1969). *Recommended Intakes of Nutrients for the United Kingdom.* London : HMSO.

Department of Health and Social Security. (1979). *Recommended Daily Amounts of food energy and nutrients for groups of people in the United Kingdom.* London : HMSO.

Department of Health and Social Security. (1984). *Diet and Cardiovascular Disease.* London : HMSO

Douglas, P. and DePietro, D. (1992). *Computerised analysis of selected menu items : A practical tool for the university nutritionist.* Journal of the American Dietetic Association 92 992-993.

Dubbert, P.M., Johnson, W.G., Schlundt, D.G. and Montague, N.W. (1984). *The influence of calorific information on cafeteria food choices.* Journal of Applied Behaviour Analysis 17 85-92.

Edmunds, N. (1992). *Good Relations.* Personal Computer World May 242-294.

Englyst, H. N. and Cummings, J. H. (1988). *An improved method for the measurement of dietary fibre as non-starch polysaccharide in plant foods.* Journal of the Association of Official Analytical Chemists 71 808-814.

European Community. (1978). *Council Directive No. 79/112/EEC on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs.* Official Journal of the European Communities.

European Community. (1988). *Proposal for Council Directive on the introduction of compulsory nutrition labelling of foodstuffs intended for sale to the ultimate consumer.* (COM (88) final - SYN155) 5:11:88

European Community. (1990). *Council Directive No. 90/496/EEC on nutrition labelling of foodstuffs.* Official Journal of the European Communities 33 40-44.

European Community - Policy Service (Unit 4 - Foodstuffs). (1992). *Proposal for a Council Directive on the Use of Claims Concerning Foodstuffs.* Doc SPA/62/ORIG - Fr/Rev.2 1-32.

Evans, I. (1987). *The not-so-small print.* Food, Ingredients, Processing, Packaging 9 45-57.

Finch, I. (1986). *Beware Traffic Lights Ahead.* Nutrition and Food Science 102 15-16.

The Food Act 1984 England and Wales. London : HMSO

The Food and Drugs (Scotland) Act 1956. Edinburgh : HMSO

The Food and Drugs (Northern Ireland) Act 1958. London : HMSO

The Food Labelling Regulations. (1984) SI 1984 No. 1305 London : HMSO.

Freckleton, A. (1985). *Who is shaping the nutritional label? A Report on the Activities of Government, Manufacturers, Retailers and Consumers.* University of Bradford : Food Policy Research.

Freckleton, A. (1987). *The Development of Nutrition Labelling in the UK.* Bradford : Horton Publishing Ltd.

Geiger, C. J., Wyse, B. W., Parent, C. R. M. and Hansen, R. G. (1991). *Review of nutrition labelling formats.* Journal of the American Dietetic Association 91 808-815.

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

Hackleman, E. C. (1980). *Food Label Information : What consumers say they want and what they need.* Advances in Consumer Research 8 447-483.

Hancock, T. (1992). *Star Meals.* Hospitality 126 9-11.

Health Education Authority. (1992). *Beating Heart Disease in the 1990's.* London : Health Education Authority.

Health Education Council. (1983). *Look After Yourself.* Milton Keynes : The Open University Press.

Hertzler, A. A. and Hoover, L. W. (1977). *Development of Food Tables and Use With Computers.* Journal of the American Dietetic Association 70 20-31.

Holland, B., Welch, A. A., Unwin, I. D., Buss, D. H., Paul, A. A., and Southgate, D. A. T. (1991). *McCance and Widdowson's The Composition of Foods.* Cambridge : Royal Society of Chemistry.

Howe, D. R. (1989). *Data Analysis For Data Base Design.* London : Edward Arnold.

Hughes, J. G. (1988). *Database Technology : a software engineering approach.* London : Prentice Hall International.

Jacoby, J., Speller, D.E. and Kohn, C.A. (1974). *Brand Choice Behaviour as a Function of Information Load: Replication and Extension.* Journal of Consumer Research 1 1974.

Johnson, R. D. and Levin, I. P. (1985). *More than meets the Eye : The Effects of Missing Information on Purchase Evaluations.* Journal of Consumer Research 12 169-177.

Jukes, D. J. (1988). *The Structure of Food Law Enforcement in the United Kingdom.* British Food Journal. 90 239-249.

Junshi, C., Campbell, T.C., Junyao, L. & Petro, R. (1990). *Diet, lifestyle & mortality in China, a study of the characteristics of 65 Chinese countries.* Oxford : Oxford University Press.

Kendall, V. (1989). *Food Industry - keeping the European customer satisfied.* European Trends 2 62-69.

Keys, A. (1980). *Seven Countries : multivariate analysis of death and coronary heart disease.* Cambridge Mass : Harvard University Press.

Kirk, D. and Daly, L. (1992). *The Contribution of Catering to the Diet.* British Food Journal 94 22-25.

Kirk, T. (1988). *Food Marketing : Nutrition and Health Claims.* Nutrition and Food Science 113 8-11.

Kirk, T. R. and Arens, U. (1988). *Legislation and Codes of Practice: Nutrition Information in Food Marketing.* British Food Journal 90 268- 272.

Kubena, K.S. and Carson, D.E. (1988). *Nutrition promotion in a university foodservice; reduced fat, sodium, and energy content of menus.* Journal of the American Dietetic Association 88 1412-1416.

Lang, K. (1992). *Nantucket Clipper 5.* Personal Computer World May 293-294.

Lenahan, R. J., Taylor, D.A., Call, D.L. and Padberg, D.I. (1973). *Consumer Reaction to Nutritional Labels on Food Products.* The Journal of Consumer Affairs 7 1-12.

Lew, E.A. and Garfunkel, L. (1979) *Variations in Mortality by Weight among 750,000 Men and Women.* Journal of Chronic Diseases 32 563-76.

London Food Commission (1991). *Call For Better Labels.* The Food Magazine Jan/Mar.

McDermid, K. (1992). *Menu Labelling Will Not Work.* Hospitality Feb. 12-13.

McDonald's. (1991). *McDonald's Food : The Facts.* London : Public Relations Department.

Macro, A. and Buxton, J. (1987). *The Craft of Software Engineering.* Wokington : Addison-Wesley.

Malhotra, N. K. (1982). *Information Load and Consumer Decision Making.* Journal of Consumer Research 8 419-430.

Maloff, C. and Zears, R.W. (1979). *Computers in Nutrition : Development of Food Database Systems.* Chpt 5 185-209. Dedham, Mass. : Artech.

Marecic, M. (1993). *Nutrikids^{TM} Nutritional Analysis.* Nutrition Today Jan/Feb 43-44.

Marks, D. (1986). *One School's Campaign for Healthy Eating.* Nutrition and Food Science July/Aug 8-9.

Mayer, J.A., Heins, J.M., Vogel, J.M., Morrison, D.C., Lankester, L.D. & Jacobs, A.L. (1986). *Promoting low-fat entree choices in a public cafeteria.* Journal of Applied Behaviour Analysis 19 397-402.

Mayer, J.A., Brown, T.P., Heins, J.M. & Bishop, D.B. (1987). *A multi-component intervention for modifying food selections in a worksite cafeteria.* Journal of Nutrition Education 19 277-280.

Mayer, J.A., Dubbert, P.M. and Elder, J.P. (1989). *Promoting Nutrition at the Point of Choice : A Review.* Health Education Quarterly 16 31-43.

Ministry of Agriculture Fisheries and Food. (1988). *Guidelines on Nutrition Labelling.* London : HMSO.

Ministry of Agriculture Fisheries and Food. (1990a). *Food Labelling Survey England and Wales.* London : HMSO.

Ministry of Agriculture Fisheries and Food. (1990b). *Household Food Consumption and Expenditure (1989).* London : HMSO.

Ministry of Agriculture Fisheries and Food. (1991). *Household Food Consumption and Expenditure (1990).* London : HMSO.

Ministry of Agriculture Fisheries and Food. (1993a). *National Food Survey 1992.* London : HMSO.

Ministry of Agriculture Fisheries and Food. (1993b). *Consumer Information Needs Concerning Food Sold Through Catering Outlets.* London : MAFF Publications.

Moody, R. (1992). *Nutritional information : do we know what we are eating?* Proceedings of the Nutrition Society 51 55-61.

Morris, E. M. (1991). *Nutrition Labelling.* European Food and Drink Review. Spring 77-79.

Mueller, J. (1991). *Illustrated Clipper 5.0.* Wordware Publishing.

National Advisory Committee on Nutrition Education (1983). *A discussion paper on proposals for nutritional guidelines for health education in Britain.* London : The Health Education Council.

National Consumer Council. (1989). *Comments made by the NCC on proposals for Council Directive on the introduction of compulsory nutrition labelling of foodstuffs intended for sale to the ultimate consumer.* NCC.

National Restaurant Association. (1989). *Tableservice Restaurant Trends 1989.* Washington D.C. : National Restaurant Association.

Nichols, B. W. (1992). *The COMA Report on Dietary Reference Values : The Food Manufacturers' View.* British Food Journal 94 17-19.

Ozkarahan, E. (1990). *Database Management: Concepts, Design and Practice.* London : Prentice Hall.

Paul, A. A. and Southgate, D. A. T. (1978). *McCance and Widdowson's The Composition of Foods.* London : HMSO.

Pizzaland. (1990). *Nutrition Information Leaflet.*

Pizza Hut. (1990). *Nutrition Information Leaflet.*

Pomberger, G. (1986) *Software Engineering and Modula-2.* London : Prentice Hall International.

Porkess, R. (1988) *Dictionary of Statistics.* Glasgow : Collins.

Richardson, D. P. (1987). *Effects of nutritional guidelines on food marketing and new product development.* in Solms, J, *et al. Food Acceptance and Nutrition.* London : Academic Press Ltd. 433-443.

Royal College of Physicians. (1983). *Obesity.* London : Royal College of Physicians.

Russo, J.E. (1974). *More Information is Better: A Revaluation of Jacoby, Speller and Kohn.* Journal of Consumer Research 1 68-72.

Russo, J.E. (1975). *An Information Processing Analysis of Point-of-purchase Decisions.* Proceedings of Fall Conference of the American Marketing Association.

Ryan, B.F., Joiner, B.L. and Ryan, T.A. (1985). *Minitab Handbook.* Boston : Duxbury Press.

Safeway. (1990). *Nutrition Labels.* Hayes : Safeway Nutrition Advice Service.

Salmon, J. (1984). *Does every label tell a story?* Nutrition and Food Science 91 9-11.

Scammon, D. L. (1977). *"Information Load" and Consumers.* Journal of Consumer Research. 4 148-155.

Schafer, R.B. (1978) *Factors affecting food behaviour and the quality of husbands' and wives' diets.* Journal of the American Dietetic Association 72 138-143.

Schaum, K. D.; Mason, M.; Sharp, J. L. (1973). *Patient-orientated dietetic information system.* Journal of the American Dietetic Association 63 39-41.

Scobie, P. and Firth, D. (1989). *The Food Retailing Revolution.* Nutrition and Food Science 121 8-11.

Scottish Office. (1992). *Scotland's Health : A Challenge to Us All.* Edinburgh : HMSO.

Scottish Office, Home and Health Department. (1993). *The Scottish Diet.* Edinburgh : HMSO.

Scottish Office. (1994). *Nutrition Labelling Directive (90/496/EEC): Draft Implementing Regulations.* Edinburgh : Agriculture and Fisheries Department.

Scouller, F. (1992). *The Attitudes and Understanding of Nutrition Labels in a Group of Consumers.* Honours Thesis. Aberdeen : The Robert Gordon Institute of Technology.

Seaman, C. (1992). *Review of some computer software for packages for dietary analysis.* Journal of Human Nutrition and Dietetics 5 263-264.

Seaman, C. (1993). *More computer software for dietary analysis.* Journal of Human Nutrition and Dietetics 6 171-172.

Shepherd, R. (1985). *Dietary Salt Intake.* Nutrition and Food Science 96 10-11.

Shepherd, R. (1988). *Belief structure in relation to low-fat milk consumption.* Journal of Human Nutrition and Dietetics 1 421-428.

Shepherd, R. (1989). *Factors Influencing Food Preferences and Choice* in Handbook of the Psychophysiology of Human Eating. Chichester : John Wiley and Sons.

Shepherd, R. and Farleigh, C. A. (1986a). *Attitudes and Personality Related to Salt Intake.* Appetite 7 343-354.

Shepherd, R. and Farleigh, C.A. (1986b). *Preferences, Attitudes and Personality as Determinants of Salt Intake.* Human Nutrition: Applied Nutrition 40A 195-208.

Shepherd, R. and Stockley, L. (1987). *Nutrition Knowledge, Attitudes and Fat consumption.* Journal of the American Dietetic Association 87 615-619.

Simpson, A. (1992). *Healthy Eating in Catering : Issues and Initiatives.* British Food Journal 94 32-34.

Smithers, G. (1993). *MAFF's Nutrient Databank.* Nutrition and Food Science 2 16-19.

Sneed, J. and Burkhalter, J. P. (1991). *Marketing nutrition in restaurants: A survey of current practices and attitudes.* Journal of the American Dietetic Association 91 459-462.

Southgate, D. A. T. (1981). *Use of the Southgate method for unavailable carbohydrates in the measurement of dietary fiber.* In : James, W.P.T. and Theander, O. (eds). The Analysis of Dietary Fiber in Foods. New York : Marcel Dekker 1-19.

Tesco. (1991). *Healthy Eating.* Cheshunt : Customer Services.

Tougas, J.G. (1987). *Smart meals, nutrition in restaurants.* Restaurant Hospitality 71 155-162.

Townsend, C. (1986). *Mastering dBase III Plus: a structured approach.* London: Sybex.

Wagner, J. and Winett, R. (1988). *Promoting one low-fat, high-fibre selection in a fast food restaurant.* Journal of Applied Behaviour Analysis 21 179-186.

Wheelock, V. (1992). *Healthy Eating: The Food Issue of the 1990's.* British Food Journal 94 3-8.

Which. (1986). *Better Food Labelling.* Which May 206-207.

Which. (1989). *Nutrition Labels.* Which May 214-216.

Williams, C. and Poulter, J. (1991). *Formative evaluation of a workplace menu labelling scheme.* Journal of Human Nutrition and Dietetics 4 251-262.

Wiseman, M. (1992). *The COMA Report : Dietary Reference Values for Food Energy and Nutrients for the United Kingdom.* British Food Journal 94 7-9.

World Health Organisation. (1982). *Prevention of coronary heart disease.* London : HMSO

Yudkin, J. (1956). *Man's choice of food.* Lancet i 645-649.

Zifferblatt, S.M., Wilbur, C.S. and Pinsky, J.L. (1980). *Changing cafeteria eating habits.* Journal of the American Dietetic Association 76 15-20.

Publications

Balfour, D. S., Wise, A. & Moody, R. (1994). *Visual Nutrition Information For Menu Labelling : A Study of the Decision Making Process.* International Journal of Hygiene and Nutrition in Food Service and Catering 1 3-12.

Wise, A., Balfour, D. & Moody, R. (Submitted). *Comparisons between canteens for 'healthiness' of menus.* Proceedings of the Nutrition Society.