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ASSOCIATIONS OF SOCIAL STATUS, BELIEFS AND ATTITUDES WITH DIETARY INTAKE AND THEIR INFLUENCE ON DIETARY BEHAVIOUR CHANGE

Thesis submitted for the Degree of Doctor of Philosophy

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ABSTRACT

A cross-sectional survey of a randomly selected population sample was carried out to determine the associations of social status, beliefs and attitudes with dietary intake. The survey sample was randomly selected from the adults in the population of three capital cities (Adelaide, Brisbane and Perth), with a response rate of 70.4% (874 respondents). Dietary intake was measured by quantified food frequency questionnaire; diet-related beliefs and attitudes, occupation, education and income were also measured by self-completed questionnaire. Dietary intakes were generally healthier in higher social status groups. Dietary densities of fat and fibre were associated with diet-related beliefs and attitudes, and these could account for social status differences in dietary fibre density but not in dietary fat density.

A dietary intervention trial was then carried out to assess the influence of knowledge, beliefs and attitudes and social status on dietary behaviour change. The intervention took the form of a controlled trial in a sample which was also randomly selected from the population of adults of high and low socio-economic status suburbs in one of the previously surveyed cities (Adelaide). The sample for the intervention trial included 487 participants representing a 32% response rate from the higher status suburbs and a 20% response rate from the lower status suburbs. Dietary intake, diet-related knowledge, beliefs and attitudes, occupation, plasma cholesterol level, height and weight were measured before and after the intervention trial. The intervention was followed by improvement in dietary intakes and nutrition knowledge, but there were no changes in biological characteristics. Interviewer-assessed confidence about making dietary changes and change in nutrition knowledge were the main variables associated with overall change in dietary behaviour. Degree of dietary change did not differ between higher and lower social status groups.

It was concluded that, although some social status differences did exist in dietary intakes, these were generally small compared to the differences

between the whole sample and dietary targets and recommendations. This may imply that dietary differences between social status groups in Australia are not major determinants of health inequalities among social status groups.

DECLARATION

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution, except that some data and one analysis are reported from a population survey study which was completed as part of the candidate's Master of Public Health thesis on associations of density of fat in the diet with social status and health beliefs. The survey method and the analysis related to dietary fat intakes of social status groups are reported again here for completeness. An extended analysis of the survey data was undertaken for this thesis and included: the examination of a comprehensive array of nutrients; a more sophisticated analysis of personal beliefs; and, analyses of the associations of these variables with social status data. In addition, an intervention study was carried out.

To the best of my knowledge and belief, this work contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

I consent to this copy of my thesis, when deposited in the University Library, being available for photocopying and loan.

Signed

Date 13 / 1 / 93

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OVERVIEW

Chronic disease mortality rates are high in industrialised countries and dietary constituents have been implicated in the aetiology of the many of the major chronic diseases including atherosclerotic cardiovascular disease, hypertension, obesity, some cancers, osteoporosis, diabetes mellitus, hepatobiliary disease and dental caries. Many of these diseases have higher mortality or prevalence rates in lower social status groups and dietary intake has been implicated as a possible contributing factor to this inequality.

However, there is only limited information about the potential role of dietary variation in contributing to social status morbidity and mortality differentials. This thesis seeks to address this issue using cross-sectional and intervention methods, thereby gathering information about the social status distribution of dietary intakes; the associations of social status, beliefs and attitudes with dietary behaviour; and, social status, beliefs and attitudes as predictors of dietary behaviour change.

The work in this thesis is related to three sub-disciplines:

The first is public health: the background concerns of this thesis include population health, disease prevention and social equity, and preventive strategies for reducing the burden of diet-related disease, overall and within lower social status groups.

The second is behavioural epidemiology, which guided the structure of the work: this discipline includes the study of the distribution and determinants of behaviours that are causally linked with disease, in this case the epidemiological study of dietary behaviours that are related to chronic disease aetiology.

The third is a social learning perspective within health education: the intervention trial incorporates provision of nutrition information, opportunities for learning decision-making skills, goal setting, self-

monitoring, behavioural and biological feedback, and reinforcement of behaviour changes.

This thesis is in two parts:

The first part deals with analyses of data gained from a cross-sectional survey of 894 respondents (which represented a 70% response rate). The distribution of dietary intakes of a comprehensive array of nutrients among social status groups and the associations of personal diet-related beliefs and attitudes and social status with dietary intakes were examined - dietary fat and fibre densities were selected to examine these latter associations. Dietary intake was measured by food frequency questionnaire; diet-related beliefs and attitudes, occupation and other demographic variables were also measured by questionnaire. Statistically significant, but small, differences in dietary intake were found which were generally healthier in higher social status groups. Dietary densities of fat, saturated fat, monounsaturated fat, refined sugar, cholesterol and retinol were less in higher social status groups; dietary densities of natural sugars, alcohol, fibre, beta-carotene, vitamin C, thiamine, niacin, folate, calcium, zinc, iron, magnesium and potassium were greater in higher social status groups. Beliefs and attitudes were also associated with dietary fat and fibre densities. Social status differences in fibre density could be accounted for by differences of diet-related beliefs and attitudes, but social status differences in fat density could not be accounted for by differences in beliefs and attitudes.

The second and major part of this thesis describes the results of a dietary intervention trial, the design of which was based on the results of the dietary survey study. The intervention trial involved 487 newly recruited participants (which represented a 32% response rate from the higher status suburbs, and a 20% response rate from the lower). Dietary intake was again assessed by food frequency questionnaire. Diet-related beliefs and attitudes, information related to readiness for dietary change, social status and demographic variables were also measured by questionnaire and plasma cholesterol level, height and weight were measured during clinic visits. Other

measures collected during interviews and during the intervention period included measures of adherence to dietary changes and post-hoc evaluation of the study effectiveness. The intervention trial investigated possible causal relationships between nutrition knowledge, diet-related beliefs and attitudes, social status with dietary behaviour. As well as providing the base for the design of the intervention trial, the population survey results also provided a foundation for interpreting and generalising the results of the intervention trial.

The intervention produced overall reductions of saturated fat, cholesterol and refined sugar, and increases in polyunsaturated to saturated fat (P:S) ratio, fibre, magnesium and iron. The types of dietary changes made by higher and lower status groups tended to differ only slightly. Diet-related knowledge, beliefs and attitudes have been widely studied as predictors of dietary behaviour: in this study, change in knowledge about healthy eating was associated with dietary behaviour change and interviewer-assessed confidence in the participant's ability to make dietary changes was predictive of dietary behaviour change. Social status was not predictive of dietary change. The results of this intervention trial may not be generalisable to the whole population, as reference to the population sample surveyed indicated that the intervention sample had healthier dietary intakes and stronger beliefs in the relationship between diet and disease prevention.

In the population-based sample studied, differences in dietary intake among social status groups were small compared with the gap between dietary recommendations and the intakes of all social status groups. Dietary behaviour changes would be required in all social status groups in order to achieve the dietary intake levels recommended for the Australian population, but from the results of the survey study it appears that the needs of lower social status groups for nutrition promotion may differ from those of higher social status groups. The social status differences in nutrient density were generally confirmed in the intervention trial, which found a lower response rate in lower status groups highlighting the need for different nutrition

promotion strategies in higher and lower social status groups. However, there was an equal change in dietary behaviour in those of higher and lower social status who did respond.

Individualised dietary intervention in volunteer groups which focused on providing information about healthy eating, feedback of dietary and biological measures, behaviour change goal-setting and reinforcement and feedback about goal achievement was effective in producing dietary behaviour change in volunteers from all social status groups. It cannot be inferred that this strategy would be equally effective in the whole population or in non-volunteer segments of the population.

Diet-related knowledge, beliefs and attitudes were found to be associated with dietary intakes, but the relationships differed between nutrients (in this case fat and fibre densities). Measures of nutrition knowledge and interviewer-assessed confidence, which were either worded in relation to the targeted behaviour changes or in relation to the nutrition information discussed, were more strongly predictive of or associated with dietary behaviour change, compared to those which were worded in more general terms (e.g.'healthy diet'). Future intervention studies investigating knowledge, beliefs and attitudes as predictors of dietary behaviour should define the specific aspect or construction of dietary behaviour that they wish to target.

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CHAPTER 1

LITERATURE REVIEW

1.1 Dietary factors associated with chronic disease

Dietary behaviour is an important determinant of health: dietary intake can both enhance health and cause disease. Dietary intakes have been extensively studied as causative agents for chronic diseases. An expert panel in the USA recently reviewed the relationships between diet and chronic diseases and concluded that there was evidence of some degree of dietary causality for eight major classes of disease: atherosclerotic cardiovascular diseases, hypertension, obesity, certain cancers, osteoporosis, diabetes mellitus, hepatobiliary disease and dental caries (1). The main conclusions have been summarised in Table 1.1 (shown below). Directions of association are given if the evidence was found to be strong enough to support it; if the evidence has been too conflicting to draw any conclusion about the association, this is also indicated. Other known risk factors are also listed.

Of the diet-related diseases, atherosclerotic cardiovascular diseases (CVDs) have the highest associated mortality rates in most industrialised countries, typically around 30% of deaths (2) and caused 26.4 percent of all deaths in Australia in 1991 (3). CHD rates are dropping in most industrialised countries and increasing in Eastern European countries (4). In Australia, CHD rates fell in men and women aged 30-64 years from 1966, when the rates peaked (5, 6) and have continued to fall (3). It has been suggested that this fall, which also occurred in the USA and later in the UK, might have been related to changes in fat intake, particularly to increased polyunsaturated fat intake and decreased saturated fat intake (5) as well as cigarette smoking (6).

Major risk factors for coronary heart disease, peripheral

Table 1.1 Associations between dietary and other risk factors with chronic diseases

DISEASE	DIETARY FACTOR	ASSOC (a)	OTHER RISK FACTORS
ATHEROSCLEROTIC CARDIOVASCULAR DISEASE			
Coronary Heart Disease	Cholesterol	+	Blood lipids, blood
	Saturated fatty acids	+	pressure, smoking,
	Polyunsaturated fatty acids	-	diabetes, family history
	Monounsaturated fatty acids	-	of CHD, obesity, waist
	Vegetable protein	-	to hip ratio, physical
	Water soluble dietary fibre	-	activity level,
	Alcohol - low levels	-	personality
	- high levels	+	
	Coffee	+?	
Peripheral atherosclerotic disease (PAD)	While no systematic studies have related PAD to dietary factors, they are likely to be similar to those of CHD and hypertension		Blood lipids (triglyceride, VLDL), hypertension, diabetes, smoking
Stroke			
- Cerebral infarction	Animal fats	+	As for CHD
	Saturated fatty acids	+	
	Total fat	+	
- Cerebral haemorrhage	Saturated fatty acids (Japan)	-	Hypertension
	Animal protein (Japan)	-	
	Alcohol	-	
HYPERTENSION	Sodium	+	Obesity, lack of exercise
	Potassium	-	
	Calcium	-?	
	Alcohol	+	
	P:S ratio and low fat intake	-	
	Vegetarian diet, fibre	-	
	Lead	+	
	Protein, pantothenic acid, magnesium, cadmium, chromium, mercury, fluoride	?	
	Linoleic acid (animal studies)	+	
OBESITY (b)	Energy intake	+	Energy expenditure, genetic susceptibility
	Dietary palatability, caloric density, dietary variation,fat content of diet (animal studies)	+	

(a) +: positive association; -: negative association; ?: the association is uncertain
(b) obesity is a risk factor for other diseases, described in the text

Table 1.1 continued

DISEASE	DIETARY FACTOR	ASSOC (a)	OTHER RISK FACTORS
CANCER			
Oesophageal cancer	Alcohol	+	Smoking
	Lentils, green vegetables, fresh fruit, animal protein, riboflavin, niacin, magnesium, calcium, zinc, molybdenum	-	
	Pickles, pickled vegetables, mouldy foods	+	
	Very hot foods and beverages	+	
Stomach cancer	Dried, salted and smoked fish, pickled vegetables, salt, nitrates, nitrites, nitrites in drinking water	+	
	Fresh fruit and vegetables, vitamin C	-	
	Carbohydrate, starch, fried foods, alcohol	+?	
	Milk, dietary fibre	-?	
Colorectal cancer	Fat (saturated fat)	+	Correlated with
	Fibre	-	prevalence of breast,
	Meat consumption	+	endometrial, ovary
	Protein, calories, cholesterol	+?	and prostate cancers
	Mono-unsaturated fat, vegetables,		
	vitamin A, C	-?	
	Alcohol (beer)	+	
Liver cancer	Aflatoxin (mould)	+	Hepatitis B infection,
	Alcohol	+	occupational exposures
Pancreatic cancer	Alcohol	+?	Smoking
	Coffee	+?	
Lung cancer	Vitamin A, beta-carotene	-	Smoking, occupational
	Green, yellow vegetables	-	exposures
	Dietary fat, cholesterol	+	
Breast cancer	High kilojoule western diet, fat, saturated fat, alcohol, milk, beef	+	Body weight, height, obesity, hormonal
	Carbohydrate, fibre	-	factors
Endometrial cancer	None known		Obesity, height, diabetes, exogenous oestrogen
Ovarian cancer	Animal fats	+?	Oral contraceptive
	Vegetable fats	-?	use
	Coffee	+?	

(a) +: positive association; -: negative association; ?: the association is uncertain

Table 1.1 continued

DISEASE	DIETARY FACTOR	ASSOC (a)	OTHER RISK FACTORS
Bladder cancer	Coffee, fats and oils, cholesterol, beer, non-nutritive sweeteners	+?	Smoking, occupational exposures
	Carrots, milk, vitamin A	-?	
Prostate cancer	Fats, obesity, cadmium	+?	Occupational
	Vitamin A	-?	exposure (cadmium)
OSTEOPOROSIS	Calcium	-?	Age, sex, race, genetics,
	Phosphorus	+?	oestrogen, physical
	Protein	+?	activity, adiposity
	Fibre, oxalates	+?	smoking, reproductive
	Fluoride	-?	history, thyroid and
	Alcohol	+	kidney disease
DIABETES MELLITUS	Energy intake	+	Relative body weight,
(NON INSULIN DEPENDENT)	Fat	+?	family history
	Carbohydrate	-?	
	Alcohol	+	
	Chromium deficiency	+	
HEPATOBILIARY DISEASE			
Cirrhosis of the liver	Alcohol	+	
Gallstones	Polyunsaturated fat (v high)	+?	Gene-environment
	Cholesterol	+?	interactions, genetic
			susceptibility
DENTAL CARIES	Fermentable carbohydrate (esp. sucrose): solid form, high frequency, last in meal sequence	+	Oral microflora, saliva flow
	pH of food eaten last, fluoride, xylitol	-	

(a) +: positive association; -: negative association; ?: the association is uncertain

atherosclerotic disease and stroke include blood cholesterol level and hypertension, which are associated with obesity and dietary constituents (1). Saturated and total fat and cholesterol intakes have been shown to raise plasma cholesterol levels, and mono-unsaturated and polyunsaturated fats, soluble fibre, vegetarian diet and omega 3 fatty acid intakes to lower them, as have high carbohydrate combined with low saturated fat diets (7). This

evidence has been accumulated from animal, epidemiological, clinical and intervention studies.

It has been suggested that a decrease in plasma cholesterol of 5 mg/dl in a population group should hypothetically reduce CHD mortality by 4.3%, in an industrialised population (8). Long term trials testing this hypothesis have not been conclusive. One such study, the Oslo trial (9) did support the hypothesis, several others have shown little difference in total mortality between intervention and control groups, although they have generally shown a reduction in CHD mortality (10, 11).

Although dietary intakes are associated with risk factors for peripheral atherosclerotic disease (PAD) and stroke, no systematic research has been done examining these relationships. PAD has a low mortality rate, but is a significant cause of morbidity, and is generally found in countries with high CHD prevalence rates. Strokes are of two major types: cerebral infarction, which is also found in countries with high CHD rates; and cerebral haemorrhage, which is strongly associated with hypertension and its risk factors (1). The mortality rate from strokes in Australia is presently 10% (3).

Mortality associated directly with hypertension is comparatively low, but hypertension is a strong risk factor for other cardiovascular diseases which have high mortality rates. Hypertension has a high prevalence in industrialised countries, and is found in 18% of men and 14% of women in Australia (12). Epidemiological trials, animal studies and clinical trials have provided strong evidence linking obesity and high salt intake to hypertension. There is also evidence that alcohol intake and high fat intake combined with a low polyunsaturated to saturated fat (P:S) ratio may raise blood pressure, while potassium and possibly fibre have been found to be protective. The evidence concerning other minerals and other dietary constituents is unclear (1).

Obesity, relative body weight and also distribution of body fat are risk factors for many diseases: cardiovascular diseases; hypertension; diabetes mellitus; gallbladder disease; cancers of the gallbladder, biliary duct,

endometrium, ovary, breast and cervix in women and colon and prostate in men; and, conditions of the lungs, blood, immune system, bones, joints, skin, and endocrine system (1). In Australia in 1989, obesity was present in 9% of men and 11% of women and 50% and 35% were overweight (12). The causes of obesity have been extensively studied, with the only certain finding being that obesity is caused by consumption of a higher energy intake than expenditure. In animal studies, energy density of the diet, palatability of the diet, variation of types of foods offered and energy density of the diet all lead to increased weight gain (1).

Cancer is the second highest cause of death in industrialised countries (1), and caused 23.5% of deaths in Australia in 1991 (3). Dietary risk factors for cancers have been less well delineated than those for CVDs and appear to be more diverse. Present knowledge suggests that some may act as cancer promoters while other dietary constituents may act as cancer inhibitors. Intakes of several nutrients have been linked epidemiologically with cancer aetiology, in human intervention trials and in animal studies. Dietary antioxidants and fibre seem to act as cancer inhibitors, while fat and alcohol may be cancer promoters or co-carcinogens (13, 14).

Vitamin A and beta-carotene may confer some protection against cancers of the lung, bladder, gastro-intestinal tract and breast (14). The proposed protective effect of these vitamins may be attributable to other carotenoids or other constituents of vegetables, for example a constituent of cruciferous vegetables (15). The evidence that vitamin C or E are cancer inhibitors is inconclusive, although vitamin C has been associated with lower gastric cancer risk in Scandinavians (14). Fibre components may afford protection from colon cancer; the effect may be higher in combination with a low fat diet. On the basis that national per capita fat intakes and breast cancer incident rates are strongly correlated and based also on the evidence of animal studies, a high fat intake has also been associated with increased risk of breast cancer (14).

In addition to the proposed effects of nutrients on cancer aetiology, foods such as fruits and vegetables have been associated with lower rates of cancers of the oesophagus, stomach, lung, colon and bladder, milk and beef have been associated with higher breast cancer rates, while food constituents found more commonly in the diets of eastern and developing countries such as moulds, pickles and salted and smoked foods have been associated with higher rates of stomach cancer, as shown in Table 1.1 (1).

Osteoporosis occurs mainly in post-menopausal women and the elderly. It has been estimated that 20% of women suffer osteoporotic fractures by age 65 in the USA (1) and that 15% of Australian women will suffer a osteoporotic fracture by age 70 (16). While intake of calcium up to 25 years of age may be a stronger predictor of osteoporosis than postmenopausal calcium intake, low dietary calcium probably plays a permissive rather than a causative role in the development of osteoporosis, and many other risk factors have been described, as shown in Table 1.1 (1).

Diabetes mellitus is a disease of industrialisation and its development may be linked to aspects of high fat, low carbohydrate diets, changes in activity levels and increased body weight. Chromium deficiency predisposes to diabetes, but is unlikely to be a common cause. Although dietary change is an important management tool for control of diabetes, no specific nutrients have been implicated in its development. Non-insulin dependent diabetes mellitus is known to have a some genetic aetiology, but insulin dependent diabetes mellitus probably does not (1).

The aetiologies of other diseases have been linked to dietary constituents (see Table 1.1): the probable major cause of cirrhosis of the liver in industrialised countries is overconsumption of alcohol; development of gall bladder disease may be associated with dietary cholesterol intake, and with very high intakes of polyunsaturated fat; and, dental caries occurs in the presence of fermentable carbohydrates in the mouth, especially sucrose, although starch and other simple sugars are also cariogenic. Frequency of

carbohydrate-containing meals and pH of the meal have also been shown to affect the cariogenicity of the meal (1).

Micronutrient deficiency diseases, such as scurvy, pellagra and rickets, are rare in industrialised countries. There is evidence that particular groups such as the homeless suffer from micronutrient deficiencies in Australia (17) and the USA (18). Iron status was found to be of public health concern in women of childbearing age and young children and calcium status in older women, according to the results of US government nutrition monitoring activities (19), and was found to be poor in 12-15 year old girls in an Australian survey of children (20). Low intake of thiamin is related to development of Korsakoff-Wernicke encephalopathy in alcoholics, which has a high prevalence in Australia relative to other industrialised countries (21).

1.2 Dietary goals and recommendations

As a result of the evidence linking diet and chronic diseases described in Section 1.1, many countries, including Australia, have developed dietary recommendations for their populations concerning the balance of foods and nutrients to consume in order to minimise diet-related chronic disease. Such recommendations provide a basis for nutrition education efforts. In Australia in 1979, the (then) Commonwealth Department of Health established a Food and Nutrition Policy (22), and proposed a set of eight dietary goals, which were released for the public as dietary guidelines (23) and are shown in Table 1.2.

In 1992, the dietary guidelines were revised and released in association with a revised food and nutrition policy. The up-to-date dietary guidelines are shown in Table 1.3. The qualitative Australian guidelines shown are quite similar to those in use in several European countries (24).

In 1986, the Nutrition Taskforce of the Better Health Commission developed a set of diet-related goals and quantitative nutrition targets for the

Table 1.2 Dietary Guidelines for Australians, 1982 (23)

1. Promote breast-feeding
2. Choose a nutritious diet from a variety of foods
3. Control your weight
4. Avoid eating too much fat
5. Avoid eating too much sugar
6. Eat more breads and cereals (preferably wholegrain) and vegetables and fruit
7. Limit alcohol consumption
8. Use less salt

Table 1.3 Dietary Guidelines for Australians, 1992 (26)

1. Enjoy a wide variety of foods
2. Eat plenty of breads and cereals (preferably wholegrain), vegetables (including
   legumes) and fruits
3. Eat a diet low in fat and, in particular, low in saturated fat
4. Maintain a healthy body weight by balancing physical activity and food intake
5. If you drink alcohol, limit your intake
6. Eat only a moderate amount of sugars and foods containing added sugars
7. Choose low salt food and use salt sparingly
8. Encourage and support breastfeeding

Guidelines on specific nutrients

1. Eat foods containing calcium. This is particularly important for girls and women
2. Eat foods containing iron. This applies particularly to girls, women, vegetarians and athletes.

Table 1.4 Diet-related goals, and nutrition targets for the year 2000 (25)

Goals

1. To reduce the incidence and prevalence of diet-related health disorders
2. To provide a food supply conducive to good health
3. To promote the skills and knowledge which will enable Australians to make better choices about what they eat

The following targets are associated with the achievement of these goals by the year 2000

1. To reduce the prevalence of overweight and obesity from 38 per cent to 25 per cent
2. To reduce the fat contribution to the Australian diet from 38 per cent to 33 per cent
3. To reduce the contribution of refined sugars to the total energy content of the Australian diet from 14 per cent to 12 per cent
4. To reduce dietary sodium intake from 165 mmol per day to 100 mmol per day
5. To reduce to 5 per cent the contribution of alcoholic beverages to the total energy content of the diet
6. To increase the level of breast-feeding at 3 months of life from 50 per cent to 80 per cent
7. To increase the dietary fibre content of the Australian diet from 17 grams per day to 30 grams per day

years 1995 and 2000 (25). These were based on the only available nutrient intake data at the time, the apparent consumption data. Interpretation of these population-based goals with individual intakes should be done circumspectly. The diet-related goals and nutrition targets for the year 2000 are shown in Table 1.4.

The targets for the USA (1) differ from those for Australia as they refer to individual intake levels, rather than population intake levels. Of relevance in this thesis, reduction of total fat intake to 30 percent of energy or less, saturated fat to less than 10 percent, and cholesterol to less than 300mg/day is recommended. These levels have also been recommended by

various other expert bodies in Australia such as the National Heart Foundation and the Anti-Cancer Foundation in relation to individual intake levels.

In parallel with these dietary guidelines, many countries have developed recommended dietary allowances or intakes (RDAs or RDIs) to quantify the amount of energy, protein, vitamins and minerals which should be available to the population in order to avoid diseases of nutritional deficiency. A core use of RDIs is to provide a standard against which the level of essential nutrients in the diet of different sections of the community or the whole population can be assessed (27). In addition, they are also used as a scientific basis for nutrition education, as the denominator for nutrition labelling, for planning therapeutic diets and for assessing daily nutrient intakes of groups and even individuals, although they were not intended for this last use (28). The Australian RDIs included recommended intake levels of 14 nutrients relevant for age, sex and life-stage (29).

Food selection guides are central to the process of translating current scientific knowledge about diet and related health problems into recommendations about daily food selection behaviours (30). Thus, early food selection guides were concerned with variety, adequate energy intake and protection from diseases of nutritional deficiency, while contemporary problems of high rates of chronic diseases have required a different approach. The main guides in use in Australia include the Five Food Group guide, which aims for variety and adequacy, and the Healthy Diet Pyramid, which addresses the issue of dietary balance qualitatively, using descriptive terms such as 'eat more', 'eat moderately' and 'eat less'. Other guides have also been developed by specialist health bodies, such as the Australian National Heart Foundation. A recent innovation is the 12345+ Food and Nutrition Plan (31), developed by the CSIRO Division of Human Nutrition and produced in conjunction with the Anti-Cancer Foundation, which combines concerns about lower fat and higher fibre diets with adequacy of vitamin and mineral intakes. This food selection guide was used as an

educational and assessment tool in the intervention trial described in this thesis and will be described in detail later. It was firmly based on the quantitative targets of the Better Health Commission (25) and the Australian RDI levels at the time (29).

1.3 Social status as a predictor of health status

Higher death rates have been found in those of lower social status in many industrialised countries. Major national reports in the USA (32), the UK (33) and, more recently, Australia (12), have provided strong and consistent evidence of social status inequalities in health, with the lowest status occupation, education and income groups having higher morbidity and mortality rates.

In the Australian study, all-causes death rate in men in the lowest decile of occupational prestige was 2.3 times that of the highest decile. Rate ratios for selected causes of death which were higher in the lowest decile compared to the highest were: lung cancer, 3.6; diabetes, 3.5; stroke, 2.3; coronary heart disease, 2.0. Colo-rectal cancer was the only diet-related chronic disease rate which had a higher mortality rate in the highest decile. Occupation does not reflect social circumstances as accurately for women, however measurement of socioeconomic disadvantage by area of residence shows total mortality differentials of the same order for females and males (12).

Other studies comparing mortality, prevalence or incidence rates of diet-related diseases which have been reported in the literature are shown in Table 1.5.

Coronary heart disease and stroke mortality rates have significant negative socioeconomic gradients of the order of 20-50% excess in men and women of low socioeconomic status compared with those of high socioeconomic status in Australia (34, 35, 36). Similar differences have been

Table 1.5 Diet-related disease mortality rates associated with social status

DISEASE	COUNTRY, YEAR OF STUDY (SEX)	AS[a]	REFERENCE
Coronary heart disease	Australia, 1969-78 (M)	-	(34)
	Australia, 1970-77 (M)	-	(35)
	Australia, 1976-79 (M,F) [b]	-	(36)
	England and Wales, 1971-81 (M)	-	(37)
	Scotland, 1988 (M,F) [c]	-	(38)
	UK, 1970-72,79-83 (M,F)	-	(39)
	Finland, 1971-81(M)	-	(37)
	France 1976-81 (M)	-	(37)
	New Zealand, 1975-87 (M)	-	(40)
	Sweden, 1961-79 (M)	-	(41)
	USA, 1960 (M,F)	-	(32)
	USA, 1960-65 (M) [d]	-	(42)
Stroke	Australia, 1970-77 (M)	-	(35)
	Australia, 1976-79 (M,F) [b]	-	(36)
	NZ, 1975-77,'85-87 (M)	-	(40)
	UK, 1970-72, 79-83 (M,F)	-	(39)
	USA, 1960 (M,F)	-	(32)
Hypertension	Australia, 1980 (M,F) [c]	-	(34)
	Scotland, 1988 (M,F) [c]	0,-	(38)
	USA, 1979-86 (M,F) [c]	-	(43)
Obesity	Australia, 1980 (M,F) [c]	-	(34)
	Australia, (M,F) [c]	-	(44)
	Scotland, 1988 (M,F) [c]	-	(38)
	USA, 1979-86 (M,F) [c]	-	(43)
Oesophageal cancer	UK, 1967-87 (M)	-	(45)
Stomach cancer	Australia, 1970-77	-	(35)
	Australia, 1976-79 (M,F) [b]	0	(36)
	UK, 1967-87 (M)	-	(45)
	USA, 1960 (M,F)	-	(32)

(a) AS=Direction of association; + =positive association; - =inverse association; 0 =no association; ?=association with social status is unclear. If the association differs between males and females, separate indications are given.
(b) The study included people living in Brisbane only
(c) Association with disease prevalence rate
(d) Association with disease incidence rate

Table 1.5 continued

DISEASE	COUNTRY, YEAR OF STUDY (SEX)	AS[a]	REFERENCE
Colo-rectal	Australia, 1970-77 (M)	+	(35)
	Australia, 1976-79 (M,F) [b]	+	(36)
	UK, 1967-87 (M)	+	(45)
	UK, 1979-83 (M)	0	(45)
	Finland, 1971-75 (M,F) [d]	+	(46)
	USA, 1960 (M,F)	-	(32)
Pancreatic cancer	Australia, 1970-77 (M)	?	(35)
	Australia, 1976-79 (M,F) [b]	+,0	(36)
Prostate cancer	UK, 1967-87 (M)	+	(45)
	UK, 1979-83 (M)	+	(45)
	Finland, 1971-75 (M) [d]	+	(46)
	USA, 1960 (M,F)	+	(32)
Bladder cancer	UK, 1967-87 (M)	-	(45)
	UK, 1979-83 (M)	-	(45)
Lung cancer	Australia, 1970-77 (M)	-	(35)
	Australia, 1976-79 (M,F) [b]	-	(36)
	UK, 1967-87 (M)	-	(45)
	UK, 1979-83 (M)	-	(45)
	UK, 1970-72, 79-83 (M,F)	-	(39)
	USA, 1960 (M,F)	-,+	(32)
Breast cancer	Australia 1976-79 (F)	0	(36)
	Finland, 1971-75 (F) [d]	+	(46)
	USA, 1960 (M,F)	+	(32)
Diabetes mellitus	Australia, 1970-77 (M)	0	(35)
	Australia, 1976-79 (M,F) [b]	0	(36)
	UK children, 1977-86 (M+F) [d]	-	(47)
	USA, 1960 (M,F)	?,-	(32)
Cirrhosis of the liver	Australia, 1970-77 (M)	-	(35)
	Australia, 1976-79 (M,F) [b]	0	(36)
	Finland, 1971-81 (M)	?	(37)
	France, 1976-81 (M)	-	(37)
	USA, 1960 (M,F)	0	(32)

(a) AS=Direction of association found; + =positive association; - =inverse association; 0 =no association; ?=association with social status is unclear. If the association differs between males and females, separate indications are given.
(b) The study included people living in Brisbane only
(c) Association with disease prevalence rate; (d) Association with disease incidence rate

found in New Zealand (40), the UK and Scotland (38, 39), the USA (32) and European countries (37, 41).

There is consistent evidence from many countries that the decline in CHD rates has been greatest in higher social classes, leading to a widening of social inequalities in health status within nations (4). This could be due in part to differences in lifestyle-related risk factors. In Australia, professional and technical occupations had the lowest risk factor levels in 1980 for blood pressure, plasma cholesterol, cigarette smoking, body mass and recreational exercise levels, compared to all other occupation groups (34). In more recent data collected in 1989-90, manual occupation, low educational level, low income level and living in a suburb of socioeconomic disadvantage were all associated with higher rates of smoking and low levels of participation in leisure-time physical activity. Prevalence of overweight and obesity and hypertension were higher in some of these groups; alcohol intake was lowest in low income groups, but high in males in manual occupations (12).

Smoking and exercise prevalence rates have also been shown to be higher and lower respectively in lower status groups the USA and Scotland (38, 43) although it was noted that the Scottish manual workers were more active at work. Higher social status women and lower status males were found to consume more alcohol in Scotland (38), as was found in Australia in 1980, by occupation category (34), and in Australia in 1989, by income level (12).

In a review of international trends in coronary heart disease mortality, morbidity and risk factors, it was found that the reduced mortality of higher social status groups which has been seen in recent years is most likely to be related to changes in smoking behaviour, while the evidence that it might be related to changes in dietary behaviour was inconclusive (4).

Lifestyle factors have not, however, been found to have sufficient explanatory power to account for risk factor differentials between social status groups, nor have risk factor differentials been sufficient to explain mortality differentials. In a Norwegian study, plasma cholesterol and blood pressure levels were found to be higher in the lowest educational status group

but not all of the observed differences in these risk factors were able to be explained by differences in body mass index and the lifestyle habits of smoking, physical fitness and selected food habits (48). However, their assessment of food habits was limited. A prospective observational study of British civil servants found that known risk factors of smoking, plasma cholesterol levels, blood pressure and glucose intolerance could not account for mortality differentials between social class groups (49). There is also evidence that non-lifestyle factors including occupational exposures, the effects of low income, psycho-social factors, poor quality housing, unemployment and deprivation in early life also contribute to social status mortality differentials (50).

Diet-related cancers with higher rates in lower social status groups include those of the lung, bladder, stomach and oesophagus. While most diseases shown in Table 1.5 have higher mortality rates in lower social status groups, colo-rectal, breast and prostate cancers have higher mortality rates in higher status groups, and these cancers also have been shown to have rising incidence rates in Finland (46). Directions of association differed in USA data from the early 1960s however, but patterns of association may have changed in the intervening period (32). Rimpela and Pukkala suggest that higher dietary intake of fat and meat in upper social classes in the 1960s could have led to increased colon cancer rates. Other factors they discuss which could have led to these higher incidence rates in higher status groups and in the whole population include: reproductive history in women, age at menarche and changes in nutritional factors for breast cancer; and, better access to health care and better diagnosis for prostate cancer in men (46).

Mortality due to diabetes mellitus (non-insulin dependent and insulin dependent) was found to be higher in lower occupational prestige groups in the national Australian data previously described (12), while a study of the association between the incidence of childhood insulin dependant diabetes in Britain found it was more likely in areas of material deprivation (47). Other

Australian studies of mortality due to diabetes mellitus have found no association (35, 36).

The social status distribution of mortality due to liver cirrhosis appears to vary among countries (as alcohol intake distribution also appears to): in Finland, rates were highest in employers, labourers and managers and lowest in farmers; in France, they were highest in low socio-economic groups (37); and, no consistent trend was found across socio-economic strata in Brisbane (36), or the USA (32).

Social status differences in dental health have also been demonstrated in Australia. Lower educational and occupational status groups had more decayed and missing teeth, but fewer filled teeth than upper status groups in 1987-88 (12).

In relation to general health status, prevalence of disability and serious chronic illness and number of recent days of illness and reduced activity have been found to be higher in lower status groups in Australia (12, 51). In England and Wales working class people visited their GP more often, had more hospital in-patient admissions and used out-patient services more frequently (33). This was interpreted to mean that low social class was associated with poorer GP care, greater severity of illness before the GP was consulted and greater social and economic costs associated with visiting the GP (33).

1.4 Variation in dietary intakes between social status groups

Socioeconomic differentials in dietary intakes have been described in industrialised countries. Such differences have been reported in the USA (52), the Netherlands (53), Scotland (54), Australia (55) and there is some British data (56, 57). In Table 1.6 the data from those studies which included

statistical analysis and covered a comprehensive selection of nutrients have been summarised.

As total food and energy intakes tend to be dependent on such factors as occupational activity, leisure-time exercise level, sex and size, consideration of nutrient density generally allows a better comparison of dietary quality. Fat density or intake has been found to be uniformly lower in higher social status groups, except in English samples (56, 57) and for men in a USA sample, although the less educated men in this sample did have a higher Keys score - a measure of the atherogenicity of the diet (52). Dietary fat density was also not associated with education level in a large population sample from the USA, although this study did have a response rate below 35% and cannot be interpreted as representative of the whole population (58). Cholesterol intakes and densities have also been found to be higher in lower status groups in The Netherlands and Scotland, and fibre intake or density to be higher in higher status groups in The Netherlands, Scotland and the USA.

Australian mean nutrient density data have also been tabulated by occupational prestige, although not statistically analysed. The lower occupational prestige groups had larger mean energy intakes and greater mean fat density levels; the higher prestige groups had greater dietary mean densities of fibre, beta-carotene, vitamin C, vitamin E, zinc and selenium. Mean alcohol density was greater in low occupational prestige males and high occupational prestige females (55). These results are similar to those found in the Scottish study shown in Table 1.6.

Lower intakes or dietary densities of micronutrients were reported in lower status or manual occupation groups in Scotland (54) and Holland (53) as shown in Table 1.6, and mean education level was found to be associated with number of low-intake nutrients in the large sample in the USA (58). Lower intakes or dietary densities of micronutrients were also reported in a large population sample of the elderly in the USA (59). Inadequate micronutrient intakes have been found in small samples of socially disadvantaged groups in Ireland (60), and the homeless in the USA (61) and

Table 1.6 Variation in dietary intake across social status groups

NUTRIENT	DUTCH (a) 1987-88		SCOTTISH (b) 1984-86		USA (c) 1980-82	
	Male	Female	Male	Female	Male	Female
Energy	L	0	L	L	0	0
Protein	0	0	L	0	0	0
Fat	L	L	L	L	0	L
Saturated fat	0	0	L	L	0	0
Polyunsaturated fat	L	L	0	0	0	0
Cholesterol	L	L	L	L	0	0
Carbohydrate	0	0	L	L	0	H
Sugars	0	0	L	L		
Fibre	H	0	H	H	H	H
Alcohol	H	H	L	H	0	0
Calcium	H	H				
Iron	H	H				
Retinol			L	L		
Beta-carotene			H	H		
Vitamin C	H	H	H	H		

L, greater intake/density in lower status groups; H greater intake/density in higher status groups
(a) nutrient densities compared (53)
(b) nutrient intakes compared (54)
(c) nutrient density compared (52)

Australia (62), although the methodologies used in these studies provided no comparison with more socially advantaged groups.

Preliminary evidence from the Australian National Dietary Survey of 1983 has been reported as showing that men and women of low educational status had lower intake of dietary fibre, vitamin C, thiamin, iron and calcium, but no discernible trend was found in contribution of fat or starch to total energy content of the diet. Alcohol densities were found to be higher in less well educated men and well educated women. These data have been used to

imply that a wide variation in nutrient intakes existed between socioeconomic status groups (16). The final data have not yet been published.

Differences in food choices between social status groups have also been described. Higher social status groups in the Netherlands drank less coffee and ate breakfast more regularly (53). In Finland, higher social classes consumed a healthier diet, defined and scaled according to type and amount of fat in margarine and dairy foods, frequency of eating vegetables and amount of sugar used in coffee (63). In Australia higher social status groups have been found to eat more high fat and less low fat milk (64), more breakfast cereal (65) and less high fat meat (66). Foods which may confer protection from cancer were found to be eaten by smaller proportions of lower income groups in the USA (67) and by smaller proportions of low occupational prestige groups in Australia (55). The differences between higher and lower social status groups were not generally large. The diets of disadvantaged groups in Ireland were characterised by a limited range of foods, a high intake of milk and sugar and a low intake of fresh fruits, vegetables and meat (60).

Overall, the data comparing dietary intakes of social status groups is limited and only few large scale studies exist. The findings of these studies indicate that there are social status differences in dietary intakes, which were generally healthier in those of higher social status; these differences however, do not appear large enough to explain differences in mortality rates. Other explanations for the social status differential in mortality include differences in the prevalence of cigarette smoking which has been thought to be particularly important , differences in other known lifestyle risk factors and also differences in non-lifestyle risk factors although these have not been well characterised, as was discussed in Section 1.3.

1.5 Beliefs and attitudes as predictors of dietary behaviour

An understanding of the determinants and predictors of health behaviour is necessary for the development of effective health education programs. Many theories and models have been used to explain health behaviour; fifty-one models were found in a review of health behaviour research (68). Many of these have traditionally focussed on intrapersonal factors involving an individual's beliefs and behaviour and some have included interpersonal factors such as the individual's perception of the beliefs of people who matter to them (68, 69). Beliefs and attitudes have been found to be useful as determinants of behaviour as they are amenable to modification by health education programs, while other variables such as socio-demographic characteristics, personality characteristics and prior behaviour are useful for identifying and targeting subgroups at risk (70).

An ecological perspective of health education was described by Glanz and colleagues, comprising intrapersonal and interpersonal as well as institutional, community and public policy factors (68). In this thesis, both personal and socio-economic influences are being examined in the context of developing nutrition education programs for all social status groups. Models of dietary behaviour in particular and health behaviour in general will be described in this section. The personal influences to be examined include diet-related and health-related knowledge, beliefs and attitudes.

The influences of personal and social factors on dietary behaviour have been acknowledged (71, 72). For example, a model of dietary behaviour described by Sims (71) included external and internal (or personal) influences on dietary behaviour. From the available food supply, individuals may choose those foods they consume on the basis of influences related to the external environment, including social, cultural, situational, religious, educational and economic factors. In this model, personal factors including knowledge, beliefs, attitudes and values interact with those from external sources and are

processed and interpreted uniquely by each person (71). A second example is the model of dietary adherence of McCann and colleagues (72) which includes factors that could be described as intrapersonal, interpersonal, institutional and community. In their model, dietary behaviour may be directly influenced by individual attributes, the health care community, social networks, and environmental influences on food choice. In addition, the influences of the health care community and social networks on the individual's dietary adherence may be constrained or aided by such factors as the food supply, income available and other aspects of the food choice environment in which the behaviour takes place. In this model, deficiencies in one area of influence can be made up for by strengths in another. For example, lack of belief that eating high fibre foods is important for health can be redressed by living in a household in which high fibre foods are always used.

In the remainder of this section, evidence on the relationships of knowledge, beliefs and attitudes with dietary behaviour will be discussed in the context of behavioural models and theories which have been applied to dietary behaviours. The evidence that socio-economic factors influence dietary behaviour has already been discussed in Section 1.4, in which it was reported that associations between social status and dietary density levels have been found in many countries.

1.5.1 Knowledge, beliefs, attitudes and dietary behaviour

Knowledge is usually defined as strongly-held and widely-accepted "fact" (73). In this thesis, nutrition knowledge will be assessed in relation to the principles underlying the 12345+ Food and Nutrition Plan which is based on Australian dietary goals and recommended dietary intake levels. Beliefs are conceptually closely related to knowledge in their effect on peoples' behaviour but beliefs are not necessarily generally regarded as fact (74). Attitudes can be distinguished from beliefs in that they refer to a persons' feelings about, or an evaluations of what is being assessed (73).

Compliance or adherence to dietary behaviour change in nutrition intervention programs has been found to be potentiated by factors such as acquisition of nutrition knowledge, changes in nutrition-related attitudes, enhanced motivation and positive social and peer influences (69, 75). Dietary intervention trials seeking to change dietary behaviour have utilised methods incorporating behavioural science techniques, motivational techniques and instructional techniques (76). Instructional techniques were at first thought to be sufficient, and nutrition knowledge and dietary behaviour were found to be correlated in some meta-analyses of nutrition education articles but not others (69, 73). Behavioural science perspectives have been developed which incorporate beliefs and attitudes as important additional predictors of behaviour change.

While many models have been used to predict health behaviour, Glanz and colleagues found that over 50% of health behaviour research articles using a theoretical framework encompassed one or more of the following: the Health Belief Model; the Theory of Reasoned Action; and, Social Learning Theory (68). These, and other models of health behaviour, have also been used to explain dietary behaviour, as will be outlined below.

The Health Belief Model (HBM)

The HBM was first designed to explain the lack of uptake of screening for tuberculosis in the 1950s (77). It has subsequently been used in various dietary studies to explain why people do or do not adhere to dietary behaviours to prevent diet-related chronic diseases. HBM variables include perceived susceptibility and severity of the outcome, and perceived benefits of and barriers to avoiding the outcome (78). These variables were found to be predictive of child's weight loss, when fear arousal was used to potentiate perceived susceptibility to poor health outcomes in a group of mothers, as perceived susceptibility may be low in relation to chronic diseases which develop later in life and are removed in time from the performance of the behaviours (79).

In other studies investigating the HMB in relation to dietary behaviour, HBM variables were predictive of dietary change according to retrospective self-report in a study of shoppers (80), and were also somewhat successful in predicting compliance with a low-sodium, low-energy diet in hypertensives (75). Finally, in a study of health maintenance activities undertaken by older people, HBM variables, socio-demographic factors and type of health insurance plan were all important in predicting compliance (81).

The HBM has recently been extended to include the construct of self-efficacy, borrowed from social learning theory (which is outlined below). It is argued that, in addition to the weighing up of perceived threats and benefits, conviction that change is within the individual's ability is also important. This may be especially relevant for the more complex behaviours associated with prevention of chronic disease, and this extension to the model has been found to be useful (77).

Ajzen and Fishbeins' Theory of Reasoned Action

The Theory of Reasoned Action was developed by Ajzen and Fishbein on the premise that intention to perform a specific behaviour is highly predictive of performance of this behaviour, for behaviours that are under volitional control (70). A person's intention to perform a behaviour may be predicted by: their attitude towards the behaviour, which can in turn be predicted by their belief that a given outcome will occur and their evaluation of that outcome; their belief about the influence of the social environment and social norms; and, their motivation to comply with those norms (70). These attitudes have been found to be most predictive of behaviour when the attitude corresponds very closely with the behaviour and is strongly felt and positive towards the behaviour (82). Therefore, the efficacy of this model relies on the researcher's ability to identify the salient beliefs, social norms and attitudes (70).

Shepherd and colleagues have studied dietary behaviour using this model, finding that the effect of peer influences had little power to predict

intake of high fat foods or salt intake, while attitudes had high predictive ability (83, 84, 85). A measure of degree of habituation of the dietary behaviour also improved the explanatory power of the model, on the premise that some eating behaviours are performed habitually with a low degree of cognitive involvement (86).

The Theory of Planned Behaviour has recently been advanced to extend the domain of behaviours covered by The Theory of Reasoned Action, to include behaviours that are not totally under a person's control (87, 88). This, and related modifications of this model, have been applied to predicting attempted weight loss behaviour, with some success (89).

Social Learning Theory

Social-learning theory, or social-cognitive theory in its most recent version (90), has received considerable attention in behaviour-change research. In this theory, it is proposed that personal goals, personal motivation to change, self regulation and external values determine behaviour change, success at which causes revision of future goals and actions, all occurring within the ambit of environmental factors (such as peer influences). Contento has described three principles of social learning theory that may be useful in understanding dietary behaviour: peoples' behaviours are influenced by their observations of others; people can gain reinforcement from their interpretation of external influences; and, people are capable of self-regulating their own environment (91). A construct from this model that has been widely used is self efficacy, as mentioned in relation to the HBM. Self efficacy is defined as self appraisal of confidence in ability to perform a task, an appraisal which is constantly updated and revised based on attempts at performing the task (90). Some studies of dietary behaviour which have used aspects of this theory will be described below.

A social-cognitive model was found to predict 35% to 61% of variance in consumption of milks and soft drinks in adults and students, while a traditional model incorporating demographic variables, nutrition knowledge

and attitudes explained only 5% to 26% of variance in consumption (92). Self-efficacy in relation to weight loss behaviour was found to be predictive of weight loss (93) and research into the validity of self-efficacy scales for dietary behaviour found them to be associated with reported health behaviours (94), but a measure of self-efficacy was not associated with retrospective self-report of dietary behaviour change in older people (95). A study of predictors of change in Mexican American families participating in a health behaviour change program found inconsistent and weak relationships between variables derived from social learning theory in adults, although self-efficacy was correlated with dietary measures in children (96).

Locus of control

Locus of control is defined as attitude towards control of general outcomes and was initially developed by Rotter, and further developed in relation to health outcomes by Wallston and Wallston. This concept has intrinsic appeal due to the contemporary emphasis on individual responsibility for health. Individuals with an internal locus of control are believed to be more likely to take responsibility for their health and therefore to perform preventive behaviours than those with an external locus of control (97).

A large body of research has found this construct to have been singularly unproductive in predicting preventive health behaviour (98), although the authors do recommend that situation-specific measures of locus of control may have greater predictive power. Such a relationship was found in a cross-sectional study which found an association between reported performance of nine behaviours oriented to a healthy dietary intake with dietary locus of control score (99). However, the measures of dietary behaviour and attitude used in this study could be influenced by each other and therefore may have over-estimated the strength of the relationship. A study of weight-loss locus of control found a specific four-item scale was predictive of attitudes towards weight loss behaviours and intentions to lose weight. However, the scale was uncorrelated with weight change (100).

The stage-of-change model

The stage-of-change model of Prochaska and DiClemente is the final model of behaviour change to be considered and differs from those mentioned above in that it can be directly applied to improving compliance in behaviour change programs. This model identifies the major stages that people progress through when attempting to change their behaviour. These included pre-contemplation, contemplation, action and maintenance stages. The contemplation stage has also been subdivided to create a preparation stage of those most ready for change (101). These stages are described below.

In the precontemplation stage, the individual is not considering change. When in the contemplation stage, the individual is evaluating the benefits of behaviour change, and may intend to make changes. In the preparation stage, the individual is making an active attempt to change or modify behaviour. The action stage involves initiation and integration of changes into the individual's lifestyle and during the maintenance stage these behaviour changes are consolidated. However the individual may lose resolve and relapse into old habits. They may then recycle to precontemplation or contemplation stages. People may cycle through these stages several times before successfully changing the behaviour (102).

This model has mainly been used to examine addictive behaviours, such as smoking, alcoholism and weight loss (101), but has not been widely used in other types of dietary intervention studies. In a study of smoking cessation, those categorised into the preparation stage had higher quit rates than those categorised into the contemplation stage, who had higher quit rates than those categorised into the precontemplation stage. These were mutually exclusive categories based on intention to quit in the next six months, in the next 30 days, and on their history of quit attempts lasting at least 24 hours during the previous year. Stages classifications were also related to self efficacy, with those more ready for change having higher self efficacy scores (101).

The stage-of-change model also describes the change processes that people use when attempting behaviour changes. In the contemplation stage, people have been found mainly to think about the problem, progression to the action stage involves activities such as seeking help and reinforcement from others and thinking about themselves differently, for example as a non-smoker in the case of smoking cessation. During maintenance, people seek to control their environment and engage in other processes to prevent relapse. Precontemplation involves few or no change-related activities apart from thinking that one day they may do something (103).

This model may therefore be useful for matching individuals to intervention programs and for correctly tailoring intervention and maintenance activities. Using this approach, participants could be classified according to readiness to change the behaviour targeted in the program: only those in preparation, action and maintenance stages would be targeted for active intervention and support for the relevant change processes described above would be provided. Theoretically, this would improve compliance and rates of behaviour-change interventions (101).

Summary

The models and research findings outlined above demonstrate that diet-related knowledge, beliefs and attitudes are, to a greater or lesser extent, associated with or predictive of dietary behaviours. Some studies were cross-sectional, showing associations at one point in time; others showed prediction of behaviour change over time. The import of these concepts to dietary behaviour change depends on their prevalence and distribution in the population. These will be examined below in the Australian population.

1.5.3 Beliefs about diet and reported dietary change in Australia

Several Australian studies have reported on: the prevalence and social distribution of belief that food behaviours should be modified; awareness of the link between diet and disease; and, attempts to make these changes. All the

studies discussed were completed in Australia during the past decade and were of random population samples, except one shopping centre survey, which is noted. In those studies in which social status differences in beliefs and reported behaviours were measured, they are described.

Studies of peoples' perceptions of their nutritional intake will be considered first. Around 40% of respondents in Melbourne reported wishing to eat more vegetables and cereal grains, and 50-60% reported wishing to reduce their intake of fatty and salty foods (104). In a follow-up study, only 25-35% considered their diet to contain too much fat, sugar and salt and too little fibre and only 4%, not enough carbohydrate (104), indicating poor knowledge of the relationships between foods and nutrients.

This appeared to change quickly. A report in the mid to late 80s of a shopping centre study in western Sydney - a low socio-economic status region - found 70-80% of respondents rated reduction of fat, salt and sugar as very important (105). In the state of South Australia around the same time, 40-60% of respondents rated these same changes as very important; younger age groups and females tended to be at the higher end of the prevalence range and there were no differences between social status groups (106).

Studies of awareness of the link between diet and disease will be considered next. In an Australia-wide survey, 65% of people were aware of the association between fat and coronary heart disease, 40-50% were aware of the associations between sugar and diabetes and salt and high blood pressure, and only 20% were aware of an association between fibre intake and bowel disease. Higher levels of awareness were noted among younger people, women and those of high occupational prestige (107).

Two studies describing the prevalence of strong belief in the causal association of diet with cardiovascular disease have found: 20% of respondents in a western Sydney (a low social status area) shopping centre rated either diet, exercise or stopping smoking as the single most important thing that could be done to reduce a high cardiovascular risk (105); while 50% of people in an Australia-wide survey in 1986 nominated dieting and

weight loss as important for reducing cardiovascular risk (108). But knowledge of the dietary steps needed to reduce cholesterol was possibly less prevalent: although 80-90% stated they would reduce intake of fried foods to reduce a high cholesterol level, only 35-50% stated they would reduce intake of dairy foods or meat (108).

A high level of awareness of the role of dietary factors in cancer causation was found in a study in the South Australian population carried about between 1988 and 1989. Around 50% of people were aware of the role of specific foods in cancer protection and cancer causation, but there was a high level of uncertainty of the role of specific nutrients. Concern about harmful chemicals in foods and the environment in relation to cancer causation was high. Few differences between social status groups were found in this study (109).

Finally the occurrence of reported recent dietary change was found to be moderate to high in three surveys carried out between 1986 and 1988. Sixty to 80% reported attempting reduction of salt, fat and body weight in western Sydney (105), while a follow-up random survey found that over 50% of the sample stated that, in order to reduce their fat intake, they had recently attempted eating eggs less than 4 times a week, not eating the fat on meat, using margarine instead of butter, drinking less than 250ml of milk a day and eating cheese less than 3 times a week (110).

There is some evidence that behaviour change may differ among social status groups. In a state-wide South Australian and a national Australia-wide survey, around 50-70% had tried to reduce fat, salt and sugar and about 40% to increase fibre intake: higher educational or occupational status groups stated they had made more changes (106, 107). In the South Australian survey, lower social status groups were more likely to be concerned with social and practical aspects of making dietary changes, while higher social status groups appeared to derive greater satisfaction from the less tangible psychological and nutritional aspects of dietary behaviour change (106).

In summary, belief that dietary change is desirable, efforts to make dietary changes, belief that dietary intake can cause disease, especially coronary heart disease and latterly cancer, all appear to have been common, and increasingly so, in Australia in the past two decades. There is evidence that they are more common in women and, to a lesser extent, in higher social status groups. The relationships described between knowledge, attitudes, beliefs and dietary behaviour change, and the high occurrence of diet-related attitudes and beliefs, but lower occurrence of correct nutrition knowledge have implications for public health dietary intervention campaigns.

1.6 Dietary behaviour-change intervention trials

The efficacy of dietary intervention trials will be discussed in this section, with reference to the results of those studies which included measures of change in nutrient intake or some other measure of dietary behaviour change. These studies are reviewed to gauge the magnitude of dietary changes that have been reported and to describe the intervention methods that have been used and the samples in which they have been used. Recent reviews of the efficacy of dietary intervention trials include those of Glanz (76), Johnson and Johnson (69) and deLooy and colleagues (111). The relative efficacy of interventions among social status groups will be considered in relation to the results of those studies in which the effect of social status was assessed.

A meta-analysis of the efficacy of nutrition education programs reviewed over 670 reports, finding 303 with usable research findings. The authors reported generally positive results: over 50% of nutrition education findings were of nutritionally beneficial behaviour change and increased knowledge about nutrition (69). Although no distinction was made about differences in efficacy among these groups, the studies reviewed included both males and females with widely varying socio-economic status, age and cultural background.

No conclusions were drawn by the authors about the effectiveness of specific educational techniques used, as most used multiple modalities including lectures, written materials, directed small group activities and individual counselling. To illustrate the types of studies reviewed, over half of the studies were North American, based in schools or published in journals and nearly half contained between 100 and 500 subjects (69).

Several large scale coronary prevention trials and, more recently, cancer prevention trials, have incorporated nutrition interventions. Social status comparisons were not generally made in these studies. These trials were carried out in individuals at high risk of developing either coronary heart disease or breast cancer and utilised a package of techniques similar to that described by the National Cholesterol Education Program (112). These techniques incorporated social learning theory concepts and included: diet and cholesterol screening to build motivation; step-by-step dietary change goals based on individualised dietary assessment; self-monitoring of success; feedback about success; continuing followup; the acquisition of new knowledge and skills to overcome barriers; and, the enhancement of self-efficacy (112).

Successful dietary change outcomes were achieved in men at high risk of coronary disease (113, 114), in women at high risk of breast cancer or breast cancer recurrence (115, 116) and in hypercholesterolaemic men (72). A review of cholesterol-lowering trials for the prevention of coronary heart disease included nine trials utilising dietary intervention, with plasma cholesterol lowering outcomes ranging from 1% to 13.9%. Non-significant mean weighted odds ratios over the ten studies were found for total mortality (of 1.00) and for coronary mortality (of 0.93), but changes in dietary intakes were not reported (11).

The North Karelia study targeted the whole community, utilising a package of mass media methods, community reorganisation and social action, with a more modest reduction in cholesterol level (117). This may indicate

that a population with a lower risk status will make fewer dietary changes, although there were many other differences between these studies.

The positive effect of identification of at-risk status on behavioural change may also have a threshold effect: the Multiple Risk Factor Intervention Trial study included a very large number of men and intensively targeted smoking, weight and blood pressure as well as cholesterol change. Those with multiple risk factors were less successful with dietary changes compared to those with high cholesterol levels only, suggesting lifestyle changes should be gradual (118).

The earlier coronary studies aimed for modest reductions in fat intake of around 5 percent of energy usually from initial levels of about 40 percent of energy - mainly in men - while the more recent breast cancer prevention feasibility trials aimed for and achieved fat intakes of between 20 and 25 percent of energy from initial levels of between 37 and 39 percent of energy, although one of these trials had a high attrition rate. Success may therefore be predicted to some extent by ambition of program goals. This had also been suggested by Brownell and Jeffery (119) in relation to weight reduction, who suggested that weight loss program goals have been too modest in the past, and weight losses larger than 10kg should be aimed for in the obese, over longer study periods. However, weight reduction trials with ambitious targets have also had higher attrition rates (119). Southard and colleagues (112) considered the intensity of the intervention and reinforcement and follow-up to be important determinants of magnitude and duration of dietary change, by comparison between different studies with different methodologies.

Two experimental studies did compare treatment modalities. One was carried out in school classes, the other included hyperlipidaemic patients referred by their doctor. Both studies support the importance of personal participation in behaviour change. The school study showed that self-monitoring enhanced the efficacy of health education, which produced mainly cognitive changes (120). An interactive education style requiring the active participation of the learners produced a greater improvement in nutrition

behaviour compared with a passive information transfer style of education (121).

Educational diagnosis has been suggested as a method of enhancing adherence. However, matching respondents with an educational program in their preferred learning style did not produce greater dietary change than did mismatching (122).

Personal contact may be a potent enhancer of change (76) and personal counselling can involve some tailoring of the intervention to the educational needs of the individual. Significant weight loss and cholesterol change were produced only in the at-risk individuals receiving mass media messages with personal counselling in the Stanford Three Community study (113). It has been suggested that using the family as the unit of intervention may produce greater or more lasting behaviour change and feasibility studies have shown this to be an effective and efficient method of intervention (123, 124). Experimental studies of weight loss have not, however, clearly shown the superiority of this method (125).

Comparisons between weight loss studies indicate that successful programs include an exercise component, better training of group leaders, recognition of eating disorders and refinement of reinforcement techniques. Longer programs may also have achieved greater weight losses, although this could also be due to these subjects being more overweight to begin with and the studies having larger attrition rates (119).

Social status

Glanz reported in 1980 that few studies had reported any consistent association between social class and dietary compliance (75). A more recent review reported that low socio-economic status had been noted to affect compliance in several studies, but this did not occur in a study in which a high level of support for change was given (111). Results in three other studies of dietary adherence which did include some measure of socio-economic status have also been inconsistent. In an intervention trial with women at high risk

of breast cancer, college educated women were more likely to adhere to a low fat diet (20 percent of energy as fat) than less-well educated women (126). Two other smaller studies found no effect of social status: education did not distinguish self-reported diet-changers from non-changers (80); and, adherers and non-adherers to a diabetic diet did not differ by occupation or education, although this study only included 40 diabetic patients (127).

Studies of dietary change in lower socio-economic status groups have demonstrated dietary compliance, which was assessed as weight loss in a behaviour modification program adapted for low socio-economic status participants (128) and as child's dietary behaviour change in a nutrition education program for low income parents (129). The Stanford Five-City Project used methods designed to overcome educational barriers and found reduction in blood pressure in men was strongest in the least-well educated group, but reduction in cholesterol level was weakest in less-well educated women. Changes in smoking behaviour in men and women and blood pressure in women were similar in the least and best educated groups (130).

In summary, several aspects of dietary intervention programs may improve success including ambitious program goals (although this would have a threshold), longer programs (although attrition rates need to be considered), knowledge of a high risk status, a personal counselling component and self-monitoring as an adjunct to health education. The evidence relating social status to efficacy of dietary intervention is conflicting and patchy.

1.7 Aims and Hypotheses

AIMS

The aims of this thesis were to:

1. Determine the needs of different social status groups for diet-related public health intervention, in the Australian population, by:

    1.1. Describing the associations of social status with nutrient density levels and the underlying differences in food intake patterns, in a cross-sectional study of the Australian population.

    1.2. Investigating whether diet-related beliefs and attitudes are associated with nutrient density levels.

    1.3. Investigating relationships between diet-related beliefs, attitudes and social status with nutrient density levels.

2. Conduct a dietary intervention trial which builds on the findings of the survey study described above, to examine social status and knowledge, beliefs and attitudes as predictors of dietary behaviour change by:

    2.1. Investigating dietary behaviour changes in response to a dietary-change intervention (comprising dietary information-based face-to-face consultation with participants, and follow-up materials for reinforcement) in the intervention group and among social status groups.

    2.2. Examining the associations of social status and diet-related knowledge, beliefs and attitudes with dietary behaviour change.

HYPOTHESES

Hypothesis 1: The difference between the dietary recommendations and the nutrient density levels of all social status groups is larger than the difference between the nutrient density levels among social status groups.

Hypothesis 2: The following beliefs and attitudes are associated with healthier dietary intake (lower fat and higher fibre densities):

2.1. Strong positive belief that diet is a cause of disease

2.2. Confidence in ability to maintain a healthy eating pattern

2.3 Strong positive belief that health is an important consideration when making food choices

Hypothesis 3: Beliefs and attitudes and social status are associated with dietary intake (dietary fat and fibre densities) in the following ways:

3.1 Associations of beliefs and attitudes with dietary intake are independent of associations of social status with dietary intake.

3.2 Associations between beliefs and attitudes and dietary intake are attenuated in lower social-status groups.

Hypothesis 4: Specific, individualised dietary advice will result in a healthier eating pattern, which is lower in fat, saturated fat, cholesterol, refined sugar and salt, and is higher in fibre and vitamin and mineral densities.

Hypothesis 5: In response to dietary information and advice, higher social status groups will make more dietary changes than will lower social status groups.

Hypothesis 6: The following knowledge, beliefs and attitudes will predict successful dietary change:

6.1. Strong positive belief that diet is a cause of disease

6.2. Confidence in ability to maintain a healthy eating pattern

6.3. Feeling of personal control over dietary intake

6.4. Change in knowledge of a healthy eating pattern

6.5 Having previously thought about how to make dietary changes and having previously made some dietary changes.

CHAPTER 2

THE ASSOCIATION OF SOCIAL STATUS WITH DIETARY INTAKE

2.1 Introduction

Chronic disease mortality rates are high in industrialised countries and dietary constituents have been implicated in the aetiology of the following chronic diseases: atherosclerotic cardiovascular disease, hypertension, obesity, some cancers, osteoporosis, diabetes mellitus, hepatobiliary disease and dental caries. Many of these diseases have higher mortality or prevalence rates in lower social status groups. Reasons for these differences are largely unknown; however lifestyle risk factors for these diseases do differ among social status groups and dietary differences have been proposed as one possible mechanism (25).

Dietary intake levels have been shown to vary by social status in several industrialised countries, including Australia, but the differences have not generally been large, as was discussed in Section 1.4. Most of the studies have used a single measure of social position, and the Australian data that is available did not test for associations between the social status variable and nutrient or food intakes with statistical methods. Therefore a random population survey was undertaken to investigate whether there were any statistically significant associations of nutrient and food intakes with four measures of social position.

The aim of the study described in this chapter was to determine the needs of different social status groups for diet-related public health intervention, by describing the associations of social status with nutrient density levels and the underlying food intake patterns in the Australian population (Aim 1.1). Based on the limited data available in Australia, the hypothesis examined in this chapter is that, although dietary differences have been proposed as

determinants of social status differences in health status, the difference between the dietary recommendations and the nutrient density levels of all social status groups is larger than the difference between the nutrient density levels among social status groups (Hypothesis 1), and therefore may not be a major determinant of social status differences in health status.

2.2 Method

2.2.1 Survey Methodology and Administration.

A sample of 1500 adults was randomly selected from the Australian Electoral Rolls for Adelaide, Perth and Brisbane. As voting and registering to vote is compulsory for all Australian citizens, the Electoral Rolls contain the names of over 98% of all Australian citizens over the age of 18 years. The cities chosen for this study were the capital cities of three of the Australian states. They were of similar size (around one million people) and of broadly similar demography, in terms of income, education, ethnicity and age, although Adelaide had a slightly older population, and Perth a slightly younger one (131). Data for all-causes mortality and mortality due to major chronic diseases (neoplasms and coronary heart disease) were very similar among these cities, after the effects of differences in age profiles had been accounted for (3). No major differences between cities in food or nutrient intakes were expected based on previous surveys (132, 133).

Given an expected shortfall of 500 due to population mobility, mortality and inability or refusal to take part, a sample size of 1500 was selected to yield a sample of 1000 respondents, with a power of 0.85 - 0.95 to distinguish differences of 5-10% in variable values between major population subgroups. The survey was administered by mail using a method based on that described by Dillman (134). It was initially posted out to the sample population in May 1989 with a pre-addressed, pre-paid reply envelope. A covering letter was enclosed explaining the purpose of the study. This letter

also assured strict confidentiality of information received. After two weeks, a reminder postcard was sent to all non-respondents encouraging them to reply and assuring them of confidentiality once again. After four weeks a replacement questionnaire, cover letter and return envelope was posted to non-respondents. After eight weeks, the remaining non-respondents were followed up by telephone if their number was available in the telephone directory, or by certified mail.

Ethical considerations

The survey study protocol was considered by the Human Experimentation Ethics Committee of the CSIRO Division of Human Nutrition to be ethical. Names of respondents were not stored in the data base in a way in which they could be linked to study data, and Electoral Roll lists were destroyed after all the data was recorded.

2.2.2 The dietary assessment methodology

The dietary assessment technique chosen to measure usual dietary intake was a quantified food frequency questionnaire. The applications and limitations of methods of measuring usual dietary intake have been addressed in the literature and many recent studies have compared the food frequency questionnaires (FFQs) with other methods and have found moderate levels of correlation (135, 136, 137, 138, 139, 140, 141, 142).

However, comparison between FFQ and record methods may give rise to falsely low correlations because of the intra-individual variability of short terms records, that is, they are limited in the degree to which they reflect usual intake. Correction for this variability improved the correlations by up to 50% for highly variable nutrients in one comparative study (142). While diet records tend to give lower estimates of energy intake than FFQs (140, 142), a review of doubly labelled water studies found that certain groups in the population (especially the overweight) tend to both under-eat and under-

report their intakes when recording what they eat (143), hence true energy intake may lie somewhere between the two methods.

A low-income group appeared to underestimate energy intake from diet records in work by Crotty and colleagues (144) in Australia. They found that the estimated energy requirement of the group based on resting metabolic rate was more closely aligned with energy intake measured by a FFQ than that obtained from the diet records (the mean energy intake from the FFQ was 8580 kJ, while the mean from the diet records was 6000 kJ).

Comparison of dietary intakes across social status groups is limited by several factors when using any self-reported method of dietary assessment. Firstly, the summary nature of food data bases used in these studies may lead to under-estimation of differences in intakes, for example, if mincemeat or other processed meats eaten by lower social status groups were fattier than those eaten by higher status groups, as has been suggested in the Australian context (145). Secondly, the requirement for a certain level of literacy and numeracy also limits all self-report methods when making comparisons between social status groups. Finally, it is very difficult to overcome the tendency of people to bias their dietary assessments due to beliefs about social norms and wishing to record a socially acceptable intake (146, 147, 148); this could bias responses if beliefs about social norms differed across social status groups.

In addition to these concerns, the FFQ method may underestimate variation across social status groups because of the standard lists of foods and standard serve sizes used. Although the instrument used in this study did allow for serve sizes to be adjusted and additional foods to be added in an open-ended fashion, these modifications do require extra effort on the part of the respondent.

Although the relative accuracy of the food frequency method among social status groups has not been studied, FFQ have been tested in low income groups and found to give comparable results to those of record methods (144, 149, 150, 151). However, in one of these studies (149) the energy intakes of

about 15% of these low income women as measured by FFQ were judged by the investigators to be grossly overestimated (over 4,500 Calories or 19,000 kJ/day) which appeared to be due to overestimation of their frequency of intakes of a whole range of foods. In the present study this was not found to be a problem as all booklets were examined for very high and very low intake levels and few had to be discarded for seemingly unreasonable energy intake levels. There is some evidence to suggest that FFQs may even be more suitable for those with lower literacy and numeracy. The investigators in one of these studies found that weighed food records placed too much burden on low-income respondents, as only 15 out of 60 gave usable data, while 51 out of 60 gave usable FFQ data (151).

Although problems of accuracy of data do exist for the FFQ method - as with all measures of dietary intake - it was the method of choice in this study due to the relatively low burden it places on respondents and because it can be done without the need for personal contact between investigators and respondents. These attributes should lead to a relatively high response rate and ease of survey of a large sample. The methodology is therefore cost efficient - in terms of financial and time costs. It has been shown to provide a good estimation of nutrient intakes for comparison between groups (135, 152), especially when they are adjusted for energy intake (136).

There is evidence that the food frequency method is also appropriate for measuring relative frequency of intakes of specific foods and types of foods (e.g. use of low fat vs high fat milk and low fibre vs high fibre bread) among large population samples: a study of a semi-quantitative food frequency questionnaire found food frequency items and observed domestic food stores were correlated over a range between 0.42 and 0.86 (139). The methodology used in the present study has been found to be repeatable over one year (153) and valid by comparison of sodium and protein intakes with levels indicated by multiple urinary nitrogen and sodium collections (154).

The FFQ format used in the present study has been developed over a period of 15 years and has been used extensively in Australian statewide and

nationwide dietary surveys (e.g,.65, 155, 156) and case-control surveys (157, 158). It is a highly detailed questionnaire that does not rely solely on quantitative data relating to frequency of intake but includes adjustments for cooking techniques, food preparation and use of modified foods, as described below.

2.2.3 The survey instrument

This was a booklet containing questions relating to usual food intake over the previous six to 12 months and questions about social and economic background. Information regarding the respondent's, and their spouse's, occupational and educational status was obtained, as well as their household income category. If respondents were retired from the workforce, their usual occupation before retirement was requested. Usual food intake was assessed using a quantified food frequency questionnaire format including a list of 172 food and drink items with specified serve sizes and supplemented by questions about specific types of food eaten, cooking and preparation methods, which were used to modify the nutrient analysis (Appendix 2.1).

The food item list was marked off by respondents using an open ended scale according to whether they considered they usually ate a food never "N", rarely "R" or a number (n) of times a month "nM", a week "nW", or a day "nD". For example, someone eating two slices of crispbread twice a day would respond 2D next to "Crispbread, 2 slices". A comment column was available to alter serve sizes where appropriate and special attention was given to seasonal foods. Qualitative and quantitative information were also gathered and used to adjust data from the main frequency grid. Choices of specific food types which could have one of several different nutrient compositions were given (e.g., breads, cereals, fat spreads); questions on frequency of use and relative amount of discretionary sugar and salt were asked; choices of low salt, low sugar, high fibre, low fat and modified fat alternatives were given; and, food preparation habits such as trimming the fat from meat, salting of food and cooking methods used were requested.

Additional open-ended questions on intake of foods not included in the frequency list completed the food frequency questionnaire.

The coding done by contract coders was checked randomly by the candidate at the rate of 5% of booklets. Another check on the coded data was performed when the data were entered into the database against the preset ranges allowed for the data. Booklets were double punched by a professional data entry firm and the data were then mounted onto a VAX microcomputer using SIR software, and cleaned, processed and analysed by the candidate.

Average daily nutrient intake data were derived using the Frequan program (156). This program calculates average daily nutrient intake from the frequency questions after adjusting the data according to the qualitative and quantitative answers described above. The fat content of meat was adjusted according to the level of trimming of selvedge fat reported, and type of cooking fat nominated was used in nutrient computation. Relevant nutrient composition data was used for type of dairy foods, low salt foods and energy reduced foods nominated. Milk and sugar added to cereals, and hot beverages were totalled. The nutrient database used the revised British tables with updates (159) and with modifications for Australian data where necessary and possible. At the time of survey, comprehensive Australian composition data were not available.

2.2.4 Nutrient and food intake scores

As energy needs inevitably vary across some of the socio-demographic groups of interest (men versus women, manual versus non-manual workers, and by age), comparisons of dietary quality (intake of nutrient or food/unit energy intake) rather than absolute quantity (g or mg per day) were used to compare groups. This strategy also aids statistical normalisation of the distributions of many nutrients. For nutrients contributing to total energy intake, percent energy contributed by that nutrient was used (including percent of energy contributed by fat, protein, carbohydrate and alcohol),

while other nutrients were expressed as daily intake per 10MJ of energy intake (including fibre, cholesterol, vitamins and minerals).

The vitamins and minerals investigated were beta-carotene, retinol, vitamin C, thiamin, riboflavin, niacin, folate, iron, calcium, zinc, magnesium, sodium and potassium. Although both vitamin E and selenium would have been useful additions to this list because of their antioxidative properties, the food data bases for these nutrients are not as extensive as those for the other micronutrients and were therefore deemed less reliable. In order to maximise the utility of the results in terms of nutrition education or food policy initiatives, analyses were undertaken on dietary intake alone, excluding supplementation of micronutrients. Data on the extent of vitamin and mineral supplementation across social groups are reported separately.

Food group intake data were also calculated as amount of food eaten in grams per 10 MJ, for the same reasons as those given above for nutrient data. It was of interest to know which food groups were contributing to which nutrient intake differences across social status groups. Calculation of nutrients contributed by particular food groups was achieved by running separate computations of nutrients contributed by sub-sets of foods, which were data-based individually. These food groupings were organised to represent foods with similar nutrient composition profiles. Analysis of different contributions among social status groups was achieved by calculation of median food group contributions of each nutrient of interest. Median levels were used in this context due to the skewed distributions of food group intakes.

For analytical purposes, it was necessary to use the natural logarithms of food and nutrient density for all nutrients, except percentage of energy from fat and sodium and potassium densities, in order to statistically normalise the distributions. Mean nutrient densities were therefore mostly represented by geometric means and not arithmetic means.

For the purpose of comparing dietary adequacy of vitamin and mineral intakes, data were compared with 70% of the RDI. This was used rather than the 100% level because RDI levels are related to group and population intakes

(28), not individual intakes and 67% or 70% are often used as a level for assessing proportion of individuals at risk for nutritional deficiency (58, 160). Mean intake levels of the sample as a whole were also compared with 100% RDI levels in a separate analysis.

2.2.5 Social status and occupational category measures

In this study, social status is the term used to define inequality based on such things as prestige, lifestyle, education, occupation and income. This is also referred to in epidemiological literature as socioeconomic status (161) and as social class, although this term has a different meaning in sociological terms (162).

Four measures of social status were assessed for associations with nutrient density levels. These included occupation, which was coded using two different methods, and education and income levels. Firstly, the two occupation scales will be described; one represents a relative ranking of occupational prestige, the other a categorisation based on education and training required for different occupations. Occupational prestige, education and income levels were considered to be measures of social status, while it is unclear whether occupational category provides an adequate measure of social status (163), so it was not referred to as such.

Data on past (if retired) or present occupation and spouse's past or present occupation (if applicable) were coded using a scale of occupational prestige ranging from 10 to 70 (164). This scale was developed specifically for the Australian population and is derived from survey data collected from selected occupation groups relating to lay perceptions of the relative prestige of certain occupations. This scale was also used to form a categorical variable of five equally sized groups (quintiles) for tabulating nutrient intake data and for assessing the numbers of people lying outside recommended intakes. The quintiles were found to lie between the following scores: the highest quintile lay between 18 and 37; the middle-high quintile between 38 and 41; the

middle quintile between 42 and 47; the middle-low quintile between 48 and 54; and, the lowest quintile between 55 and 67.

Occupational category was derived by grouping occupations according to training and qualifications needed for the job using an Australian system of classification (165. The one digit classification system was used, ranging from 1 to 8 (e.g. 1, managers; 2, professionals; 3, para-professionals; 4, tradespersons; 5, clerical workers; 6, salespeople; 7, semi-skilled manual workers; 8, un-skilled manual workers). Retired persons were coded by their past occupation, and students by their future occupation if one was possible to predict. All respondents who were married (or in a de facto relationship) and were not in employment at the time of the survey were coded according to their spouse's or partner's occupation, unless they had nominated a past occupation which had a higher prestige than that of their partner. These occupational categories were not considered to be a ranked order, but separate categories for comparative purposes.

Secondly, education was coded into categories based on a ranking of educational level. Education was coded as years of schooling and highest qualification received since leaving school, which was used to construct a four point educational status score. The first group included those who had left school at 16 years of age or younger, the second included those who had left at 17 years of age or older and were without further education, the third included the holders of technical and trade certificates and the fourth were the holders of diplomas, degrees and higher degrees. Educational status related solely to the respondent's training and was never substituted by spouse's training.

Thirdly, respondents were asked to nominate one of six categories of gross household income to assess household income level. Categories used accorded with classifications used for the 1986 Australian Census (131) with adjustment for inflation between the time of the Census and the time of the survey. The fourth income level would have represented the median at this time, while lower income levels represented old age pension and

unemployment benefit levels. Household income code was then adjusted to some degree for number of persons in the household so that some comparison could be made between individuals in households with different numbers of occupants. This was somewhat arbitrarily accomplished by adjusting the code down by 1 if the household included more than one adult or child.

2.2.6 Statistical analysis

Multiple linear regression analysis was used to test for linear relationships between nutrient and food group intakes with occupational prestige, education and income. Analysis of variance was performed to test for non-linear associations of mean nutrient intakes among occupational categories. Both types of analysis were adjusted for age and sex differences between groups, as appropriate, by adding them into the regression equation (or analysis of variance for occupational category) before adding in social status. In addition, chi-square tests were performed on proportions above and below recommended dietary reference levels and on proportions using vitamin and mineral supplements among social status groups.

Foods were grouped together according to similarity of nutrient composition. Median contributions of food groups to nutrient intakes were calculated to describe the differences among social status groups. No statistical tests were done, as this would have added little to the tests already performed; only those food groups which appeared to make some contribution to total differences in nutrient density levels between higher and lower status groups were graphed.

The 5% significance level was used to test for statistical significance of nutrient and food density results. Although multiple comparisons were made in this study, adjustment of the significance level was not performed due to the correlations among food and nutrient variables.

2.3 Results

2.3.1 Survey response rate and sample distribution

The initial response rate after three mailings and after six weeks was 56%. Follow up of non-responders by telephone and certified mail, and late returns brought the final response rate to 70.4%, representing 874 of the 1241 people who were contacted. There was a total of 259 non-participants who were discarded from the original denominator of 1500 due to death, moving house to an unknown address or moving interstate or overseas. Response rates differed only slightly between cities (68.4% in Adelaide, 74.4% in Perth and 69.3% in Brisbane).

The survey sample was compared by age, gender, country of birth, occupation, education and income distributions to the Australian population as a whole using data from the 1986 Census, in order to assess any undue bias in the respondent population caused by the survey methodology. The distribution of the sample by demographic characteristics has been reported (166) and is given again in Appendix 2.2. The main biases in the sample were: over-representation of people with post-secondary education (observed proportion was 50%, expected was 33%); under-representation of manual workers (observed 16%, expected 23%) and over-representation of professionals and para-professionals (observed 28%, expected 20%); and, under-representation of 18-29 year olds (observed 22%, expected 28%) and females who were not in the labour force (observed 36%, expected 52%). In terms of other age, sex, ethnic origin, income and occupation groups, proportions were within 5 percentage points or less of expected values.

2.3.2 Dietary intake and food choice differences among occupational prestige, education and income groups and occupational categories

Nutrient intake data were analysed in two sets, the first involved those relating to the dietary goals and targets described in Section 1.2, including

energy, macronutrients, cholesterol, fibre and sodium, and the second involved those relating to RDI levels including vitamins and minerals.

Macronutrient, cholesterol, sodium and fibre density levels

The directions and strengths of the linear associations between macronutrient, sodium, fibre and cholesterol densities with occupational prestige, educational status and income status and the non-linear relationships among occupational categories are shown in Table 2.1. Age and sex were adjusted for in the analyses as necessary, as these were confounding factors in several relationships between nutrient intake and these measures of social position. Unadjusted intake data for males and females in occupational prestige quintiles are shown in Appendix 2.3.

Lower occupational status respondents had larger energy intakes, greater contributions of energy from total, saturated and mono-unsaturated fat and refined sugars, and a greater density of cholesterol in the diet. Higher status respondents had a larger contribution of energy from natural sugars and alcohol, and a greater density of fibre in the diet. Contributions to energy intake of protein, polyunsaturated fat, complex carbohydrates and salt density did not differ by occupational prestige.

Educational status showed weaker, but otherwise similar, inverse associations with percent of energy from total, saturated and mono-unsaturated fats and refined sugar and a positive association with fibre density. Income level was also similarly inversely associated with percent of energy from fat and natural sugar, and income level was positively associated with high dietary alcohol density. Although income level was not associated with fibre density, high income was positively associated with a larger percentage of energy from complex carbohydrate.

Grouping by the training- and qualification-based occupational categories also showed that there were differences in energy intake, percent of energy contributed by alcohol, and fibre density. Professionals and para-

Table 2.1 Variation in macronutrient, sodium, fibre and cholesterol densities among occupational prestige, education, income and occupational category groups

Nutrient	% Var (a)	Occupational prestige quintile					Directions and strengths of associations			
		High	High -mid	Mid	Low-mid	Low	OP (b)	E	I	OC (c)
Energy (MJ)	0.4	8.17	8.51	8.04	8.11	8.80	▼			** (d)
% energy from:										
Fat	1.7	35.0	34.3	34.9	36.3	36.5	▼▼▼	▼	▼▼	
Saturated fat	0.9	13.0	12.7	12.9	13.3	13.7	▼	▼		
Monounsaturated fat	1.6	12.3	12.0	12.2	13.0	13.0	▼▼▼	▼		
Polyunsaturated fat	0	5.98	5.94	6.07	6.22	5.81				
Starch	0	21.8	21.9	22.6	21.9	21.6			▼▼	
Natural sugars	3.3	12.7	12.5	11.8	11.0	10.7	▲▲▲	▲▲	▲▲▲	
Refined sugars	0.8	7.72	8.07	8.61	8.59	8.91	▼▼	▼		
Protein	0	16.2	16.4	15.7	16.2	16.1				
Alcohol	0.6	1.89	1.70	1.79	1.12	1.29	▲		▲▲▲	*
Cholesterol (e)	0.6	27.4	28.2	26.4	29.2	29.8	▼			
Sodium (f)	0	3.41	3.38	3.40	3.48	3.49				
Fibre (f)	2.9	29.3	27.0	27.7	26.1	24.2	▲▲▲	▲▲▲		**

(a) Percentage of variance in nutrient intakes accounted for by variation in occupational prestige.
(b) OP, Occupational Prestige; OC, Occupational Category; E, Educational Status; I, Income Status.
(c) Non-linear associations with occupation categories, * $p<0.05$; ** $p<0.01$ using analysis of variance.
(d) Males only.
(e) mg/10MJ
(f) g/10MJ
▲,▼ $p<0.05$; ▲▲,▼▼ $p<0.01$; ▲▲▲,▼▼▼ $p<0.001$ using linear regression.
▲ up arrow, greater intake in higher status group, ▼ down arrow, greater intake in lower status group.

professionals had the greatest dietary fibre densities, while the manual labouring occupations had the least. Managers, professionals and salespeople had the largest dietary alcohol densities, and unskilled manual workers the least. A relationship was found between occupational category and energy intake for males, but no relationship was found for females. Males in manual labouring occupations had higher energy intakes, in the range between 10,260 and 10,700 kj/day than those in sedentary occupations whose intakes ranged between 8,640 to 9,850 kj/day ($F=2.99$; $df=7,375$; $p<0.01$).

All four methods of social grouping were associated in the same directions with nutrient density levels, with occupational prestige showing the strongest and largest number of associations. For this reason, occupational prestige was used as the measure of social status for further analyses of macronutrient, cholesterol, sodium and fibre intakes, food intakes and dietary habits.

The nutritional, as opposed to statistical, significance of these findings is indicated by the mean nutrient density levels of the occupational prestige quintiles shown in Table 2.1. The largest dietary density differences were seen for fibre, natural sugar and refined sugar densities: high status groups had a 17% greater density of fibre; a 16% greater density of naturally derived sugars; and a 15% lesser density of refined sugars. Differences in saturated and monounsaturated fats represented much smaller increases of only 8% from the high-mid (2nd) to the lowest (5th) occupational prestige quintile, while total fat increased by only 6% across these same groups. The highest (1st) quintile had slightly higher total fat, saturated fat and monounsaturated fat intakes than the high-middle and the middle quintiles, thereby reducing the strength of the linear trend. Thus, although differences across groups were statistically significant, variations in mean intakes were not large. The variance in nutrient density in the diets of respondents that was accounted for by occupational prestige score was also of a moderate magnitude, ranging from zero for several nutrients to a peak of 3.3% for

Table 2.2 Proportions of occupational prestige quintiles within dietary recommendations

Nutrient	Rec level	Occupational prestige quintile					χ^2	sig
		High	High-mid	Mid	Low-mid	Low		
Fat (a)	<30%	19.4	20.1	19.3	13.4	9.1	11.53	*
Fat (b)	<33%	33.5	38.4	35.5	28.2	22.9	11.98	*
Refined sugar (b)	<12%	78.8	73.8	69.3	64.0	64.6	12.45	*
Fibre (b)	>30g	27.1	25.0	22.3	19.5	21.7	3.18	NS
Sodium (b)	<2300 mg	28.2	28.7	31.9	31.3	20.6	7.32	NS
Alcohol (c)	<20g (f) <40g (m)	90.0	93.9	96.4	96.6	94.3	8.56	NS

* $p<0.05$; NS, not significant at 5% level
f, females; m, males
(a) (1)
(b) (167)
(c) (168)

natural sugars, as shown in the left hand column of Table 2.1.

To further assess the implications of differences between social status groups, the proportions of respondents in occupational prestige quintiles who had dietary intakes within recommended levels were calculated for fat, fibre, refined sugar, sodium and alcohol and are shown in Table 2.2.

The only nutrients for which there were differences in compliance among occupational prestige groups were total fat and refined sugar intake. While differences in the proportions achieving 30% and 33% of energy as fat differed among status groups, the difference between the highest and the lowest groups was 10%; the difference for refined sugar was also significant and 15%. There was no significant trend for the other nutrients for which Australian dietary recommendations exist. Large proportions of people in all status groups appeared to be adhering to the recommendation for alcohol intake, many were below the refined sugar recommendation especially those of higher status, but few in any status groups were adhering to recommendations for fat, fibre and sodium intakes.

Micronutrient density levels

Micronutrient densities across occupational prestige, education and income groups and among occupational categories are shown in Table 2.3.

Table 2.3 Variation in micronutrient density levels (per 10MJ of energy intake) across occupational prestige, education, income and occupational category groups

	% Var (a)	Occupational prestige quintile					Directions and strengths of associations			
Nutrient density (per 10MJ)		High	High -mid	Mid	Low-mid	Low	OP (b)	E	I	OC (c)
Retinol (ug)	1.0	517	532	523	555	590	▼▼			
Beta-carotene (ug)	2.9	6230	5610	5660	5580	4730	▲▲▲	▲		***
Vitamin C (mg)	1.1	162	152	161	143	134	▲▲	▲▲▲		***
Thiamin (mg)	1.4	1.72	1.68	1.73	1.66	1.58	▲▲▲	▲▲		
Riboflavin (mg)	0.1	2.44	2.41	2.31	2.33	2.35				
Niacin (mg)	0.5	24.4	23.9	23.6	24.0	23.1	▲	▲		
Folate (mg)	2.3	282	269	278	259	251	▲▲▲	▲▲▲		*
Calcium (mg)	0.0	1100	1120	1070	1050	1060				
Zinc (mg)	1.1	14.1	13.9	13.4	13.4	13.4	▲▲	▲▲	▲▲	**
Iron (mg)	3.3	16.3	15.9	16.0	15.5	14.8	▲▲▲	▲▲▲	▲▲	**
Magnesium (mg)	3.9	411	398	394	368	365	▲▲▲	▲▲▲	▲▲	**
Potassium (mg)	2.3	4355	4285	4245	4130	4000	▲▲▲	▲▲	▲▲	*

(a) Percentage of variance in nutrient intakes accounted for by variation in occupational prestige.
(b) OP, Occupational Prestige; OC, Occupational Category; E, Educational Status; I, Income Status.
(c) Non-linear association, * $p<0.05$; ** $p<0.01$ using analysis of variance.
▲,▼ $p<0.05$; ▲▲,▼▼ $p<0.01$; ▲▲▲,▼▼▼ $p<0.001$ using linear regression.
▲ up arrow, greater intake in higher status group, ▼ down arrow, greater intake in lower status group.

Higher occupational prestige quintiles were found to consume diets containing greater densities of vitamin C, folate, zinc, iron, magnesium, potassium, beta-carotene and thiamin, while lower occupational prestige quintiles consumed diets which were denser in retinol. No differences in riboflavin or calcium levels were found between higher and lower prestige groups.

Associations between micronutrient density levels and the four methods of social grouping were again similar in direction and strength of association; occupational prestige showed slightly stronger associations with vitamin and mineral densities. Education level also showed strong associations, while income level was associated only with mineral densities. Beta-carotene, vitamin C, zinc, iron, magnesium and potassium densities tended to be higher in women and men in professional occupations and men in sales occupations, and lower in men and women in semi-skilled and un-skilled occupations.

As the occupational prestige measure tended to have the strongest associations with micronutrient density levels in these analyses, this was also used as the measure of social status in subsequent analyses with these nutrient data.

Unadjusted data for males and females in occupational prestige groups are shown in Appendix 2.4 with the relevant RDI levels. Mean intakes of males and females in all occupational prestige quintiles were over the RDI level except for zinc intake in males (which was above the lower end of the range but well below the upper end in all quintiles), zinc intake in females (which was below the lower end of the range in all quintiles) and iron intake in females which was above the lower end of the range but well below the upper end in all prestige quintiles).

The proportion of men and women in occupational prestige quintiles who achieved intakes of at least 70 percent of the RDI for the micronutrients selected to be most at risk of being deficient in the diet are shown in Figures 2.1 and 2.2. The calcium intake of women over 50 years of age, the iron intake

Figure 2.1 Proportion of women achieving 70% RDA levels among occupational prestige quintiles

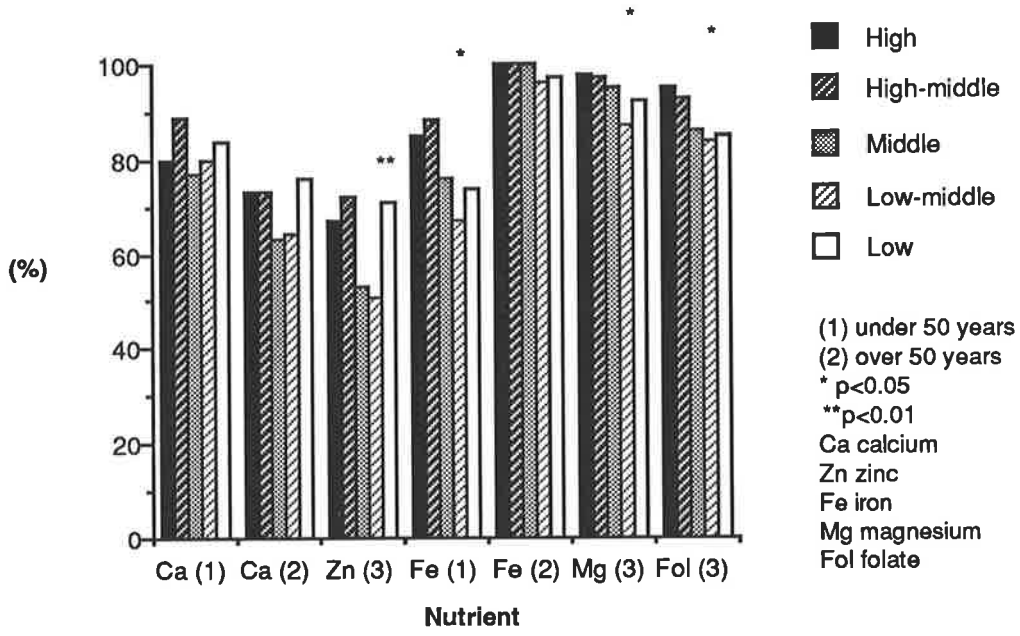
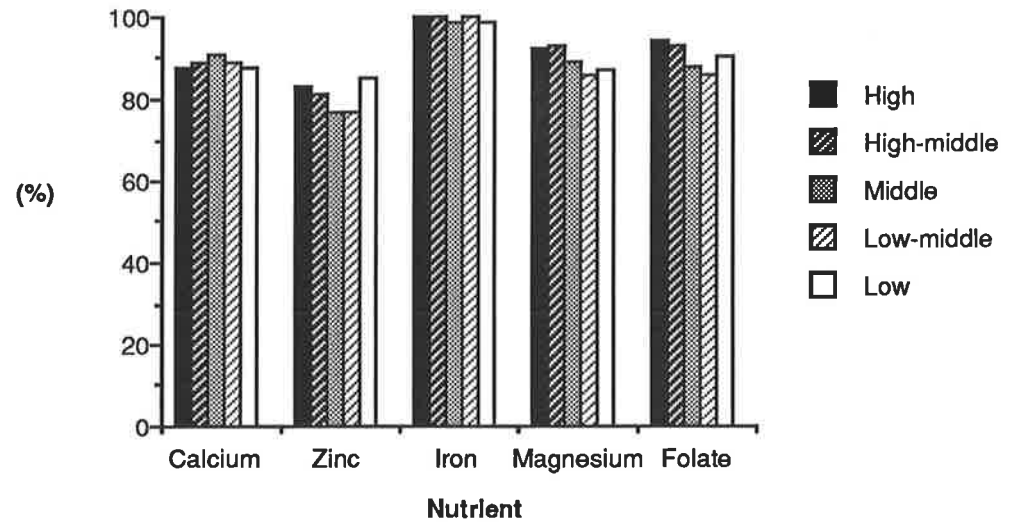


Figure 2.2 Proportion of men achieving 70% RDA levels among occupational prestige quintiles



of middle-, middle-low and low-status women 50 years of age or younger, and
the zinc intake of women generally, were consumed at below 70% of the RDI level in 25% of the sample or more. Zinc and calcium intakes as a proportion of RDI levels tended to be lowest in women in the third and fourth quintiles. Although the fifth quintile generally had lower density levels, women in this quintile also consumed a larger energy intake. Although about 20% of men consumed diets low in zinc, there were no differences in men in the proportions below 70% of the RDI among occupational prestige groups.

While intakes of magnesium and folate did decrease across occupational prestige groups for women, intakes of magnesium and folate were greater than 70% of the RDI in 80% or more of the sample for men and women in all occupational prestige groups, as were intakes of calcium and iron in men and women other than those specified above.

Food group intake

As some food-related risk factors for conditions such as cancer are not thought to act through nutrients per se, but through other, as yet unknown, components of food (such as the protective factors in cruciferous vegetables) and as knowledge of food patterns can be useful in designing intervention strategies should these be necessary, the patterns of food usage among the various social status groups were also investigated.

Thirty-three groups of nutritionally-related foods were formed. To adjust for the variation in total food intake requirements across groups, the amount of the food group eaten per 10MJ of energy consumed was used as the comparative unit. Food groups were classified as "high status-related", "low status-related" and "status-unrelated" on the basis of their association with occupational prestige (Table 2.4).

Table 2.4 Linear associations between food group intake and occupational prestige groups

FOOD GROUP	sig	FOOD GROUP		sig
'High status-related' food groups		**'Low status-related' food groups**		
Wholegrain breads and cereals	***	White bread and refined cereals		***
Rice, pasta	***	Fried meat		***
Fruit (a)	***	Meat products (e)		***
Fruit, seasonal (b)	***	Discretionary sugar		***
Low fat milk	***	Fullcream milk		**
Meat dishes (c)	***	Potatoes boiled, mashed		*
Dried beans (legumes)	**	Takeaways, pies (f)		*
Carrots, pumpkin	**	Eggs		*
Salad vegetables (d)	**	**'Status un-related' food groups**		
Fruit juice	**	Grilled and roast meat	Cakes, biscuits	
Cheese	**	Peas, green beans	Chocolate	
Alcoholic beverages	*	Chicken	Lollies, jams	
Leafy green, brassica	*	Fish	Cordial, soft drink	
vegetables		Dairy desserts (g)	Polyunsaturated	
		Butter, table	margarine	
		margarine		

(a) Fruit includes apple, orange and banana
(b) Seasonal fruit includes berries, melon, stone fruits, grapes
(c) Meat dishes includes various styles of stews, casseroles and meat and pasta dishes
(d) Salad vegetables includes celery, pickled onion, mushroom and beetroot, lettuce, cucumber and coleslaw
(e) Meat products includes frankfurters, bacon, ham, luncheon meat and salami
(f) Takeaways and pies includes pies, pasties, sausage rolls, pizza and yiros
(g) Dairy desserts includes cream, icecream, custard, milk puddings and flavoured milk drinks.
* $p<0.05$; ** $p<0.01$; *** $p<0.001$ related to F ratios calculated from linear regression analyses

Foods which have been promoted in the Australian and USA dietary recommendations (1, 26) were generally found in larger relative amounts in the diets of higher social status groups. These included wholegrain breads and cereals, rice and pasta, fruit and some vegetables, except potato. Although higher status groups consumed more low fat milk, they also consumed more cheese and more alcoholic beverages. The foods eaten in larger relative amounts by lower status groups tended to be lower in fibre (white breads and more refined breakfast cereals), higher in fat (fullcream milk, fried meat, meat products, takeaways and pies), higher in discretionary or added sugar,

and higher in cholesterol (eggs), except that low status groups consumed more potatoes. Foods which did not differ between high and low status groups included several high fat, high sugar foods (cakes, biscuits, jams, lollies, sweetened drinks, fat spreads, icecream and other milk-based desserts) as well as more staple foodstuffs (meat, chicken, fish and peas and beans).

Contribution to nutrient intake differences of variations in food intake patterns

The median contributions of these food groups to intakes of nutrients which differed between high and low status groups were derived. Of the major food groups contributing to dietary fat intake only two appeared to vary between the highest and lowest status groups: full cream milk (a larger contributor in lower status groups) and cheese (a larger contributor in higher status groups). A larger consumption of eggs appeared to be the single main dietary factor contributing to the higher cholesterol density of the diets of the lower status groups.

The higher relative intake of refined sugars in the lower status groups appeared to be mainly due to a larger contribution from discretionary sugar, as shown in Figure 2.3. Sweetened, non-alcoholic drinks (cordials, soft drinks and fruit juice drinks) also appeared to contribute more sugar to the diet of lower social status groups, but the difference in intake of this food group across quintiles was not statistically significant, as was shown in Table 2.4. While refined sugar density increased with decreasing social status, naturally derived sugar density conversely decreased. Fruits and fruit juices accounted for the majority of the difference in natural sugar density between social groups. High status groups had a very much larger intake of wholegrain cereals which accounted for most of the difference in fibre intake among groups, they also received more fibre from fruits and less from refined cereals and bread, as shown in Figure 2.4.

Figure 2.3 Foods contributing to refined sugar density differences among social status groups

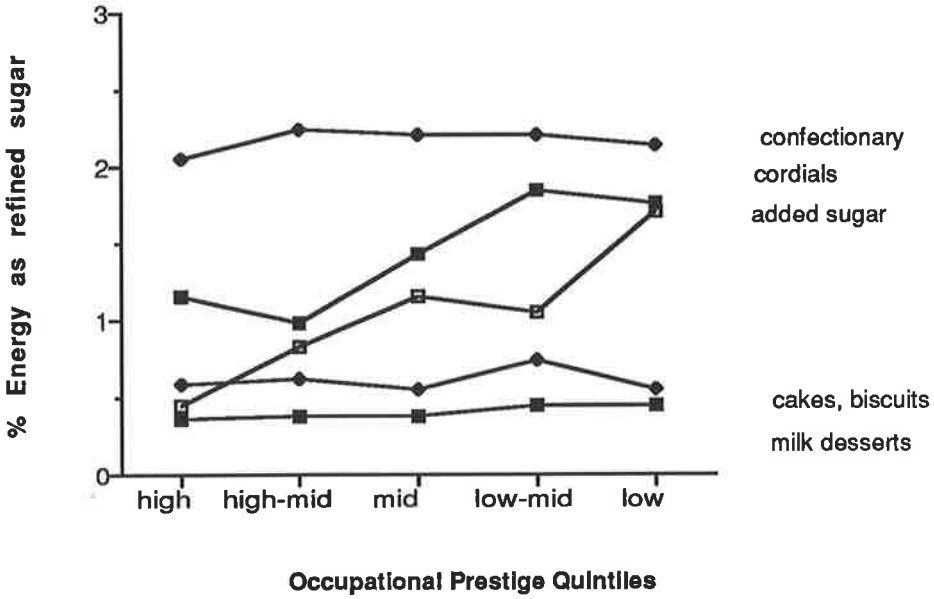
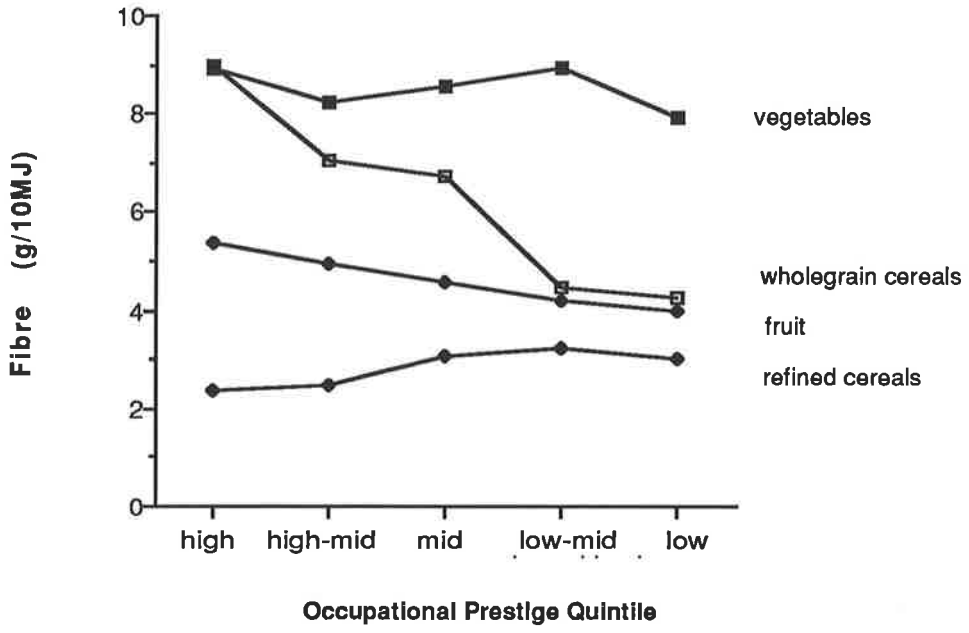


Figure 2.4 Foods contributing to fibre density differences among social status groups



In Figure 2.5 it can be seen that fruit and vegetables contributed more to the vitamin C density of the higher status quintiles; this was also true for potassium, beta-carotene and folate. In Figure 2.6, it can be seen that wholegrain cereals contributed most to the difference in iron density between the highest and lowest status quintiles. Wholegrain cereals were also the main contributor of greater dietary densities of vitamin B1, folate, potassium and zinc and magnesium in higher prestige groups. The significance levels for the differences in intakes of wholegrain cereal and fruit intakes between high and low status groups are those shown in Table 2.4.

Wholegrain breads and cereals and fruits and vegetables, which were consumed in greater relative amounts by higher status groups, were found to contribute to a large proportion of the advantage in median nutrient densities of higher status groups for those nutrients for which a difference in density had been found. However, nutrients derived from white bread and refined cereal foods and meats, which were consumed in greater relative amounts by the lower social groups, offset about half of this advantage for zinc, iron and vitamin B1. Other foods, such as dairy foods, made important contributions to nutrient intake, but these were not a major source of difference in micronutrient density levels across groups.

Dietary habits

The dietary habits that trended upwards with occupational status included: use of low fat milk which was used by 38.4% of the lowest social status group and 56.6% of the highest social status group (χ^2=17.07, p<0.01); wholemeal bread, 36.2% and 59.1% (χ^2=22.23, p<0.01); non-use of sugar in tea, 54.8% and 75.4% (χ^2=16.68, p<0.05) and in coffee, 48.0% and 64.9% (χ^2=11.23, p<0.05); and cooking of beef sausages by grilling, roasting or microwaving but not frying, 65.5% and 80.7% (χ^2=15.3, p<0.01) and cooking of steak by methods other that frying, 66.7% and 77.8% (χ^2=9.49 p=0.05

Figure 2.5 Foods contributing to vitamin C density differences among social status groups

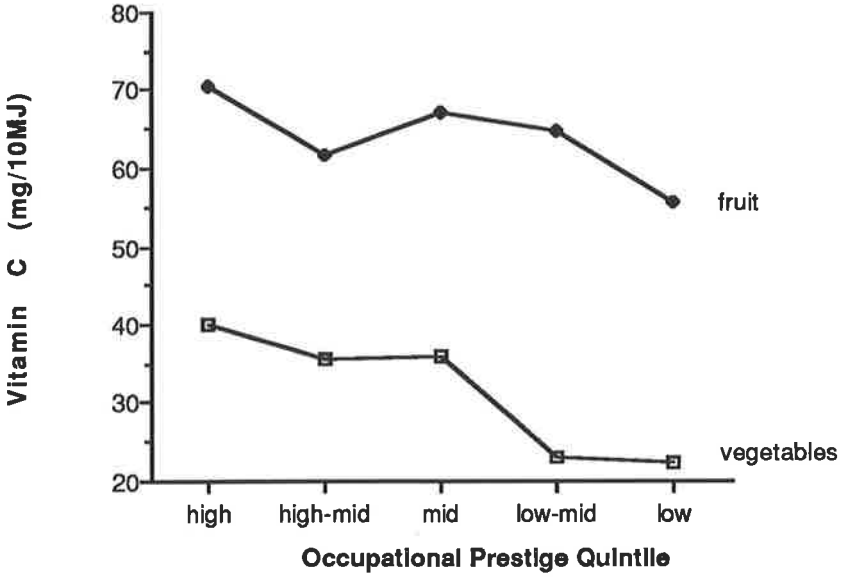
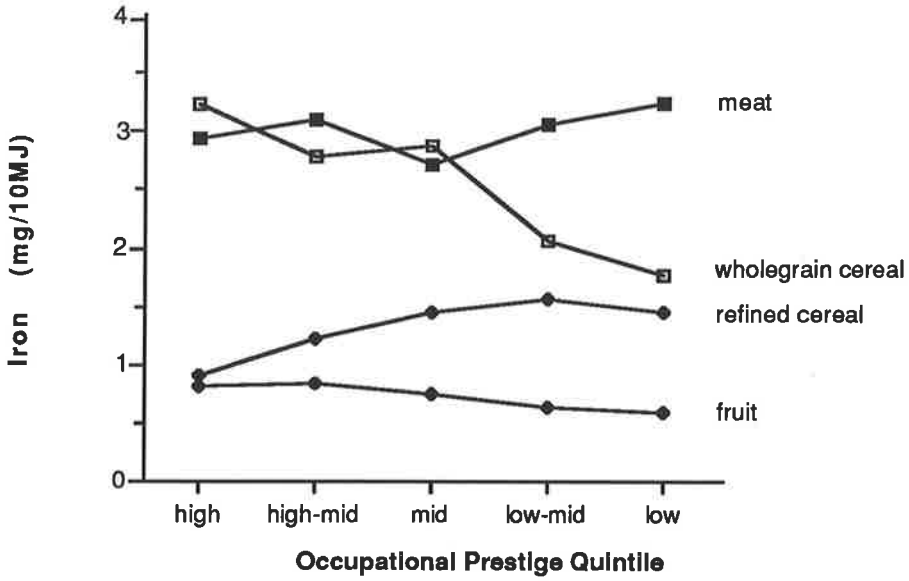


Figure 2.6 Foods contributing to iron density differences among social status groups



respectively). The trends in food habits were generally linear across groups. No significant differences were found in the use of butter versus margarine; eating most or all, versus none or little, of the fat on meat; or, in the use of table salt.

Vitamin and mineral supplementation

Women, persons over 25 years of age and males in higher occupational status and income groups were more likely to use supplements compared to their complementary groups. Of the social status measures, income showed the most clear-cut differences and the data are shown in Figure 2.7 and 2.8; but only for those over 25 years of age as those under 25 years had a higher level of supplement use and may have confounded the comparison between income groups. Overall more women than men used vitamin and mineral supplements. However, among men, three times as many men in the highest income bracket used supplements, equivalent to the overall proportion of women, while men with middle and low incomes used supplements much less frequently. No difference in prevalence of supplement use was found among women in different income brackets.

Figure 2.7 Proportion of women using supplements among income groups

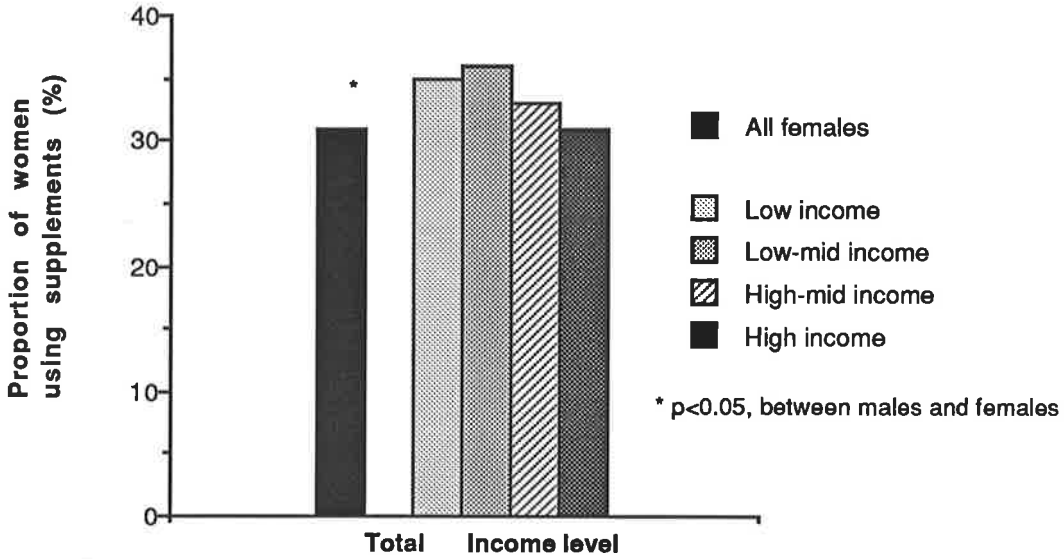
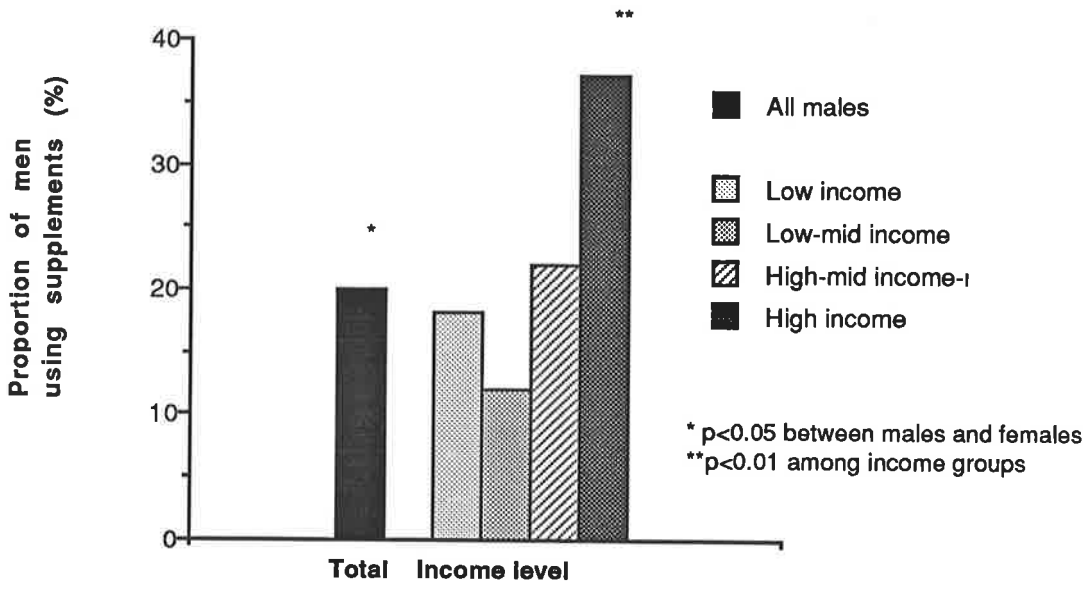


Figure 2.8 Proportion of men using supplements among income groups



2.4 Discussion

The associations of various measures of social status with nutrient and food intakes have been investigated in population samples from industrialised countries such as Australia (55, 64, 65), the USA (52, 58, 169), The Netherlands (53) and the UK (54, 56), but the present study is the first which included multiple measures of social status, investigated a wide range of food and nutrient intakes, and examined the statistical significance of social status differences in both nutrient and food intakes in a large population sample.

Measures of social position

Four different measures of social position, namely occupation, occupational prestige, education and income were examined in this study, in order to compare the directions and strengths of association with dietary intake among the measures of social status and occupation used. Education and income tap two important but distinct influences on social position which have direct explanatory power (170). Occupation would be expected to incorporate both of these factors to some extent, but mainly for those in the labour force, and additionally gives information on working conditions, while occupational prestige incorporates other meanings of social position as well.

This could account for occupational prestige having a stronger association with nutrient density levels than education or income status. While the associations between education and nutrient density levels mainly mirrored those of occupational prestige, income levels did provide some additional information, for example low income groups were found to have a larger complex carbohydrate intake, whereas carbohydrate intake did not differ across occupational prestige groups. Macronutrient densities differed little between occupation categories, although energy intakes showed distinct differences between manual and nonmanual categories of males and beta-carotene, vitamin C, zinc, iron and magnesium showed apparent differences between professional and manual occupation groups. Occupation seems

therefore to have generally had a lesser influence on proximate dietary composition than did occupational prestige, but a marked effect on dietary quantity, at least in males.

The measures of social position used in this study were not found to be interchangeable. In general, education and occupational prestige tended to be similarly related to nutrient density levels, while income and occupational category were differently related.

Macronutrients and energy

This study confirms the findings of previous studies which used similar food frequency methodologies in Australian population samples and found similar directions of difference across occupational prestige quintiles, although no tests of the strengths of associations were performed in the earlier studies (55, 64, 65).

Energy intakes in manual workers in Scotland were also higher than in non-manual workers (54), as was found in the present study. Other studies which used social status-related measures rather than occupation category generally found no difference (52) or little difference (53) in energy intake among status groups, as was also found in the present study.

In previous publications on differences in nutrient intake across social status groups in Australia (55), the USA (52), The Netherlands (53) and the UK (54, 56), fibre intake was found to be higher in socially advantaged groups in all four countries, as was found in the present study, using a variety of dietary measurement methods and social status measures.

Three types of association of social status with dietary fat intake have been found. Firstly, dietary fat density was lower in higher status Dutch people and Scottish women (53, 54) and in better educated women in the Minnesota Heart Health Study (52). Keys dietary score - a measure of the atherogenicity of the diet - was also found to be lower in better educated men in this sample (52). Secondly, an analysis of the dietary intakes of a large sample of the USA population surveyed for the 1987-88 Nationwide Food

Consumption Survey found no difference in dietary fat density by educational status or relative income group. This finding may have been influenced by the low response rate of this study of less than 35% (58). Finally, dietary fat density was higher in upper social classes in England (56) and in Scottish men employed in non-manual occupations (54).

The Scottish study found a larger alcohol intake level in male manual workers, but no difference in alcohol density in men, but a higher alcohol density in higher status women (54). In the present study it was found that higher status groups reported greater alcohol densities, but the highest and lowest prestige quintiles consumed the largest absolute mean and median amounts of alcohol, which was shown in Appendix 2.3.

Micronutrients

Mainly similar directions of association between micronutrient density levels and social status measures were found in the present study as were found in other studies. The Dutch study found higher calcium and vitamin C intake levels in the higher status group (53), but very slight or no differences in iron, thiamin and riboflavin intakes. As energy intake levels differed little between high and low status groups in the Dutch sample, intake data should be reasonably comparable with the density data of the present study. In the present study no difference in calcium and riboflavin densities were found while vitamin C, iron and thiamin densities were greater in the higher status groups. The Scottish study also reported higher antioxidant micronutrient density and intake levels in higher status groups, excepting retinol which was higher in lower status groups, as were found in the present study and that of Baghurst and colleagues (55).

In relation to the lower iron and zinc intake levels found in lower status groups in the present study, similar prevalence levels have been found in low income women in the USA (19), although levels in the rest of the USA population were not shown. Although high risk for zinc deficiency was indicated equally across all social groups by dietary intake criteria in an

Australian study of nutritional status and intake of zinc, plasma zinc measurements gave no evidence of levels which might indicate moderate or severe deficiency in any occupational prestige group, although the authors pointed out that plasma zinc level is not a sensitive indicator of marginal zinc deficiency (171).

An analysis of the 1987-88 Nationwide Food Consumption Survey found that a gross score of inadequate nutrient intake was higher in lower educational status groups in most sex-age groups, although they did not state which nutrients these related to (58). Higher prevalence of inadequate intakes in mainly younger women in lower status groups were also found for some micronutrients in the present study.

Dietary supplement use

In the present study it was found that while all women and higher status men were most likely to take vitamin and mineral supplements, women in the third and fourth occupational prestige quintiles were most likely to have intakes below the RDI level. The data showed particular groups to be at higher risk of inadequate dietary micronutrient intake, especially intakes of minerals, and these groups did supplement their diets, but so did others at less risk of having low intake levels. However, this does not indicate that the individuals with low dietary intakes were the ones to supplement their diets.

It has been previously reported that dietary supplementation was more common in women (172), as was also found in the present study; data for social status groups have not previously been reported. Supplement users have been previously reported to be more health-oriented in that they practised more healthy behaviours, had more interest in health maintenance, and sought out more nutrition information (172), therefore the supplementers in the present study may have been more likely to have also had healthier dietary intakes.

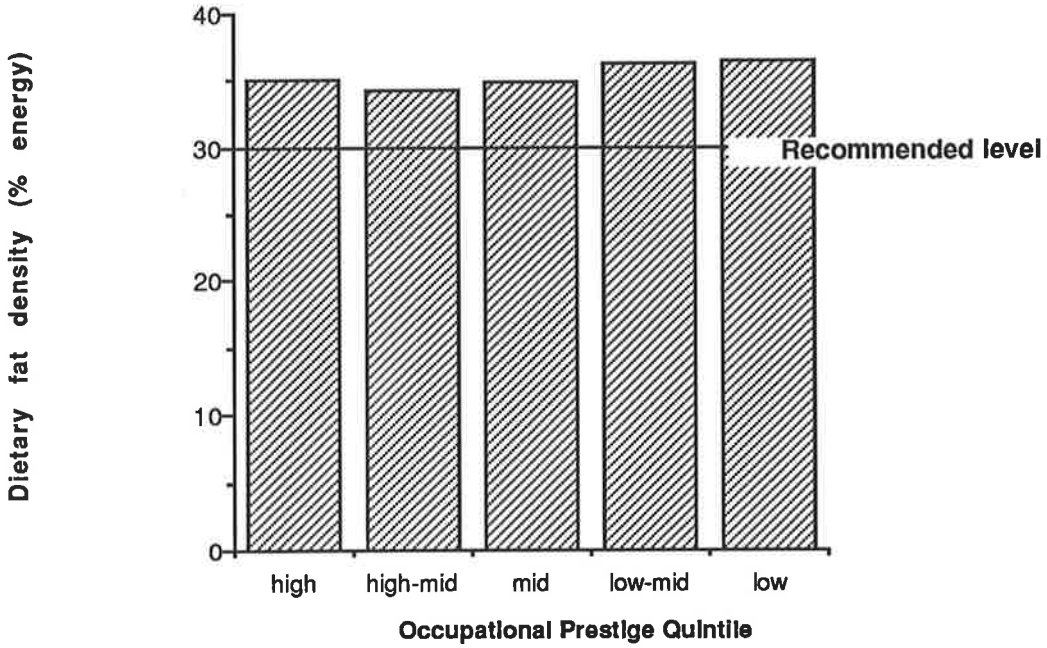
Comparison of intakes with recommended levels

The nutrient intakes of lower social status groups were less in line with Australian dietary recommendations (25) than those of higher social status groups, with smaller proportions of lower status groups having intakes below the recommendations for total fat and refined sugar densities.

However, the differences in nutrient intakes and in the percentages of people attaining recommended intake levels across social groups were narrow compared to the wide gap between the nutrient profile of the whole sample and the recommendations of health authorities. For example, the mean dietary density of fat in all groups was well above the recommended 30% of energy as fat, as shown in Figure 2.9 (from the data in Table 2.1). To put it another way, while twice as many individuals in the upper occupational prestige quintile (compared to those of lower status) attained the recommended level of 30% energy as fat, 80% of these individuals still failed to achieve the target versus 90% in the lower status group. Comparison of saturated fat density levels with the USA recommendation of 10% of energy as saturated fat (1) leads to a similar conclusion. No difference was found across groups in proportions of people attaining the recommended level of sodium or fibre intakes; large proportions of all groups ingested too much sodium and too little fibre. While more people of lower social status ingested more than the recommended amount of refined sugar, over 60% of all groups were below the recommended intake level.

While mean micronutrient intakes were low only for zinc, especially in women, there were social status disparities for intakes of iron in younger women and zinc, magnesium and folate in all women, compared to RDI levels. The groups at greatest risk tended to be the middle and middle-low status groups. Lower social status groups were at significantly greater risk due to lower zinc intake, lower micronutrient density levels and lower fibre and higher fat density levels, but the relatively small differences in dietary profiles between the social groupings examined here do not seem to support the widely held notion, expressed in various government health policy documents (16, 23, 173) that people of lower social status have a markedly poorer dietary profile

Figure 2.9 Comparison of dietary fat densities of occupational prestige quintiles with the recommended intake level of 30% of energy as fat (1)



While mean micronutrient intakes were low only for zinc, especially in women, there were social status disparities for intakes of iron in younger women and zinc, magnesium and folate in all women, compared to RDI levels. The groups at greatest risk tended to be the middle and middle-low status groups. Lower social status groups were at significantly greater risk due to lower zinc intake, lower micronutrient density levels and lower fibre and higher fat density levels, but the relatively small differences in dietary profiles between the social groupings examined here do not seem to support the widely held notion, expressed in various government health policy documents (16, 23, 173) that people of lower social status have a markedly poorer dietary profile compared to those of higher status. Two studies of sole-parent low-income families also supported this finding. The nutrient levels in the diet of this group were found to be denser or comparable in macro- and micro-nutrients compared to the mean levels found in the Australian National Dietary Survey (144, 151). In both of these studies these were volunteer families whose diets may have been better than the average for low-income sole-parent families, however one of these studies specifically attempted to recruit families in difficult circumstances (151).

Using a bench-mark such as the RDI to assess "adequacy" of the diet might underestimate the significance of the social status differences. With increasing knowledge about the links between diet and the oxidative processes that may be related to cancer, coronary heart disease (1) and possibly other chronic disease entities (174), it may be that our concept of "adequacy" of intake could change and the differences between social groups in nutrient intakes might take on more significance.

Food intakes

As nutrient density levels between the highest and lowest social status quintiles differed, so specific food choices and dietary habits showed some diversity, but also many similarities. Some foods which made large contributions to nutrient intakes, such as grilled and roasted meat, bread, fat

spreads, cakes, biscuits and dairy foods, were eaten in similar amounts by all social groups. Nutrient intake differences were due to type of foods chosen within food categories, such as wholemeal versus white bread or full cream versus low fat milk; to variations in cooking methods used, such as the numbers of respondents preferring frying to grilling; and, to specific habits such as the use of discretionary sugar in beverages or on cereals.

Overseas and Australian studies have found some quite similar food intake differences among social status groups to those found in this study. Better educated women in the USA (169) and upper occupational prestige men and women in Australia (55, 64, 65) have previously been found to eat more high fibre bread, low fat milk, cheese, and fruits and vegetables, although the better educated North American women also used more full cream milk, high fat, high salt snacks and high fat desserts. People in the USA with a higher poverty index (67) and low occupational status groups in Australia (55) were also found to consume less high fibre foods, and fruits and vegetables. But again in these studies, consumption by all groups fell well short of the recommended intake levels of fruits, vegetables and wholegrain cereals (1), overshadowing the differences among social status groups (55, 67).

Scottish non-manual workers were also found to eat more fruit and vegetables, while manual workers consumed larger relative amounts of fried meats and meat products and used discretionary sugar more frequently, as were found in the present study.

Generalisability of the survey findings

This study of food and nutrient intake distributions among social status groups in Australia provided evidence that these were generally healthier in higher social status groups, over a whole range of nutrients, however, the disparity between nutrient intakes of the whole sample and the recommended nutrient intakes for fat, saturated fat, fibre, refined sugar, salt and zinc were larger than the disparity among social status groups. These results therefore confirm the need for nutrition intervention in all social status groups.

Intake levels of iron in younger women and magnesium in all women did differ more among social status groups than the disparity between the recommended intake level and overall intakes. These results, and the differences in food intake patterns among social status groups, suggest that nutrition intervention needs in lower social status groups may differ from the needs of higher status groups.

In terms of assessing the generalisability of these data to the whole population, the voluntary base of the sample, the requirement for respondents to complete lengthy questionnaires and the effect of potential sampling and response biases need to be considered. While higher status groups were somewhat over-represented and lower status groups were under-represented in numerical terms, the range of income, education and occupational categories as enumerated by the last Census were all well represented in the present sample (131) and similar response rates were achieved in other reference studies such as the Australian National Dietary Survey (132) and the National Heart Foundation Risk Factor Prevalence Study (175).

However, the technique used undoubtedly reduces or minimises the participation of certain sectors of the community such as those with limited free time, those with no fixed address or those who change address often and those disadvantaged by limited literacy or English language skills, disabilities or homelessness. Thus conclusions cannot be drawn about specific disadvantaged groups such as homeless men (17), the institutionalised elderly (176) and the Aborigines (25) who are known to have a high risk of poor nutrient intake. The results of the present study are not generaliseable to these groups. Further studies using smaller samples and more individualised, labour-intensive techniques would be required to assess the nutritional profile of disadvantaged groups.

CHAPTER 3

ASSOCIATIONS OF DIETARY FAT AND FIBRE DENSITIES WITH DIET-RELATED BELIEFS AND ATTITUDES AND SOCIAL STATUS

3.1 Introduction

Differences in dietary behaviour across social status groups were reported in Chapter 2, with those of higher social status having generally healthier dietary intakes, although the differences tended to be small. These findings have implications for public health and food policy, as lower social status groups have higher mortality rates from diseases that may have some dietary aetiology, as was outlined in Section 1.2.

While nutrition education cannot alter social status, an understanding of beliefs, attitudes and dietary behaviours among different social strata should facilitate the development of socioeconomically appropriate nutrition interventions and aid identification of target groups (Carter, 1990). Research on beliefs and attitudes as predictors of dietary behaviours has utilised social learning theories of behaviour to find that, among other cognitive factors, confidence in ability to successfully maintain diet-related behaviour changes and in beliefs about the outcomes of behaviour are associated with dietary behaviour, as was outlined in Section 1.5.

The aim of the work reported in this chapter is to investigate whether personal diet-related attitudes and beliefs are associated with nutrient density levels (Aim 1.2); and to investigate associations between diet-related beliefs and attitudes, nutrient density levels and social status (Aim 1.3).

Two hypotheses are examined in this chapter. Hypothesis 2 states that the following beliefs and attitudes are associated with healthier dietary intake: strong positive belief that diet does cause disease, confidence in ability to maintain a healthy eating pattern and belief that health is an important

consideration when making food choices. In this section dietary fat and fibre densities are the indicators of dietary intake examined as these have been the focus of nutrition education campaigns in recent years. Hypothesis 3 states that beliefs and attitudes (those outlined in Hypothesis 2) and social status are associated with dietary intake (dietary fat and fibre densities) in the following ways: associations of beliefs and attitudes with dietary intake are independent of associations of social status with dietary intake (Hypothesis 3.1); and, associations of beliefs and attitudes with dietary intakes are attenuated in lower social status groups (Hypothesis 3.2).

3.2 Methods

In this chapter, diet-related belief and expectation items from the survey questionnaire are examined; these have already been described in Chapter 2. This methods section therefore describes how these items were constructed into variables and the methods of analysis used to examine associations of these with dietary variables. Social status and dietary variables discussed in this section were devised as previously described in Section 2.2.

3.2.1 Health beliefs

Health belief questions dealt with the perceived strength of various environmental and social threats to health (pollution, occupational exposure, access to a good doctor, family stress and work stress), genetic threats to health (family history of disease) and lifestyle threats to health (diet, smoking, alcohol abuse, weight control and lack of exercise). Disease belief questions dealt with perceived strength of diet-disease relationships (various chronic and acute conditions with varying degrees of association with diet). These questions were made up for this survey and based on the concept of perceived susceptibility to diet-related health outcomes from the Health Belief Model

described in Section 1.5. They were constructed on a three point scale of perceived strength.

Self-efficacy questions dealt with confidence about maintaining healthy food intake patterns in socially and emotionally difficult situations. Questions about confidence in maintaining a healthy eating pattern were asked only of those who reported that they had ever attempted dietary change. These questions were adapted from a validated weight loss self efficacy scale (Glynn and Ruderman, 1986).

Another set of questions dealt with the extent to which such factors as lack of access to healthy food, lack of preparation skills and unsupportive social factors were perceived to be barriers to eating a healthy diet. Questions about barriers to eating a healthy diet were asked only of those respondents who thought their eating habits could be healthier. Another question required respondents to rate their perception of the importance of various influences on food choice including health, price, tastiness, freshness and convenience. Both of these sets of questions were made up for this survey. The form of the questions are shown in Appendix 2.1.

All belief and expectation items had been pretested on about 60 people attending a Community Health Centre in a low income area for understandability and readability and modified where necessary.

3.2.2 Statistical analysis of health beliefs and social status with fat and fibre densities

Densities of dietary fat and fibre were chosen as indicators of healthy eating patterns which might relate to peoples' own perceptions of healthy diet. These nutrients have been the target of many nutrition education programs. Densities (as opposed to crude intakes) were used as a marker of healthy diet because of the intrinsic adjustment for differing total energy intake levels and for their statistical properties as explained earlier. The natural logarithm of fibre density was again used to statistically normalise the distribution as

previously explained. Densities (or their logarithms) were analysed as continuous variables.

For analysis of interaction effects of health beliefs and social status with fat and fibre densities, the occupational prestige quintiles described in Chapter 2 were collapsed into three groups to maintain groups with sufficient numbers, with the upper and lower groups each consisting of two quintiles, and the middle group of one quintile. Otherwise the continuous scale of occupational prestige was used.

Factor scores were calculated for health belief measures by principal components analysis. The number of factors was determined by visual examination of the scree plot, followed by factor analysis using varimax rotation. Respondents were then categorised into approximately equal groups according to their level of belief so that predicted nutrient density levels could be calculated to illustrate associations between these variables; the number of groups depended on the distribution of the scores. Respondents with missing health belief scores were excluded from analyses involving that score.

There were sub-groups within the study sample who answered specific groups of questions: the sub-group which had previously attempted dietary change answered the questions on confidence about maintaining dietary change; the sub-group which desired healthier eating habits answered questions on barriers to achieving dietary change. Associations of these constructs with dietary fat and fibre densities were, of necessity, modelled only for the relevant subgroups.

Complete data on health beliefs and attitudes were therefore available for about half of the sample, due to these response sub-groups. So that multivariate models included data from as many subjects as possible, the following sequence of analyses was performed. First, univariate regressions of belief and attitude variables with dietary fat and fibre densities were performed. Variables which were significantly associated with dietary variables in univariate models were included in multivariate analyses.

Two multivariate methods of testing Hypothesis 3 were used. The first involved step-wise multivariate regression analysis in which all univariately significant belief and attitude variables were added into the model together and the significance of each variable was determined in the presence of the others by dropping them from the model one by one and measuring the change in F ratio. Only those variables which showed a significant reduction in F ratio when dropped from the model were included in final regression models. The final step involved addition of social status into the regression equation to determine it's independent contribution to variation in dietary fat and fibre densities (Hypothesis 3.1).

The second method involved modelling of interactions using those belief and attitude variables which had been found to be significantly associated with dietary intake in univariate analyses between social status and belief and attitude variables (Hypothesis 3.2).

The 5% significance level was again used to test for associations between variables.

3.3 Results

3.3.1 Factor scores for beliefs, barriers and confidence.

Factor scores for beliefs, barriers and confidence were calculated from individual item scores in order to derive more meaningful and powerful patterns of association. Five factors emerged which were related to the perceived effect on health of i) smoking and alcohol; ii) diet, weight and exercise; iii) stress; iv) occupational and environmental exposure; and, v) not having a good doctor and family history of disease. Analysis of beliefs about the causative effect of diet also yielded five factors, which related to: i) coronary heart disease, blood cholesterol level and body weight; ii) hypertension, diabetes and stroke); iii) mental outlook, concentration and stress; iv) indigestion and allergy; and, v) fitness and dental health.

Five factors also emerged from the analysis of potential barriers to eating a healthy diet: i) food eaten by friends and family; ii) lack of money; iii) lack of availability of healthy food in shops and the workplace, and lack of availability of transport to get to the shops; iv) lack of time to cook, and boredom with healthy foods; and, v) lack of label information and cooking skills. The factor analysis of confidence scores produced two factors related to confidence about maintaining a healthy diet when: i) in food stores, at parties, and out with friends; and, ii) alone, worried or anxious, and tired. An additional score, not produced by factor analysis, was calculated from the importance that respondents placed on health as a consideration when making food choices, as opposed to convenience, price, tastiness or freshness. Respondents were grouped according to whether they rated health as the first, second or third consideration, or did not rate it among the first three of these considerations.

3.3.2 Associations of health- and diet-related beliefs and attitudes with social status and dietary fat and fibre densities

Only two health-related beliefs differed among social status groups in univariate analyses. Pollution and occupational exposures were perceived to be more threatening by lower status groups ($F=2.91$; $df=4,800$; $p<0.05$), and smoking and alcohol abuse were seen to be more threatening by upper status groups ($F=3.52$; $df=4,800$; $p<0.01$).

Stronger and more positive health-, diet- and confidence-related beliefs and attitudes were found to be associated with more favourable dietary fat and fibre densities, as shown in Tables 3.1 and 3.2. The only barrier perceived to be associated with dietary fat or fibre intake was perception of money as a barrier to eating a healthy diet: stronger perception of which was associated with a higher dietary fat density.

Only belief that diet-related influences affect long-term health and belief that diet can cause cardiovascular diseases were associated with dietary fat density, while diet-related and other lifestyle factors and belief that diet

Table 3.1 Predicted dietary fat density (% of total energy intake) of groups with strong and weak belief factor scores: the results of univariate linear regression analyses.

	Strongest Belief	Strong belief	Weak belief	Weakest Belief	% Var	F ratio (df)
Belief that diet, exercise, weight affects health	34.2	35.5	35.6	37.3	3.7	8.6 *** (3,574)
Belief that diet causes stroke, high BP, diabetes	35.0	34.5	35.2	37.4	2.4	4.2 ** (3,420)
Belief that diet causes CHD, cholesterol, weight	34.8	34.4	36.5		2.0	5.0 ** (2,395)
Confidence in healthy eating in social situations	33.9	35.0	34.9	36.1	1.7	3.2 * (3,366)
Confidence in healthy eating in emotional situations	33.2	35.4	35.3	35.6	2.1	3.7 * (3,366)
Perception of money as a barrier to eating a healthy diet	36.3	35.4	33.2		1.5	3.0 # (2,314)
Perception of importance of health when choosing food	34.4	35.6	35.3	37.3	3.5	9.4 *** (3,693)

p=0.05; * p<0.05; ** p<0.01; *** p<0.001; related to the significance of linear trends in fat density across health belief groups.

Table 3.2 Predicted dietary fibre density (g/10MJ) of groups with strong and weak belief factor scores: univariate analyses.

	Strongest Belief	Strong belief	Weak belief	Weakest Belief	% Var	F ratio (df)
Belief that effect of diet, exercise, weight affect health	30.0	28.6	26.01	23.3	6.2	18.2 *** (3,574)
Belief that smoking and alcohol use affect health	28.2	24.6	21.7		4.5	19.3 *** (2,575)
Belief that diet causes stroke, high BP, diabetes	29.9	28.8	26.9	22.7	6.0	11.7 *** (3,420)
Belief that diet causes CHD, cholesterol, weight	30.1	26.6	24.7		4.7	13.4 *** (2,395)
Belief that diet causes mental disorders	29.3	28.2	27.9	23.9	3.0	6.1 *** (3,420)
Belief that diet causes indigestion, allergy	28.9	27.7	25.5		1.4	4.4 * (2,421)
Belief that diet causes poor fitness, bad teeth	29.1	29.2	24.6		4.2	12.1 *** (2,421)
Confidence of healthy eating in social situations	30.0	28.6	26.3	25.8	2.7	5.8 *** (3,366)
Perception of importance of health when choosing food	30.1	27.0	23.6	23.3	7.7	29.1 *** (3,693)

* $p<0.05$; *** $p<0.001$; related to the significance of linear trends in fibre density across belief groups

Only belief that diet-related influences affect long-term health and belief that diet can cause cardiovascular diseases were associated with dietary fat density, while diet-related and other lifestyle factors and belief that diet can cause all diseases mentioned were also associated with dietary fibre density.

When all variables which were significantly associated with dietary fat density in univariate models were tested in the stepwise regression analysis described in Section 3.2.2, nominating health as the main consideration when making food choices was the only belief variable which was independently associated with lower dietary fat density, as shown in Table 3.3. Social status was also independently associated with dietary fat density in this model.

Additionally, a stronger perception of money as a barrier to eating a healthy diet was associated with higher dietary fat density in the sub-sample which desired healthier eating habits and therefore reported on barriers, shown in Table 3.4, while social status was not independently associated with dietary fat density in this model. The same pattern of association was found with dietary fat density in the whole sample and in the sub-sample that had previously attempted dietary change (separate data not shown).

After multivariate stepwise regression analysis, nominating health as the main consideration when making food choices and stronger belief in the health effects of diet were the only variables which were independently associated with higher fibre densities in the whole sample, as shown in Table 3.5. Social status was not independently associated with dietary fibre density after these variables were entered into the model.

Table 3.3 Associations of dietary fat density with health beliefs and social status in the whole sample (n=697): multivariate analysis.

	% variance in dietary fat density	F ratio (df)
Age	2.3	17.0 *** (1,695)
Perception of importance of health when choosing food	3.4	9.5 *** (3,693)
Social status	1.5	6.8 ** (2,694)

** p<0.01; *** p<0.001

Table 3.4 Associations of dietary fat density with health beliefs , in the sub-sample who reported that they would like to have healthier eating habits (n=318): multivariate analysis.

	% variance in dietary fat density	F ratio (df)
Perception of importance of health when choosing food	3.1	4.5 * (3, 314)
Perception of money as a barrier to healthy eating	3.4	6.8 ** (2, 315)

* p<0.05; ** p<0.01

Table 3.5 Associations of dietary fibre density with health beliefs, in the whole sample (n=799): multivariate analysis

	% variance in dietary fat density	F ratio	df
Age, sex	15.8	51.1 ***	(3, 795)
Perception of importance of health when choosing food	4.9	18.5 ***	(3, 795)
Belief that diet, exercise, weight affect health	3.5	13.4 ***	(3, 795)

*** p<0.001

Table 3.6 Associations of dietary fibre density with health beliefs, in the sub-sample who had previously attempted dietary change (n=417): multivariate analysis.

	% variance in dietary fat density	F ratio	df
Age, sex	16.2	27.8 ***	(3, 413)
Perception of importance of health when choosing food	2.2	5.0 **	(3, 413)
Belief that diet, exercise, weight affect health	1.1	2.9 *	(3, 413)
Belief that smoking and alcohol use affect health	1.0	3.7 *	(2, 414)
Confidence of healthy eating in social situations	1.7	4.0 *	(3, 413)

* p<0.05; ** p<0.01; *** p<0.001

Nominating health as the main consideration when making food choices and stronger belief in the health effects of diet were independently associated with higher fibre densities in the sub-sample that had attempted dietary change (shown in Table 3.6). In addition, confidence in ability to maintain dietary change in difficult social situations and belief in the health effects of smoking and alcohol use were also associated with fibre density in this sub-group. None of the barrier factors had any association with dietary fibre density (as was shown in Table 3.2), so the sub-sample that desired healthier eating habits was not modelled separately. After the associations with health beliefs had been accounted for, social status was not found to have an independent association with dietary fibre intake.

Analysis of interactions between beliefs and social status suggested that two health beliefs might be associated with dietary fat and fibre densities differently among the three social status groups. Strength of belief that diet is a major cause of stroke, hypertension and diabetes had a stronger effect in the high-status and medium-status groups; the dietary fibre density of those in the low-status group showed less variation in relation to strength of belief that diet is a major cause of stroke, hypertension and diabetes (Table 3.7). The interaction effect was statistically significant ($F=2.29$; $df=6, 557$; $p<0.05$).

Strength of belief in the effects of diet, weight and exercise on health showed little association with dietary fat density in the high-status group; in the medium-status and low-status groups those who believed that dietary intake does affect long term health appeared to have slightly lower fat densities. This interaction effect was not significant at the 5% level ($F=1.89$; $df=6, 672$; $p<0.1$). No significant interactions were found for all other variables tested.

Table 3.7 Predicted dietary fibre density (g/10MJ), as a function of level of belief that diet is a major cause of stroke, hypertension and diabetes, by social status.

	High-status	Medium-status	Low-status
Strongest belief	30.4	32.6	28.5
Strong belief	29.6	33.7	27.5
Weak belief	31.5	26.2	24.5
Weakest belief	23.8	25.6	23.8

3.4 Discussion

3.4.1 Personal beliefs and dietary fat and fibre densities

Personal belief that lifestyle affects health and that diet can cause disease, confidence about making dietary changes and perception of importance of health when choosing food were found to be associated with lower dietary fat and higher dietary fibre densities in this sample as hypothesised; perception of money as a barrier to dietary change was associated only with dietary fat density. In multivariate analyses, several of these variables were not significant, however this does not mean they are unimportant as causality cannot be established from non-experimental data. It does mean that these variables were not independently associated with dietary fat and fibre densities.

Individual beliefs and attitudes explained between 1% and 4% of the variance in dietary fat and 1% and 8% of the variance in dietary fibre densities; in multivariate models the explained variance rose to 7% and 24% respectively when demographic variables were also included. The levels of explained variance of health beliefs were generally stronger than those of

social status. As described in Chapter 2, these were 1.7% for dietary fat density and 2.9% for dietary fibre density.

This level of explained variance compares poorly with the results of other studies which have been able to explain up to 60% of the variance in dietary behaviours by that of beliefs and attitudes. Most of these studies, however, have used simplified measures of dietary behaviour change such as: frequency of consumption of single foods or discrete groups of foods (84, 92, 177) or simple measures of retrospectively reported change in specific food behaviours (80, 95, 99). These studies have reported correlations between such specific food behaviours and: attitude towards specific foods (84); commitment to select specific types of foods (92); and, personal susceptibility to disease, benefits of preventive behaviours and locus of control variables (80, 177). Generally, the more specific the behaviour measured, and the more closely it was related to the belief measured, the higher the explained variance. Also many of the studies described used small heterogeneous sample sizes, such as students and university staff who may have limited variability in the distribution of outcome variables.

Few studies have used measures of behaviour change which were less closely related to the questions about beliefs and attitudes used and therefore less likely to be biased by the action of reporting beliefs and attitudes. Weight loss in overweight children has been shown to be predicted by mother's health beliefs (79) and in adults by confidence in ability to maintain dieting behaviours (93), and attitude towards adding salt to food has been shown to be predictive of measured table salt intake (85). Studies which attempt to estimate usual dietary intake may also gain some independence from the beliefs being measured; one such was a validation study which found a correlation between self-efficacy factors and a dietary habits score which was based on the frequency of consumption of 39 foods (94).

The present study modelled not one reported behaviour but two aspects of the additive outcome of many reported behaviours, by calculating dietary fat and fibre densities from detailed reports of usual intake of 172 foods in

addition to information on types of food chosen and preparation methods. The complexity of the food frequency questionnaire should partly overcome the problem of bias related to subjective reporting of related beliefs and behaviors. However, nutrient intakes are also subject to many behavioural influences and the levels of variance in nutrient intakes which can be explained by beliefs and attitudes towards a general concept of healthy eating may therefore be lower than those which refer to a specific aspect of eating behaviour. Low levels of explained variance in the present study may have resulted from the questions about health beliefs and attitudes not being specifically related to any clearly identifiable set of dietary behaviours.

The variable derived from questions about the importance of health, taste, freshness, price and convenience as considerations when making food choices was the strongest individual variable associated with low fat and high fibre densities in this study. Although this variable was not derived directly from previous studies or models, the construct has been applied in other studies. An adolescent population was segmented according to their ratings of 20 foods by eight food attributes, which defined foods according to whether or not they were perceived to be: tasty, healthy, likely to cause heart disease, high in sugar, fattening, easy to get, eaten by friends and served by parents. Three out of six groups appeared to be motivated to obtain healthful food and avoid harmful foods, but there was no clear picture of nutrient intake differences between these and other groups (178).

Seven categories of attitudes that influence consumers' food consumption choices were suggested by Bayton in 1966 (73). These are related to nutrition, economic, sensory-aesthetic, personableness, appropriateness, convenience and health apprehension influences (73). In the present study, categorisation of respondents according to the strength of their attitude that health is an important consideration when choosing food was found to yield a useful variable which was associated with both dietary fat and fibre densities. This categorisation may be useful in future research investigating food-related behaviours.

3.4.2 Associations of dietary fat and fibre densities with beliefs and attitudes and social status

While studies of health beliefs and dietary behaviour commonly measure education, income, occupation or social class to adjust for their confounding effects, few studies have examined the relationships between these three types of variables, as was done in the present study. Although no diet-related beliefs differed among social status groups in the present study, a British study found that the higher social class groups had more negative attitudes towards high fat foods and that these negative attitudes were associated with lower intakes of these same high fat foods (84).

Associations between these three categories of influence were examined in two ways, the first was a stepwise regression model which tested the additive effects of social status and health belief variables, the second involved modelling of interactions for multiplicative effects between these variables.

In the first set of analyses, the variance in dietary fibre density associated with social status could be accounted for by the variance associated with beliefs, attitudes and the perception that health is an important food attribute. The variance in dietary fat density associated with social status remained unaccounted for by variance in beliefs, attitudes and the perception that health is an important food attribute. Hypothesis 3.1 was supported by the study data for dietary fat density, but not for dietary fibre density.

That the fibre density differences could be explained by variance in these beliefs and attitudes implies that social status groups have different beliefs and attitudes which may alter their fibre-related food choices. Lower status groups have possibly not received sufficient information about fibre and health, or have been unable to incorporate this information into their belief systems. However, social status and diet-related beliefs and attitudes had independent influences on fat-related food choices, implying other barriers to lower status groups reducing their fat intake.

One of these barriers might be financial, as belief that money is a barrier to eating a healthy diet was associated with higher dietary fat density. Healthier foods have been reported to be less available or more costly in low income areas in Australia (145) and the UK (179, 180), although another study found the costs of healthy and unhealthy diets to be comparable in Australia (181). Qualitative research in working and middle class women in England found some evidence of a lack of belief that diet and lifestyle generally was a cause of chronic disease (182), while in Wales some working class women did not, and others did, believe lifestyle and chronic disease to be related (183).

In the second set of analyses of the interactions of health beliefs and social status with dietary fat and fibre densities there were 18 variables analysed. A statistically significant interaction effect with dietary fibre density was found for one variable, and with dietary fat density for no variables. These analyses do not provide strong evidence to support hypothesis 3.2. With this in mind, the relationships suggested by this analysis will be discussed.

Fibre density was found to differ less among low-status health belief groups than it did among medium- and high-status health belief groups for the variable related to belief that diet is a cause of stroke, hypertension and diabetes. In the social environment of higher status groups, it may be easier to find high fibre foods, while in the social environment of low-status groups, it may be difficult or costly to find high fibre foods - even for those with strong health beliefs. Greater cost and poorer availability of high fibre and low fat foods have been described in suburbs of low social status (145). By contrast, high fat foods may be difficult to avoid in all social environments, as was evidenced by the large number of foods contributing to dietary fat density outlined in Section 2.3.2.

Further studies to gather information on the determinants or predictors of dietary behaviour which seek to maximise explained variance should focus on food choice. While nutrient intakes are more strongly implicated in relation to many health outcomes, personal choices are more closely related to foods than nutrients, and personal beliefs and attitudes may be more

predictive of food intake changes than nutrient intake changes. However, nutrient intake is generally the important outcome in relation to disease rates and has therefore more relevance in terms of improvements in public health.

3.4.3 Study limitations

Although validated measures were used where possible, the beliefs and attitudes measured in this survey may also have lead to some underestimation of associations if they lacked validity in this setting; or to overestimation of associations if responses were at all biased by responses to the food frequency questionnaire.

The limitations discussed in Section 2.2 and 2.4 about the dietary assessment methodology and sample response are also true of these analyses. The results presented here do, however, suggest that social norms may not have differentially biased the way social status groups filled out the FFQ as diet-related beliefs were not found to differ among social status groups. However, the associations of beliefs with dietary fat and fibre densities may differ in more socially disadvantaged groups, where barriers such as lack of income, cooking facilities and cooking skills may have a larger influence. A further limitation related to the cross-sectional design of the study is that of inferring causality of associations within a cross-sectional study. While beliefs have been shown to influence behaviour, behaviour can also influence beliefs and attitudes. A longitudinal study design is required to test these associations for causality.

CHAPTER 4

A DIETARY-CHANGE INTERVENTION TRIAL: RESULTS IN THE INTERVENTION AND CONTROL, AND SOCIAL STATUS GROUPS

4.1 Introduction

Social status differences in nutrient density levels have been described in many countries (see Section 1.4) and were again found in the survey study reported in Chapter 2. However, differences among social status groups were generally smaller than the difference between all status groups and recommended intake levels, indicating a need for dietary intervention in the community generally. In addition, diet-related beliefs and attitudes were associated with dietary intakes in the survey study, but direction of causality was not measured.

Therefore it was decided to undertake a dietary intervention trial which would build on the findings of the survey study, to examine social status, knowledge, beliefs and attitudes as predictors of dietary behaviour change by: investigating dietary behaviour changes in response to a dietary-change intervention (comprising dietary information-based face-to-face consultation with participants) in the intervention group and among social status groups; and, examining the associations of social status and diet-related knowledge, beliefs and attitudes with dietary behaviour change.

A face-to-face method of dietary intervention was chosen for three main reasons. This method was chosen firstly for its flexibility which allowed dietary goals to be set relative to individual intakes and preferences in a sample with no common dietary problem, that is, in a healthy population sample. Secondly, face-to-face intervention is a method of proven efficacy (76) and behaviourally-based intervention methods which have been found to be effective, as described in Section 1.6, were incorporated into the

methodology were possible. Thirdly, the method was appropriate to the skills of the candidate and to the setting in which the intervention took place.

The hypotheses to be examined in this chapter were that: specific, individualised dietary advice will result in a healthier eating pattern, which is lower in fat, saturated fat, cholesterol, refined sugar and salt, and higher in fibre and vitamin and mineral densities; and,.in response to dietary information and advice, higher social status groups will make more dietary changes than lower social status groups.

4.2 Method

The intervention study protocol was considered by the Human Experimentation Ethics Committee of the CSIRO Division of Human Nutrition to be ethical. Names of respondents were not stored in the data base in a way in which they could be linked to study data, and Electoral Roll lists were destroyed after all the data was recorded and the final contacts with participants had been made. Signed, witnessed consent forms and information sheets were collected from participants in the intervention trial and filed.

4.2.1 Sample selection

In order to achieve a sample comprising a range of social status groups, names were randomly selected from suburbs chosen to have either a high, or a low social status profile. Suburbs were therefore chosen to contain either a high proportion of people in professional occupations, people with tertiary education and high income levels, or to contain a high proportion of labourers, and people without tertiary education and with low income levels (184). Suburbs were also matched to a limited extent for proportion of retirement-aged people, and were selected to be within 8kms distance of the place of interview, which was located in the centre of Adelaide and easily accessible by public and private transport.

From experience gained from a pilot study, three names from low status suburbs were initially selected for every two from the higher status suburb. After forty percent of the participants had been recruited, this was modified to a ratio of 2:1, to maintain approximately equal numbers from each area.

Although a sample which was totally representative of the population from which it was drawn could not be expected due to the demands of the study, it was hoped to achieve a broader cross-section of people than would be achieved by publicly advertising for volunteers. From the results of a pilot study, a response rate of the order of 30% was expected, therefore a large element of self-selection into the study was expected.

4.2.2 Recruitment

The study protocol is outlined in Table 4.1. Between one and two hundred recruitment letters were posted at weekly or fortnightly intervals between February and March, 1991 and September and December, 1991. Each posting contained the same ratio of people from lower and higher status suburbs. In the letter, people were invited to participate in a study of dietary change and cholesterol level. The letter outlined the study requirements, offered free cholesterol tests and dietary advice by a dietitian and provided a freepost return envelope, tear-off slip and contact phone number (see Appendix 4.1). The study was referred to as the "Food and Cholesterol Study" to participants, as they were offered cholesterol tests and dietary advice during the recruitment period. Prospective participants were asked to return the tear-off slip or phone the study co-ordinator to enrol in the study. Recruitment of the sample and allocation to intervention and control groups were administered by the candidate.

Assessment visits began in March and went through until May, 1991, then these same participants were followed up between June and August, 1991. The second set of assessments ran from October to December, 1991 with follow-up from mid January to mid April, 1992.

Table 4.1 Protocol and timing of the intervention trial, in relation to the initial assessment visit

TIME	ACTIVITY
-3 weeks	Recruitment letter mailed.
-2 weeks	Appointments made, information sheets and consent forms and questionnaire booklets posted for completion at home.
0 weeks	Biological assessment made, questionnaire booklets returned and allocation to intervention or control group made.
0-2 weeks	Questionnaire booklets coded and punched, feedbacks prepared.
2 weeks	Intervention group received dietary intervention, goal setting and first healthy eating record.
3 weeks	Healthy eating record 1 to be returned in the post.
7 weeks	Healthy eating record 2 received in the post, to be completed and returned in the following week.
10 weeks	Participants phoned for follow-up appointment.
11 weeks	Healthy eating record 3 and follow-up booklet received in the post.
12 weeks	Follow-up interview, re-test of biological measures, return of follow-up booklet and healthy eating record 3. Dietary intervention received by control group.
13 weeks	Follow-up data coded and entered, second feedback prepared and posted.

Initial appointments for assessment measurements were generally made between 8.00 am and 11.00 am, at 15 minute intervals, although some were made at alternative times to accommodate the needs of particular individuals. As outlined in Table 4.1, respondents were then posted a covering letter stating their appointment time and other relevant details and a study information sheet, consent form (shown in Appendix 4.2) and a questionnaire booklet (which will be described later). They were asked to complete the relevant enclosures, and return them when they came in. Reimbursement of bus fares or parking costs incurred in travelling to the appointment was offered to all participants, to minimise exclusions due to financial constraints.

In the later part of the study, recruitment letters also included an invitation for a family member or friend to join the study. This was done to boost the recruitment rate and because some respondents wished to bring a companion into the trial.

4.2.3 Allocation to intervention and control groups

Respondents within each suburb status category were assigned to intervention or control groups by the candidate, prior to their first clinic visit. This was done by making up two listings each day of all participants with appointments: one containing those recruited from the high status suburbs, and the other containing those recruited from the low status suburbs, ordered by their appointment time. Separately, on each list, participants were then alternately allocated to the intervention or control group. The allocation was continued from one day to the next, so that all participants with a particular appointment time were not allocated into the same group. Although this was not a strict randomisation procedure, it did allow ease of organisation in the clinic and was flexible if appointments were not kept, in which case the next attendee within the same suburb category took over the non-attendee's group. Separate lists were kept of those from high and low status suburbs so that equal numbers of control and intervention participants would be achieved in both groups. If the respondent had recruited a family member or friend into the study, they were both allocated to the same group, although each received their own personalised intervention.

4.2.4 Initial assessment

A five ml blood sample was collected from each participant by a trained clinical nurse for the blood cholesterol determination. Body weight and height were also measured and recorded by the nurse, who also asked the participant about their use of medications, whether they had heart disease, high blood pressure, diabetes, whether they were pregnant and when they had last eaten or drank. This information was recorded on the form shown in

Appendix 4.3. During the same visit, all participants were seen by the candidate, the study protocol was explained and information and consent forms and the questionnaire booklet were collected. Participants were informed of their group allocation at this time.

The control group were told that they had been randomly allocated into the comparison group and that they would receive their cholesterol test result in the post in about two weeks time, but they wouldn't receive their dietary feedback and advice until three months time. They were also told that they could change their eating habits if they wished to do so, but they would not receive dietary advice about appropriate changes until their follow-up appointment. Although they were not encouraged to change their eating habits, they could also not be discouraged, as some received a cholesterol test result indicating a level requiring intervention.

The intervention group were informed of their group allocation and asked to come back in two weeks time and receive their cholesterol test result and dietary feedback. An appointment time was made for two weeks later (as outlined in Table 4.1). During the intervening fortnight, the dietary questionnaire was coded, punched, analysed and checked and a study feedback booklet called the "Food and Cholesterol Study Personalised Healthy Eating Plan" was prepared (which will be described later).

4.2.5 The control condition and the intervention procedure

The control and intervention groups therefore completed the same assessments of diet, diet-related knowledge, beliefs and attitudes, weight, height and cholesterol. They also both received their cholesterol test result. The intervention therefore consisted of dietary feedback and dietary counselling.

The intervention interview was conducted by the candidate, a trained dietitian. A standard set of questions was first asked of each intervention group participant prior to going through their feedback information, these questions are shown on the interview form used, in Appendix 4.4. These

concerned previous experience with cholesterol testing and dietary change, family experience of heart disease and whether they presently had any reason to want to change their diet.

Next, each participant's study feedback booklet containing their cholesterol test result and dietary feedback was explained to them and discussed. The feedback information was conveyed to the respondent both in terms of nutrient intake levels and food consumption levels using verbal, written and pictorial descriptions (these are described in Section 4.2.8). Then, after receiving advice about appropriate dietary changes, the participant was asked to set their own dietary behaviour change goals. A maximum of five dietary change goals were set and recorded on a study form, on a page of the respondent's dietary feedback booklet and on a "Healthy Eating Record" (these are also described in Section 4.2.8).

If the participant recruited had also recruited a family member or friend to join the study, they were usually seen together for the intervention interview, but each received their own personalised intervention and set their own dietary change goals. Therefore, each was treated as a separate participant for the intervention.

If the participant felt that the summary of their eating pattern was inaccurate, appropriate revisions were made to their assessment dietary questionnaire and nutrient intake levels.

Finally, each participant was asked to record his or her adherence to dietary goals over the seven days following the interview on a "Healthy Eating Record" and to return the completed sheet in a postage paid envelope. A second "Healthy Eating Record" was sent out to all intervention participants four weeks after the interview, and a third in the final week of the study.

Interviewer ratings of the participants' reactions to the intervention

After the interview, the interviewer noted her assessment of the participant's apparent confidence concerning the dietary changes discussed, apparent control over dietary behaviour, general comprehension of the

information discussed and the relative number of questions they asked. The interview time was also recorded. These ratings were recorded on a standard format in the form of a five point scale, as shown in Appendix 4.4. These scores were recorded due to their relevance to the specific dietary-change goals made and dietary counselling received. The duration of the interview was also recorded.

4.2.6 Follow-up

Appointments for follow-up visits for both groups were arranged by phone, approximately three months after the first assessment visit. The questionnaire booklet was posted to the participant with their third "Healthy Eating Record" two weeks prior to their follow-up appointment. Follow-up data collection included re-testing of cholesterol level, weight, diet-related knowledge, beliefs and attitudes and usual dietary intake over the last three months. Although the food frequency questionnaire booklet was originally designed to assess usual food intake over the preceding six to twelve months, respondents were asked to record their intake over the preceding three months.

Data were also gathered from the participants in the intervention group about their overall perception of success with dietary change, and what aspects of the intervention they found most useful. Information received during the follow-up intervention interview was recorded on a pre-specified form, shown in Appendix 4.5.

The control group received his or her dietary feedback at this time (as outlined in Table 4.1). The interview format used is shown in Appendix 4.6. The feedback was shortened to include the eating pattern only, otherwise it was similar to the Personalised Healthy Eating Record used for the intervention group (which will be described later). The participant's nutrient intake data were available for reference during the interview. The control group also had the same opportunity to note inaccuracies in the summary of

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their initial assessment eating pattern and these were revised in the same way as was done for those in the intervention group.

Three weeks after the follow-up assessment, cholesterol, weight and dietary feedback data were posted out to both groups (as outlined in Table 4.1). Once the whole trial was completed, a summary of the main study findings was posted to all participants.

4.2.7 Data coding and entry

Some data coding of questionnaire booklets was done by the candidate but most was done by one other experienced coder. Checks of dietary coding were made during preparation of dietary feedback forms and when the data were entered into the data base, as only data within pre-specified ranges were accepted. The data were double-punched by a data entry operator, then transferred onto a SUN computer, and processed by the candidate.

Data collected during interviews and from healthy eating records were coded and single-punched directly into the data base by the candidate. Again, setting of pre-specified ranges for data base variables provided a check when entering data into the data base.

4.2.8 Materials used

<u>The questionnaire booklet</u>

The questionnaire booklet was similar to that described in Section 2.1 and is shown in Appendix 4.7. It contains the same or similar questions on usual food intake, socio-demographic details and diet-related beliefs and attitudes. There were new questions on knowledge of the 12345+ Food and Nutrition Plan (FNP) and application of this to a days healthy dietary intake, the participant's stage of dietary change, and questions concerning the participant's dietary locus of control.

Questions on diet-related beliefs and attitudes consisted of a statement, to which participants were requested to respond. They were asked to rate each statement in the form of a five point response from a positive extreme to

a negative extreme (for example: strongly agree, slightly agree, neutral, slightly disagree, strongly disagree). This differed slightly from the method used in the survey described in Section 2.1, that offered only three or four options. It was hoped that five choices would allow beliefs to be scored with more precision and over a greater range of responses. Some questions about health beliefs used in the survey which were not found to be related to dietary intake were not used for the intervention trial. One question which had been found to be related to dietary intake in the population survey study was unfortunately not used in this study (the question about the relative importance of health compared to other considerations for making food choices), as this relationship had not been examined at the time of designing the questionnaire booklet.

Knowledge about healthy diet was assessed using five questions relating to the 12345+ FNP (which is described below), that was to be used as the food selection guide and education tool in the intervention. As this guide recommends the number of serves of five food groups (plus "indulgences") to be eaten each day, participants were asked what their perception was of a healthy daily intake of these five groups of foods. They were also asked to outline the meals that they believed would comprise a healthy day's food intake, with prompts for breakfast, lunch, dinner and three mid-meals (see Appendix 4.7: page 24, Q-2 and page 25).

The question on the participant's dietary stage-of-change was based on a method of devising a set of questions based on the Prochaska and DiClemente model of behaviour change (185), as was previously done in a smoking-related stage-of-change questionnaire which allowed one of six choices as a basis for allocation to a stage-of-change group (186). The question is shown in Appendix 4.7: page 26, Q-1. The questions on dietary locus of control were adapted from questions used in a weight-loss locus of control in a study which scaled questions on a five point rating from internality at one extreme to externality at the other. Two questions were

worded as external and two as internal (100). These questions are to be found in Appendix 4.7: page 24, Q-1.

Dietary feedback

Nutrient analysis was carried out using an updated version of the Frequan program called Questan, from data organised on a SIR database, as previously described in Section 2.1. Computer dietary analysis and dietary feedback programs had been previously developed within CSIRO, and were adapted for the needs of this study where appropriate by CSIRO computing personnel in consultation with the candidate.

The dietary feedback sheet first displayed average daily intake levels of energy, protein density, total carbohydrate density, density of complex carbohydrates plus sugar derived from fruit sources, density of sugar derived from that added to foods during processing (commercial and in the home), total fat density, saturated fat density, polyunsaturated fat density, and also total daily intake of cholesterol, alcohol, fibre, sodium, potassium, calcium and iron. They were given to the participant in their Personalised Healthy Eating Record, shown in Appendix 4.8 on page 3. Recommended intake levels of these nutrients, except energy level, were listed alongside the participant's measured intake level (25, 29, 168), and with average Australian intake levels (from previous CSIRO surveys).

On the next page, the feedback listed the foods (from a list of 40 groupings) which contributed to higher than recommended intakes of refined sugar, total fat, saturated fat, cholesterol, sodium, potassium and protein - if these occurred. It also listed good food sources of nutrients that were low in the participant's diet - again if these occurred (also shown in Appendix 4.8, page 4).

Finally, the participant's average daily serves of meats, dairy foods, fruits, vegetables, breads and cereals and "indulgence" foods as assessed by the 12345+ FNP were listed, next to the recommended healthy eating pattern that was based on their calculated energy intake (described below and shown

in Appendix 4.8, page 5). The participant's average daily serves were computed from the food frequency questionnaire, by assigning the foods listed in the frequency questionnaire into the six groups - based on published material (31, 187). Where serve sizes listed in the frequency listing were not in accord with those used in the 12345+ FNP, they were adjusted.

The 12345+ Food and Nutrition Plan

The 12345+ FNP (31, 187) is a recently developed food selection guide encapsulating the Australian Dietary Guidelines, the Better Health Commission nutrition targets (25) and the recommended dietary intakes of essential nutrients (29). The technique used for developing this plan involved computer simulation and assessment of various daily diet plans based on Australian dietary survey data, and beginning with pre-existing food guides. Foods and portion sizes were based on those currently consumed in Australia. A nutrition education booklet based on this plan was jointly produced towards the end of the trial by the CSIRO Division of Human Nutrition and the Anti-Cancer Foundation of SA (188).

The 12345+ FNP recommends a daily intake, with prespecified serve sizes, of: 1 serve of red meat (or alternative); 2 serves of dairy foods; 3 serves of fruit (no more than 1 serve as juice); 4 serves of vegetables (including a green, leafy or brassica, and an orange or yellow vegetable); and, 5 or more serves of cereals (mainly wholegrain). As the dietary culture of many industrialised countries often includes many foods and drinks which are considered to be too high in salt, fat or sugar to be recommended as regular components of the diet, an additional food group ("indulgences") was designed to provide guidance as to how these foods can be included in a healthy dietary intake. Two serves a day of these foods (worth 600 kJ each), or extra serves of the other groups can be included in the diet by those with energy intakes over 6000 kJ. The food groupings are described in more detail, with serve sizes, in the subject feedback booklet shown in Appendix 4.8 (pages 7 to 9).

The control group received the same "Personalised Healthy Eating Record" as that received by the intervention group, except that the nutrient intake information was missing and the preface was revised so that it was appropriate for use with the control group.

The Healthy Eating Record

The Healthy Eating Record consisted of a listing of the dietary change goals set during the intervention interview, with seven boxes next to each goal to mark off over the following seven days. Each participant was asked to place a tick next to the steps they felt they had achieved on that day (shown below in Figure 4.1).

Figure 4.1 The healthy eating record

Please keep a record over the next week of your progress with these steps to change your eating pattern, by filling out the table below. Please send this sheet back to us by _ _ / _ _/ _ _ in the envelope provided.

Fill out one column each day.
Tick the box for each step if you consider that you succeeded for that step on that day. Please begin tomorrow.

CHANGES TO YOUR EATING HABITS	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Step 1							
Step 2							
Step 3							
Step 4							

4.2.9 Scoring of dietary measures

Nutrient density level scores were calculated as previously described in Section 2.1. Mean nutrient density values were converted to natural logarithms, for those nutrient densities for which this strategy aided statistical normalisation, and were therefore calculated as age-adjusted geometric means from regression equations. Only sodium, potassium, total fat and saturated fat densities were calculated as arithmetic means.

Food group intakes were computed as serves per day of the same pre-specified food groups that had been used in the dietary feedback (meat, dairy, fruit, vegetables, cereals, and indulgence food groups). These six food groups were also broken down into 14 food groups to examine changes within food groups. For example, cereals were divided into wholegrain and more-refined cereals; dairy foods were divided into low-fat milk, fullcream milk and cheese; the fruit group was divided into fruit juice and fresh fruit; the vegetables group was divided into the four types of vegetables specified in the 12345+ FNP and indulgences were divided into three types: sweet, savoury and discretionary sugar and sugar in beverages and cereals.

Nutrient contributions from each of these 14 food groups were again computed, as described in Section 2.1.

4.2.11 Scoring of knowledge questions

Knowledge items were scored by giving a mark for the answer closest to that indicated by the 12345+ Food and Nutrition Plan. As there were two sets of questions regarding this construct, these were scored separately. The first variable, the "12345+ knowledge score", concerned knowledge of the number of serves of the five food groups (excluding indulgence foods) described by the 12345+ FNP. Half marks were given for answers one serve different to the correct number, and the total mark was scored out of 100.

The second variable, the "applied knowledge score", concerned how closely the ideal healthy day's diet as described by the participant was consistent with the 12345+ FNP. This variable also reflected some of the

nuances of the 12345+ FNP, as points were given for healthier food choices within groups: for mentioning a wholegrain cereal food, a low fat product, a deep yellow and a green vegetable, and for not mentioning a high sugar food and a high salt food. For this score, the number of indulgence foods was also assessed, as well as the other five groups, in relation to the pattern recommended by the 12345+ FNP. For these variables, five serves of cereal foods was used as the recommended number.

4.2.11 Biological measures

After collection, blood samples were transferred from the syringe into a heparinised tube, and kept on ice for no more than 3 hours until they could be spun down in a centrifuge on 3000 r.p.m. for 10 minutes. Plasma (0.5 ml) was then pipetted into a Treff tube and frozen at -4^{o}C by the clinic nurse. Analysis of blood samples for cholesterol content by laboratory staff took place at approximately weekly intervals. The sample was again spun down in the centrifuge at 3000 r.p.m. for five minutes to remove fibrin and duplicate samples were aliquoted into the COBAS BIO (Roche) cup with Cholesterol reagent. A quality control was included in each run (CIBA-Corning QCS Normal Control Serum). Duplicate sample results were then averaged to give the mean plasma cholesterol level.

Body height and weight were measured in light clothes and without shoes on SECA scales, weight was measured to the nearest 0.5 kg, and height was measured to the nearest 0.5 cm.

4.2.12 Statistical analyses

Initial assessment nutrient density data of the intervention trial sample was compared with that of the more population-representative survey sample by calculation of t-tests and age, sex and occupational prestige distributions of these samples were compared by the use of Chi-square tests.

Baseline data for the intervention and control groups and among higher and lower social status groups were next examined. Measures of food and

nutrient intakes and knowledge scores between groups were compared by analysis of variance. Those who were categorised into the middle status group were excluded from analyses comparing changes between higher and lower status groups.

The effect of the intervention was analysed as the difference between pre-intervention and post-intervention measures of outcomes, by analysis of variance. To avoid regression to the mean effects, the mean of the initial and the follow-up measure of the outcome being assessed was used as a covariate in the analysis of variance (189). Food intake changes were examined according to the food groups designated by the 12345+ FNP. This was done in two ways, firstly according to the six major food groups (meats, dairy foods, fruit, vegetables, breads and cereals and indulgences). These food groups were also broken down into smaller groups to examine changes to types of foods within these groups, as already described.

Variation in response to the intervention among the high, high-middle and middle-low social status groups was analysed as an interaction effect, by modelling the main effects of the intervention and of social status, plus the interaction effect of the intervention by social status. All social status groups were included in these analyses.

Descriptive analyses were conducted in order to examine which food intake changes contributed to the nutrient density changes seen. Mean contributions by each of the 14 smaller food groups to change in each of those nutrient density levels which differed between groups were tabulated and the difference between intervention and control, and higher and lower social status groups calculated. No statistical analysis was done on these data, as it would essentially have repeated earlier analyses of mean change in total daily consumption of these food groups, and was not necessary for hypothesis testing.

Although many of the analyses carried out appear to involve multiple comparisons, many of the variables are not independent (e.g. nutrient intakes and food intakes) and therefore if a significant result is obtained with one

variable it is highly likely that a significant result will be obtained with related variables. In addition, the variance of the dietary data may be under-estimated due to the clustered sample design whereby some participants were recruited into the study by a directly recruited participant living in the same household. These clustered participants were, however, treated individually in the intervention. To adjust for this clustering effect, a significance level of 1% will therefore be used in interpreting the significance of hypothesis-testing data (58). Analyses which are significant at the 5% level will still be reported.

4.3 Results

4.3.1 Response rate and characteristics of the intervention study participants

In this section, the response rate of the intervention sample is first described. Next the characteristics of the intervention sample are compared with those of the population survey, for measures which were collected from both samples. This analysis will be referred to later in assessing the implications of the results of the intervention studies.

Response rates

The response rate for the higher-status suburban area was higher by than that of the lower-status suburban area, with approximately equal final numbers from both areas, as shown in Table 4.2.

Table 4.2 Response to the intervention study

	Lower-status suburbs	Higher-status suburbs
Recruited	247	240
Letters sent	1350	800
Known non-contacts	75	55
No appointment possible	7	3
Total denominator	1268	742
Response rate (%)	19.6	32.3

Table 4.3 Sample size at each stage of the intervention trial

Time	Activity	Sample size	
		Total	
-3 weeks	Recruitment	1250	
0 weeks	Assessment data collected	487	
	Allocation to study condition	Intervention sample size	Control sample size
		249	238
2 weeks	Intervention interview	246	
3 weeks	Diet record 1	196	
7 weeks	Diet record 2	193	
11 weeks	Diet record 3	203	
12 weeks	Any follow-up data	Total	
		459	
	Follow-up booklet	447	
	Follow-up interview	453	
		Intervention	Control
		223	230

Sample sizes at each stage of the study are shown in Table 4.3. The study began with 487 participants. Over the study period, 29 (5.9%) respondents did not return at all: 20 (4.1%) from the lower-status suburb, and nine (1.8%) from the higher-status suburbs. In addition, 12 respondents did not return their dietary booklet but did attend their follow-up interview, and six did return the booklet but did not attend for follow-up. Two participants were unable to provide blood samples at assessment and three were unable to do so at follow-up, due to difficulty of venupuncture or pregnancy at follow-up.

Clustering of respondents from the same household

The intervention sample was made up of 169 individuals who participated on their own and the control sample was made up of 176 individuals who participated on their own, hence of the total 345 individuals participating alone, there were similar proportions in the intervention (49%) and control (51%) groups. In addition, there were 88 pairs of respondents who participated together who were either related or friends, but 16 of these did not live in the same household. Of the remaining 71 pairs of respondents who participated with someone else in the same household, 40 (56%) pairs were allocated to the intervention group, and 31 (44%) to the control group.

Examination of the characteristics of respondents who participated with another household member and the characteristics of the whole sample shows that those who accompanied a directly recruited household member appeared to be older (45% over 60 years of age compared to 32% in the whole sample) and more likely to be male (54% compared with 41%). However, the occupational prestige and educational status distributions of respondents who participated with another household member appeared to be very similar to those of the whole sample.

Distribution of the intervention trial sample

Age, sex and occupational prestige distributions of the sample and mean nutrient intakes, biological measures and diet-related beliefs and attitudes will be described and compared with these characteristics in the population survey sample. Although the population survey achieved a 70% response rate and is therefore not a truly representative population sample, this is close to the 75% achieved by reference prevalence surveys, such as the National Heart Foundation Risk Factor Prevalence Survey and the National Dietary Survey 132, 175). For the purpose of applying the results of the intervention trials to population measures, it is important to gain some understanding of how the sample of the intervention trial compares to the more representative population sample from the cross-sectional survey reported in Chapter 2.

Comparison of the proportions of males and females in the intervention samples revealed a ratio of females to males of 59:41 which differed little from that of the survey sample, which had a ratio of 55:45 (χ^2=2.51; df=1; NS). The age distributions of the samples did differ, with more respondents in the sample for the intervention trial aged over 60 years (31% compared to 18%), the same proportion aged between 40 and 59 years (34% in both) and fewer in the intervention trial aged between 18 and 39 years (34% compared to 45%) (χ^2=24.0; df=4; p<0.001). The potential therefore exists for comparison measures between samples to differ due to differences in their age distributions.

The occupational prestige distribution of the sample for the intervention trial also differed to that of the sample for the survey study (χ^2= 85.0; df=4; p<0.001). Compared to the same groupings as were used to define occupational prestige quintiles in the survey study, a larger proportion of the intervention trial sample (43%) had occupational prestige scores equivalent to those of the top quintile (20%) of the survey sample. Smaller proportions of the intervention trial sample had scores equivalent to the score cut-offs of the second (18%), third (13%), fourth (15%) and fifth (10%) quintiles in the survey sample. The sample recruited for the intervention trial did not contain a mainly high and a mainly low status group as planned. Rather, it can best be

seen as containing a high, a middle-high and a middle-low status group and these groupings will be used in subsequent analyses involving comparisons between social status groups.

The age distribution of social status groups within the sample for the intervention trial was also examined. As shown in Table 4.4, for females, the high status group contained slightly more younger and middle-aged women, the middle-low status group contained more older women, while the middle-high status group was intermediate between the two (χ^2=18.3; df=4; p<0.01). The age distribution of occupational prestige groups tended to follow the same pattern among males, but differences between groups were not significant (χ^2=7.3; df=4; NS). The lower social status group of the sample recruited for the intervention trial was therefore somewhat over-represented by older women.

Table 4.4 Occupational prestige distribution of males and females by age-group in the intervention sample

	Males			Females **		
	Age 18-39 (years)	Age 40-59 (years)	Age 60+ (years)	Age 18-39 (years)	Age 40-59 (years)	Age 60+ (years)
Sample size (n)	66	70	61	96	97	89
Occupational prestige	(%)	(%)	(%)	(%)	(%)	(%)
High	47	56	36	44	46	30
Middle-high	34	23	29	43	29	30
Middle-low	19	21	35	13	25	40

** p<0.01 among women of different age and occupational prestige groups

Dietary intake

Mean intakes of selected nutrients of the samples of the survey and intervention studies were compared, to describe the relative healthiness of the dietary intake of the intervention sample. Age-adjusted nutrient densities for males and females in both samples are shown in Appendix 4.9. The intervention sample ate a generally healthier diet than did the survey sample. The dietary intake of the intervention sample contained a lower density of fat, saturated fat, alcohol, cholesterol and sodium, but also a lower density of zinc and mono-unsaturated fat, and was denser in total carbohydrates, natural sugars, fibre (in females), calcium, magnesium, but also refined sugar (in males) (all significant at $p<0.01$ for males and females). Females in the intervention sample also tended to have a higher beta-carotene and refined sugar densities and lower protein density and males tended to have a higher fibre density ($p<0.05$). Little secular change in the general population from which the two samples were drawn would have been expected as the two studies were only two years apart.

Reported dietary changes in the last six months were compared between the intervention and survey samples in Appendix 4.10. Recent increases in consumption of fruit, vegetables and wholegrain bread and reductions in consumption of fullcream milk were reported in larger proportions of the intervention sample, especially in those aged over 60 years.

Due to the demographic (particularly age) differences between the samples described these results should be interpreted cautiously even though data were adjusted for age differences, but it seems that those in the intervention trial had made more recent dietary changes and they had healthier dietary intakes, than the more population-representative sample in the survey study.

Anthropometry

Comparison of height, weight and body mass index required comparison of self-report survey data with measured intervention study data. The data

are shown in Appendix 4.11. The self-reported mean heights of males and females in the survey study appeared to be taller than measured heights in the intervention trial. This discrepancy appears to be somewhat age-related, as age accounted for 8.2% and 15.8% of the variation in height for males and females in the intervention sample, but only 2.3 and 0.8% in the survey sample, from the results of regression analyses. It may be that older-aged people tended to over-estimate their height, as might be expected if they had shrunk with age without realising it, and this observation is supported by participant's comments in the clinic during measurement of their height. Weight and body mass index differed little between samples. These data indicate similarity of these measures between samples, but should also be interpreted cautiously due to demographic and measurement differences between studies.

The mean cholesterol levels of males and females in 10 year age groups in the 1989 National Heart Foundation (NHF) Risk Factor Prevalence study 175) were used to calculate indirect age-standardised "expected" cholesterol levels (190) for the intervention sample. Men of the same age in the two samples had similar cholesterol levels (expected mean: 5.53 mmol/l; observed mean: 5.58 mmol/l; $p>0.05$) and so did women (expected mean: 5.54 mmol/l; observed mean: 5.47 mmol/l; $p>0.05$). These data provide evidence of similarity of the cholesterol levels of those in the intervention trial to the population sampled by the NHF study.

Health-related beliefs

It is important to know whether the respondents in the intervention sample might have had greater interest in diet and health than the non-respondents, for the purpose of generalising from the findings of the intervention trial. Some information about the beliefs of non-respondents could be indirectly inferred by comparison with the results of the population survey.

Two sets of questions about health-related beliefs and attitudes were asked of both samples. The data for these two sets of beliefs are shown in the Appendix 4.12, and described below. The respondents in both samples were asked their belief as to the potential harmful effect of seven lifestyle and environmental causes of ill health. The survey sample was allowed only one option of strong belief - out of three choices - while the intervention sample was allowed a strong or very strong belief option - out of five choices - and these two have been combined.

Over 63% of males and 83% of females in all age groups of the intervention sample reported believing that the possible effects on long term health of eating a high fat, low fibre diet and of being overweight were potentially strong or very strong, compared to between 40-67% of males and 48-63% of females in the survey sample. Proportions in both samples indicating strong belief for all other causes (including smoking, alcohol use, lack of exercise, occupational exposure and environmental exposure) appeared to be of similar magnitudes.

Both groups were also asked to nominate how strong they perceived the causal effect of a high fat, low fibre diet to be on six diseases or conditions. The results of the strongest two categories out of four for the survey sample were compared with the strongest two out of five for the intervention sample. Higher proportions (of up to 50% more) of the intervention sample believed strongly in the causal relationship between a high fat, low fibre diet and all diseases mentioned, especially heart disease, high blood pressure and stroke. This was despite there being more categories for the intervention sample to choose from. While these results should be interpreted cautiously, it may be the case that the intervention sample agreed to join the study because of their stronger beliefs regarding the outcomes of eating a high fat, low fibre diet.

4.3.2 Dietary, biological and knowledge measures for intervention and control, and social status groups at the initial assessment

Intervention and control groups

The intervention and control groups contained similar proportions of males (38% and 44% respectively) and females (62% and 56%) (χ^2=2.04; df=1; NS). The age distribution of males in the intervention and control samples did tend to differ, although not at the 1% level of significance (χ^2=8.12; df=2; $p<0.05$), while the age distribution of females did not differ. As can be seen in Table 4.5, there appeared to be fewer 18-39 year old males in the intervention group. The occupational prestige distributions of males and females in intervention and control samples did not differ (χ^2=1.28; df=4; NS and χ^2=0.94; df=4; NS respectively). Participants were matched for status of suburb of residence - which was the only information available at the time of group allocation - however, this does not necessarily equate with individual occupational prestige, and they were not matched for age or sex.

There were some nutrient intake differences between the intervention and control groups at initial assessment, as shown in Table 4.6. Mean percent of energy from fat and saturated fat were lower in the intervention group than in the control group while percent of energy from carbohydrate and folate density in the intervention group tended to be higher and monounsaturated fat density tended to be lower than in the control group. Age and sex were included as covariates in these analyses.

Table 4.5 Age, sex and occupational prestige distribution of the intervention and control groups

	Males		Females	
	Intervention group n=94 (%)	Control group n=105 (%)	Intervention group n=155 (%)	Control group n=133 (%)
Age				
18-39 years	24	43	34	34
40-59 years	40	31	32	35
60+ years	36	26	34	31
Occupational prestige				
High	52	42	41	39
Middle-high	27	30	32	37
Middle-low	21	28	27	24

Table 4.6 Mean nutrient densities of intervention and control groups at initial assessment

Nutrient density	Intervention group	Control group	F ratio df=1,443	Prob (a)
Energy (kJ)	8480	8550	0.33	NS
% energy from:				
Protein	15.8	16.2	2.34	NS
Fat	30.8	32.5	9.96	**
Saturated fat	11.1	12.2	14.1	***
Monounsaturated fat	10.6	11.1	5.25	*
Polyunsaturated fat	6.03	6.02	0.00	NS
Carbohydrate	49.3	47.9	5.54	*
Starch	23.1	22.4	0.11	NS
Refined sugars	8.43	8.45	0.00	NS
Natural sugars	15.3	14.3	3.80	NS
Alcohol	3.02	2.47	2.38	NS
P:S ratio	0.63	0.58	3.67	NS
Cholesterol (mg/10MJ)	246	256	1.41	NS
Fibre (g/10MJ)	32.2	30.8	2.00	NS
Sodium (mg/10MJ)	2870	2920	1.11	NS
Potassium (mg/10MJ)	5020	4940	0.62	NS
Calcium (mg/10MJ)	1200	1240	1.21	NS
Magnesium (mg/10MJ)	443	438	0.23	NS
Iron (mg/10MJ)	16.2	15.9	1.59	NS
Zinc (mg/10MJ)	12.8	12.9	0.24	NS
Beta-carotene (ug/10MJ)	6180	6320	0.25	NS
Folate (ug/10MJ)	297	277	5.80	*

(a) probability, * $p<0.05$; ** $p<0.01$; *** $p<0.001$; NS not significant

The fruit intake of the intervention group was also higher than that of the control group at the baseline measure, possibly contributing to the nutrient intake differences described above, although differences in choices of foods within groups could have also occurred. Intakes of the five other main food groups did not differ, neither did knowledge scores or biological measures, shown in Table 4.7.

Table 4.7 Mean food group intake and knowledge and biological measures of intervention and control groups at the initial assessment

Food group intake serves [a]	Intervention group	Control group	F ratio df=1,443	Prob [b]
Meat	1.42	1.49	1.34	NS
Dairy	2.02	2.12	0.79	NS
Fruit	3.30	2.78	7.48	**
Vegetables	4.85	4.69	0.80	NS
Breads and cereals	5.44	5.35	0.17	NS
Indulgences	3.78	3.84	0.10	NS
Knowledge score (%)				
12345+ knowledge	52.4	50.0	2.94	NS
Applied knowledge	54.2	54.7	0.16	NS
Biological measures				
Weight (kg)	69.2	68.5	0.33	NS
Height (cm)	167.2	167.6	0.52	NS
Body mass index	24.7	24.4	0.70	NS
Plasma cholesterol (mmol/l)	5.58	5.51	0.50	NS

(a) Food serve sizes and groupings were based on the 12345+ FNP
(b) probability * $p<0.05$; ** $p<0.01$; *** $p<0.001$; NS not significant

These differences may have occurred due to the demographic differences between the intervention and control groups described in Table 4.5, or they may have been due to random differences in dietary behaviour between groups. Although the analyses were adjusted for age and sex differences, the method of adjustment used may not have been adequate to fully adjust for these differences.

Two methodological differences were also investigated as possible causes of the differences in dietary fat density between intervention and control groups. The first involved the method of processing the dietary questionnaire. For those recruited in the first phase, coding and data entry

were done immediately for the intervention group, by the study co-ordinator, while the control group's booklets were stock-piled and coded later by another coder and entered by a commercial data-entry operator. In the second phase of recruitment the coding and data entry were done in the same, latter, way for both groups. However, the difference in dietary fat density between the intervention (31% energy as fat) and control (31% energy as fat) groups did not differ between the first phase of recruitment (intervention group 31.3% and the control group 31.9 % energy as fat) and the second phase (intervention group 30.0% and control group 33.0% energy as fat) and even tended to be greater in those recruited in the second phase (F ratio for the interaction effect=3.54; df=1,441; p=.061).

The second methodological issue was intrinsic to the intervention, in that more of the intervention group (44%) revised their answers to the dietary questionnaire than did the control group (29%). A comparison of the dietary fat density of those who did and did not revise their intakes within comparison and intervention groups found no difference (F ratio for the interaction effect=0.22; df=1,441; p=0.64). Therefore these methodological issues do not explain the difference in dietary fat density between the intervention and control groups. Similar results were seen for saturated fat.

Social status groups

Initial assessment measures of high and middle-low status groups were compared: the middle-high status group was not included for ease of comparison of the data of the other groups. The data are shown in Table 4.8 and 4.9. Although the data were adjusted for age and sex differences between status groups, comparisons may still be slightly flawed due to age and gender differences among groups as previously described, as the social status groups were not age- or sex-stratified. Cholesterol and sodium densities were highest in the middle-low status group; and natural sugar, alcohol and magnesium densities were higher in the highest status group, shown in Table 4.8.

Table 4.8 Mean nutrient densities of high social status and middle-low social status groups at the initial assessment

Nutrient density	High status group	Middle-low status group	F ratio df=1,322	Prob (a)
Energy (kJ)	8550	8580	0.18	NS
% energy from:				
Protein	16.1	16.4	1.48	NS
Fat	31.5	32.8	3.93	*
Saturated fat	11.4	12.0	3.19	NS
Monounsaturated fat	10.9	11.1	0.41	NS
Polyunsaturated fat	6.00	6.42	3.14	NS
Carbohydrate	47.9	47.8	0.03	NS
Starch	22.9	24.0	4.57	*
Refined sugars	7.54	8.42	2.43	NS
Natural sugars	15.3	13.6	7.40	**
Alcohol	3.46	1.98	10.21	**
P:S ratio	0.62	0.61	0.03	NS
Cholesterol (mg/10MJ)	247	277	7,53	**
Fibre (g/10MJ)	33.1	30.2	6.65	*
Sodium (mg/10MJ)	2820	3070	12.24	***
Potassium (mg/10MJ)	5120	4840	5.39	*
Calcium (mg/10MJ)	1190	1220	0.54	NS
Magnesium (mg/10MJ)	459	425	9.48	**
Iron (mg/10MJ)	16.6	15.9	3.95	*
Zinc (mg/10MJ)	13.2	12.9	2.16	NS
Beta-carotene (ug/10MJ)	6630	5920	5.04	*
Folate (ug/10MJ)	298	279	3.70	NS

(a) probability, * $p<0.05$; ** $p<0.01$; *** $p<0.001$; NS not significant

Table 4.9 Mean food group intake and knowledge and biological measures of high and middle-low social status groups at initial assessment

	High status group	Middle-low status group	F ratio df=1,332	Prob (b)
Food group intake serves(a)				
Meat	1.47	1.62	2.26	NS
Dairy	2.00	2.09	0.40	NS
Fruit	3.32	2.51	11.6	***
Vegetables	4.79	5.10	1.53	NS
Breads and cereals	5.45	5.46	0.00	NS
Indulgences	3.70	3.68	0.00	NS
Knowledge score (%)				
12345+ knowledge	53.1	46.9	13.6	***
Applied knowledge	55.7	53.0	3.00	NS
Biological measures				
Weight (kg) -males	76.6	79.2	1.27	NS (c)
- females	61.5	67.1	7.96	** (c)
Height (cm) -males	177	172	13.0	***
- females	163	161	5.22	*
BMI -males	24.5	26.6	11.6	***
- females	23.3	26.1	15.3	***
Plasma cholesterol -m	5.65	5.66	0.00	NS
(mmol/l) -f	5.47	5.52	0.12	NS

(a) Food groups and serve sizes derived from the 12345+ FNP
(b) probability * $p<0.05$; ** $p<0.01$; ***$p<0.001$; NS not significant
(c) for males, df=1,138; for females, df=1,183.

Total fat, complex carbohydrate, fibre, potassium, iron and beta-carotene tended to differ, but were significantly different only at the 5% significance level.

Food intakes differed between the high and middle-low status groups at baseline only in that the middle-low status group consumed less fruit than the high status group (shown in Table 4.9).

The 12345+ knowledge score was lowest in the middle-low status group, while applied knowledge score did not differ between status groups. Biological measures are shown for males and females separately as the age-sex distribution differed between the high and middle-low status groups and these measures vary strongly by age and sex. Body mass index was less and height was taller in high status males compared to middle-low status males, while in females, body mass index and body weight were also less while height tended to be taller (also shown in Table 4.9). Although these analyses were adjusted for linear relationships between age and anthropometric data, the adjustment may not have been sufficient to overcome the effect of women in the middle-low social status group having an older age profile, as was discussed in 4.3.1 and shown in Table 4.4.

Blood cholesterol level at assessment did not differ among status groups.

4.3.3 The intervention

Dietary change goals set

Within the intervention sample of 246 respondents, 15 people set no dietary change goals, as their intakes were already in line with the recommended 12345+ FNP. Although the maximum number of dietary change goals was five, some of these were composite goals which required two codes to be adequately described, hence ten dietary change codes was the maximum possible. Nearly half of the sample (47.5%) had four or five

dietary change codes, with 30.9% having between one and three codes, and 15.5% having between six and eight codes.

A range of 18 general types of dietary changes were set by the intervention group participants. These were further grouped according to the six food groups used in the 12345+ FNP, plus a further category of nutrient-based changes not specifically related to any particular food group, as shown in Table 4.10.

Seventy percent of the 246 intervention group participants set goals in relation to their bread and cereal intake; 68% set goals in relation to their intake of "indulgence" foods; 57%, in relation to their meat intake; 42%, in relation to their fruit intake; 40%, in relation to their dairy foods intake; and 37% set goals in relation to their intake of vegetables. In addition, 36% of the intervention group set dietary change goals related to the type or amount of added fat eaten, salt content of foods, meal patterns and total amount of food eaten. No changes were attempted by 6% (15) of the intervention respondents.

While most changes were in the direction of increasing intakes of fruits, vegetables, breads and cereals and reducing intake of other food groups, Table 4.10 also shows that ten intervention group participants set goals to increase their meat intake, and 21 to increase their intake of dairy foods, as their intakes were below the recommended intake levels.

Adherence to dietary change goals

Participants in the intervention group were asked to record their adherence to dietary-change goals on four occasions during the intervention period. On three of these occasions they were required to record their perceived adherence over a specific seven day period at the beginning, middle and end of the intervention. In addition, a final assessment was made at the follow-up interview of their overall perceived adherence over the three month period.

Table 4.10 Dietary change goals made by participants in the intervention group

DIETARY CHANGE GOALS (LISTED IN FOOD GROUPS)	NUMBER OF PARTICIPANTS	TOTAL FOR FOOD GROUP
Meat group changes		139
Less meat, eggs, processed meat	101	
More chicken, fish, beans, lentils	28	
More meat	10	
Dairy food changes		98
Less dairy	27	
More dairy	40	
More low fat dairy, less cheese	63	
Fruit and vegetable changes		186
More fruit	104	
More vegetables	82	
More orange, green vegetables	10	
Bread and cereal group changes		172
More breads and cereals	149	
More wholegrain varieties	23	
Indulgence group changes		166
Less indulgences	166	
Other nutrient-based changes		88
Reduce salt	18	
Reduce added fat	19	
Change type of fat	23	
Other	42	

Table 4.11 Distribution of participant-reported adherence to dietary-change goals

Food group change	0-2 days	3-4 days	5 days	6 days	7 days
	(%)	(%)	(%)	(%)	(%)
Meat group	9.2	12.8	11.1	19.0	48.0
Dairy group	8.3	10.5	10.0	14.0	57.2
Fruit and veg	9.4	19.8	21.7	16.1	33.0
Cereals	9.3	14.3	11.1	13.2	52.1
Indulgences	8.2	17.3	15.0	17.9	41.7
Other	9.1	9.4	7.3	13.3	60.1
Weighted average	9.0	14.6	13.4	16.0	47.1

Of the 231 participants who were attempting dietary change, 167 (72.3%) completed all four measures, 33 completed three measures, fourteen completed two measures and eight completed only one measure of adherence. Adherence was then averaged over all measures completed by the participant and weighted according to the number of participants making each category of change, to give a distribution of average adherence: 47.1% of participants reported that dietary goals were adhered to, on average, for 7 days out of seven; 16.0%, for 6 days; 13.4% reported adhering for 5 days; 14.6% for 3-4 days; and, 9.0% for 0-2 days out of seven. these mean figures are broken down by type of food group change in Table 4.11.

Changes to fruit and vegetable intakes appear to be less well adhered to compared to all other categories of change, while the other nutrient-based changes and dairy food group changes appear to have been adhered to somewhat better.

Summary of the data collected during the intervention and follow-up interviews

Of the 246 respondents in the intervention group, 68% had previously had a cholesterol test, 41% of these had previously tried to reduce their cholesterol level and 49% reported some family history of heart disease. Thirty percent described themselves as being on a special diet at the time of interview: 13% on a cholesterol lowering diet; 6% on a weight reduction diet; 4% on another therapeutic diet; and, 4% on general health-improving diets. Fifty-two percent stated they had a reason to change their present dietary intake: 26% to lose weight; 11% to feel better; 7% to reduce cholesterol; and, the remaining 4% for other miscellaneous reasons.

At the follow-up interview for the intervention group, attended by 223 respondents, 61% people had tried to make at least one other dietary change, apart from that specified in their dietary change goals. Of the total of 226 extra changes these people made, 22% were meat food group changes; 10% were dairy food group changes; 9% were changes to fruit intake; 6% to vegetable intake; 11% were to breads and cereal foods; 19% to indulgence foods; and an additional 7% to added fats; while 16% of these changes did not relate to any specific food group.

Fifty-six percent of those interviewed at follow-up reported that they found the dietary changes easy to make, 38% found them difficult some of the time and 7% found them mainly difficult. Most people (93%) intended to maintain the changes they had made, and 92% of these were confident of being able to do so. When asked how motivating they had found particular elements of the intervention to be, the distribution in descending order of the rating given was: receiving a dietary feedback (85% reported this gave them "a fair bit" or "a lot" of motivation); receiving a pictorial representation of the 12345+ FNP (43% reported this gave them "a fair bit" or "a lot" of motivation); receiving dietary record sheets in the post (40% reported this gave them "a fair bit" or "a lot" of motivation); having weight measured and recorded (35% reported this gave them "a fair bit" or "a lot" of motivation);

and, having a cholesterol test result (34% reported this gave them "a fair bit" or "a lot" of motivation).

Over half of the people in the intervention group (55%) reported receiving no other information or help except from the study. The most common sources of outside help reported were the media and general community awareness (18%) and family members (13%). Half of the intervention group spoke to their spouse about the program, the same number spoke to a friend, 32% spoke to their children and 17% to their parents, 24% to work colleagues, 11% to siblings, 8% to a neighbour and 3% spoke to their doctor.

At the time of the follow-up assessment, 46% of the intervention group stated that they had hoped to lose weight during the intervention period, and 52% stated that they had hoped to reduce their plasma cholesterol level.

In summary, prior to joining this intervention trial, over two thirds of participants had previously had a cholesterol test and nearly one third were on a special diet. There was a high level of dietary-change activity additional to the goals set during interview and many participants spoke to family members and friends about being in the trial. The dietary feedback was agreed to be motivational by more participants than the proportion that found other aspects of the intervention motivational. In addition to the intervention itself, participants also found that various other influences aided their dietary change activities, most especially the prominence of the issue in the general community and media.

4.3.4 Overall changes to dietary, biological and knowledge measures

This section presents the evidence relating to hypothesis 4: that specific, individualised dietary advice will result in a healthier eating pattern, which is lower in fat, saturated fat, cholesterol, refined sugar and salt, and higher in fibre and vitamin and mineral densities. The data describing changes in eating patterns and biological and knowledge measures are also presented.

Nutrient density changes

Over the intervention period, the intervention group reduced their dietary density of saturated fat and refined sugar and increased their dietary density of fibre, magnesium, iron and the ratio of polyunsaturated to saturated fats to a greater extent than did the control group, as shown in Table 4.12. The intervention group also tended to increase their intakes of polyunsaturated fat, complex carbohydrate, cholesterol, potassium, folate and zinc but these did not achieve the pre-specified significance level. Energy intake and dietary densities of protein, fat, monounsaturated fat, total carbohydrate, natural sugars, cholesterol, calcium, sodium and beta-carotene did not change over the intervention period.

Eating pattern changes

In terms of food intake changes, the intervention group tended to achieve a greater reduction in their intake of indulgence foods and an increase in their intake of bread and cereal-based foods, although these did not reach the 1% level of significance (also shown in Table 4.12). The number of serves of meat, dairy, fruit and vegetable food groups eaten did not change over the intervention period.

These six large food groups were also broken down into 14 smaller groups, to examine changes to the types of foods eaten within these groups. Although total intake of meats did not decrease in either group, the intervention group tended to slightly, but not significantly, increase their intake of chicken, fish and legumes ($F=3.06$; $df=1,444$; $p=0.081$). Change in intake of dairy foods did not differ between groups, although there was an overall trend in both intervention and control groups toward low fat diary foods and away from high fat dairy foods.

Table 4.12 Mean changes to nutrient density levels and intake of food groups over the intervention period

	Intervention group	Control group mean change	F ratio df=1,444	Prob (a)
Nutrient				
Energy (kJ)	-531	-534	0.00	NS
% energy from				
Protein	0.59	0.24	2.93	NS
Fat	-1.10	-.56	1.25	NS
Saturated fat	-1.03	-0.39	7.76	**
Monounsaturated	-0.40	-.25	0.51	NS
Polyunsaturated	0.58	0.12	4.92	*
Carbohydrate	0.64	0.39	0.24	NS
Starch	1.16	0.09	7.61	*
Refined sugar	-1.41	0.12	16.41	***
Natural sugar	0.85	0.22	2.05	NS
Alcohol	-.24	-.056	0.89	NS
P:S ratio	0.10	0.03	7.48	**
Cholesterol (mg/10MJ)	-17.6	-1.5	4.22	*
Fibre (g/10MJ)	3.2	-0.002	16.34	***
Sodium (mg/10MJ)	44	4	0.51	NS
Potassium (mg/10MJ)	184	17	4.99	*
Calcium (mg/10MJ)	13.0	-4.0	0.34	NS
Magnesium (mg/10MJ)	30.9	2.4	14.40	***
Iron (mg/10MJ)	0.79	-0.01	10.57	***
Zinc (mg/10MJ)	0.75	0.21	5.45	*
Beta-carotene (ug/10MJ)	340	-10	1.75	NS
Folate (ug/10MJ)	16.6	1.6	4.62	*
Food group (serves [b])				
Meat foods	-.033	-.027	0.01	NS
Dairy foods	-.132	-.089	0.26	NS
Fruit	-.040	-.108	0.19	NS
Vegetables	-.131	-.294	1.00	NS
Cereals	+.268	-.153	6.13	*
Indulgences	-.647	-.328	4.44	*

(a) probability: *p<0.05; NS not significant

(b) The food groups and food serve sizes are based on the 12345+ FNP

The intervention group tended to reduce, and the control group to increase their intake of fruit juice (F=4.78; df=1,444; p=.029) (Figure 4.2). The increased bread and cereal food intakes in the intervention group was mainly wholegrain varieties: intake of wholegrain bread and high fibre cereals increased by over 0.5 serves per day - most of which was wholegrain bread (F=6.56; df=1,444; p=0.011), while intake of white bread, lower fibre cereals, rice, pasta and other cereal-based foods tended to decrease slightly in both groups (Figure 4.3). The intervention group's consumption of fat spreads increased commensurately with their bread intake (F=6.34; df=1,444; p=0.012), also shown in Figure 4.3. Finally, the intervention group reduced their intake of soft drinks, cordials, and sugar added to cereals and beverages (F=8.13; df=1,444; p=0.005) (Figure 4.4). While intakes by the intervention group of other indulgence foods also appeared to decrease over the intervention period, this also occurred in the control group.

Eating pattern changes which contributed to nutrient density changes

The increase in fibre intake appeared to be mainly caused by increased intake of wholegrain breads and cereals but also from refined cereals and white bread and fruit (Figure 4.5). Increased intake of wholegrain breads and cereals also appeared to contribute to increased densities of magnesium and iron (as well as potassium, zinc, folate and complex carbohydrates, although these changed only at the 5% significance level) (data not shown).

Refined sugar density appeared to decrease mainly due to reduced intake of sweet indulgence foods (biscuits, dairy desserts, confectionery) and soft drinks, cordials and sugar added to cereals and beverages. A minor proportion of the reduction also appeared to be due to the intervention group consuming less refined sugar in the form of fruit juice drinks (which were included with the fruit juice category), as shown in Figure 4.6.

Figure 4.2 Changes within the fruit group during the intervention period

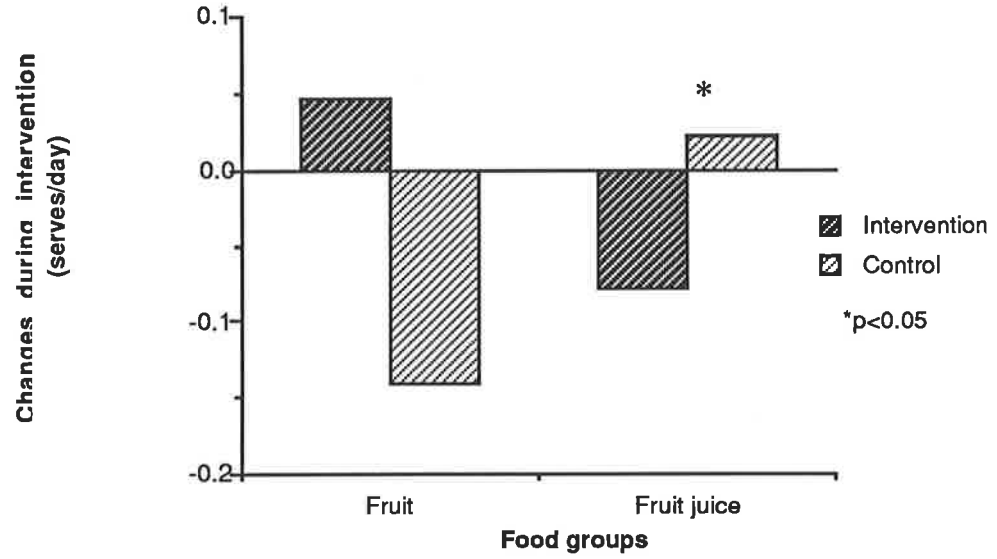


Figure 4.3 Changes within the bread and cereal group and in fat spreads during the intervention period

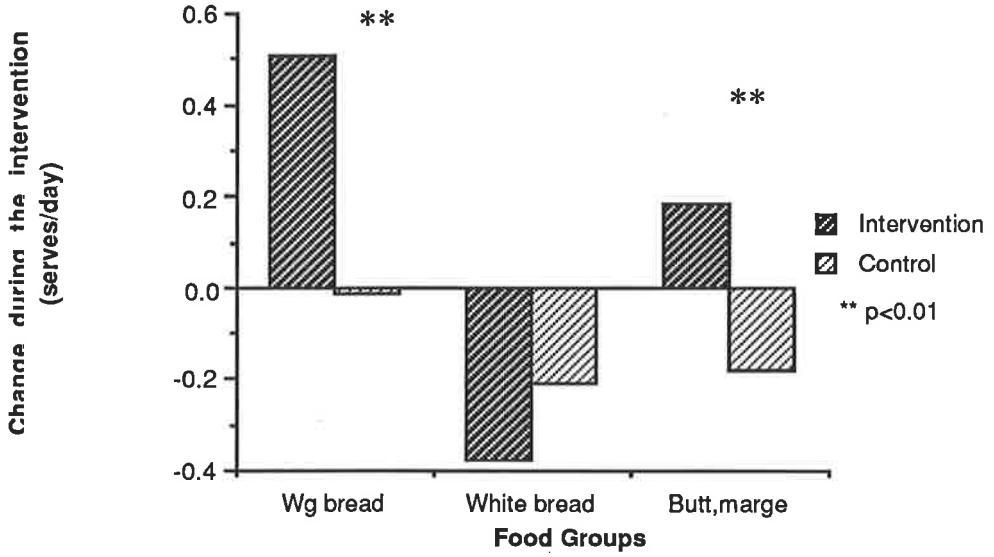


Figure 4.4 Changes within the indulgence foods group during the intervention period

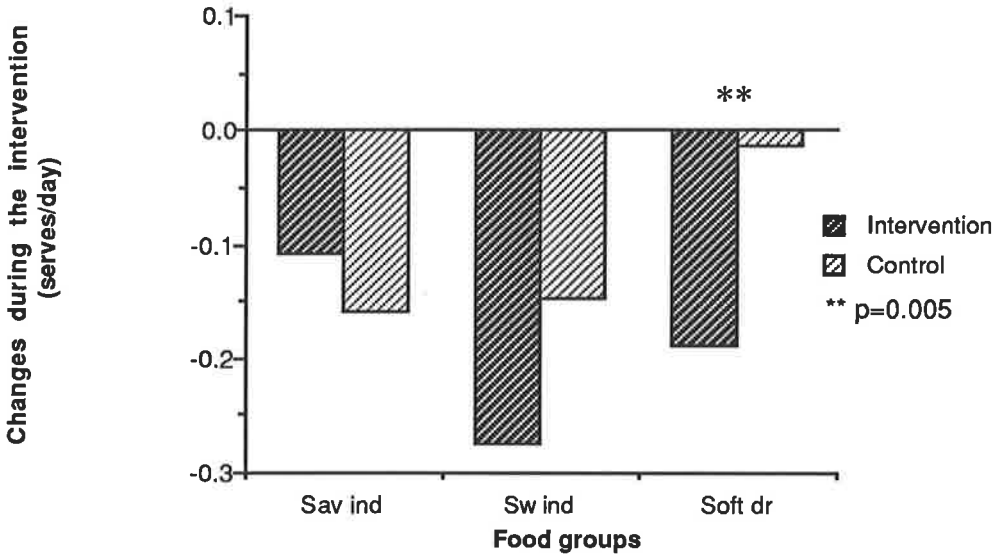


Figure 4.5 Foods contributing to fibre density changes

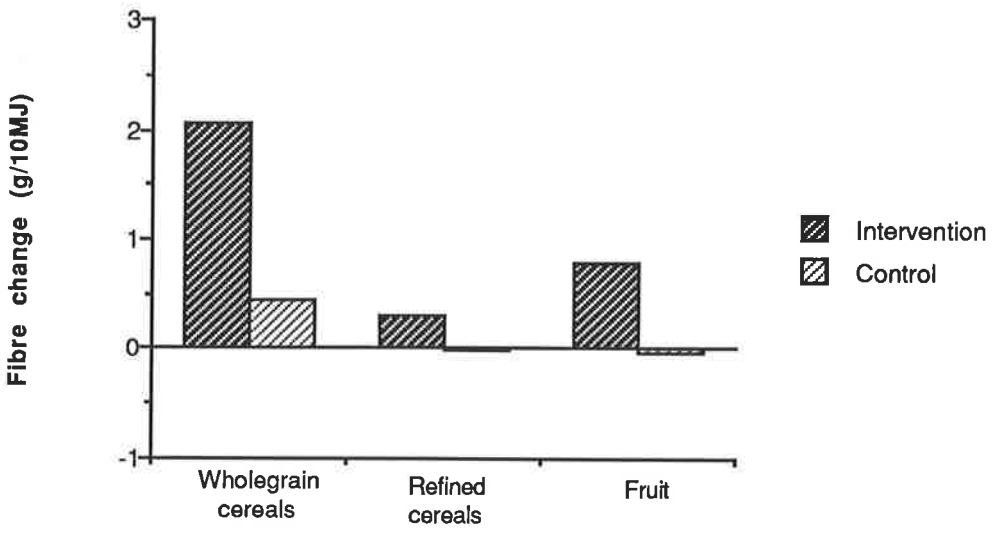


Figure 4.6 Foods contributing to refined sugar density changes

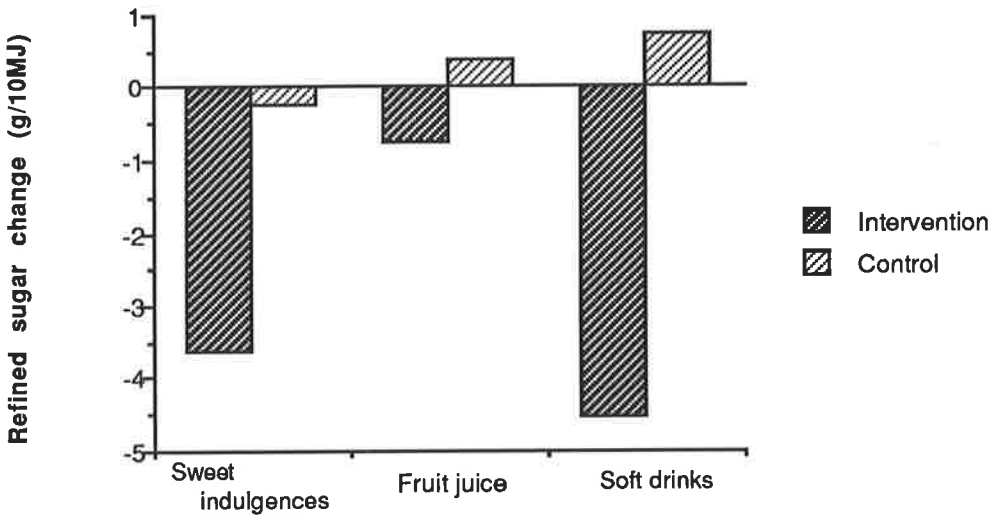
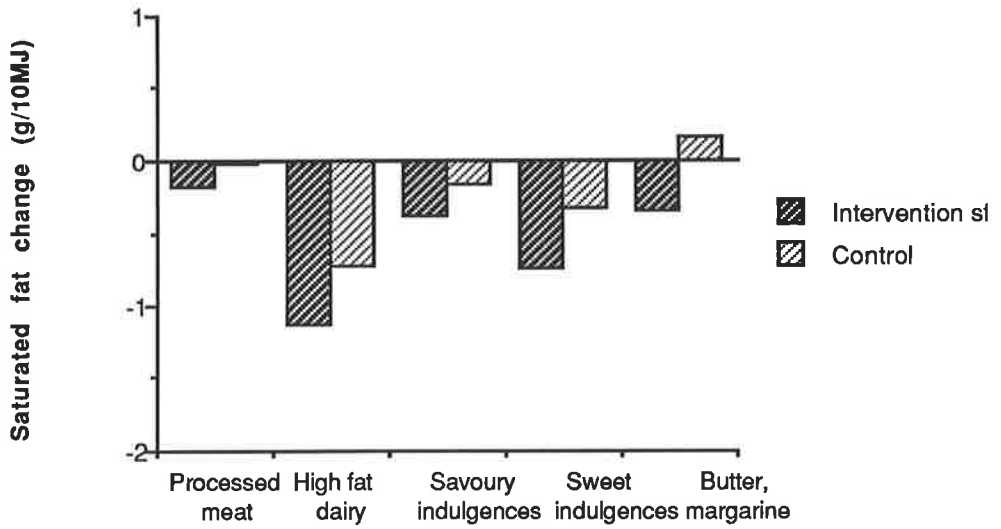


Figure 4.7 Foods contributing to saturated fat density change



Changes within the red meat and eggs category appeared to contribute to the intervention group's reduction in cholesterol density (data not shown). Changes within the butter and margarine category appeared to result in the intervention group consuming less cholesterol and saturated fat and more polyunsaturated fat. As butter and margarine intake increased in the intervention group (as was shown in Figure 4.3), they must also have changed to more frequent use of fat spreads with a higher polyunsaturated fat to saturated fat (P:S) ratio, i.e. less butter or more polyunsaturated margarine, as indicated by the reduction in saturated fat contributed by fat spreads shown in Figure 4.7. This figure also shows that changes in intakes of processed meats, high fat dairy foods, savoury indulgences and sweet indulgences also appeared to contribute towards the overall reduction in saturated fat density shown by the intervention group.

Changes in nutrition knowledge and biological measures

The intervention produced an increase in knowledge about the recommended healthy eating pattern of 8.7 percentage points more in the intervention group than in the control group, as shown in Table 4.13. The applied knowledge score which was derived from the ideal diet outlined by the participant did not change over the intervention period. Body weight, body mass index, and plasma cholesterol of the intervention group did not appear to change and did not change relative to the control group's levels, also shown in Table 4.13.

Table 4.13 Mean changes to knowledge scores and biological measures over the intervention period

	Intervention group	Control group	F ratio df=1,444	Prob [(a)]
Knowledge variable				
12345+ score (%)	+11.9	+3.2	21.1	***
Ideal score (%)	+2.8	+0.8	2.15	NS
Biological measures				
Weight (kg)	-.19	.064	1.83	NS
Body Mass Index	-.071	.026	2.05	NS
Blood cholesterol (mmol/l)	-.038	.008	0.68	NS

(a) probability: ***p<0.001; NS not significant

4.3.5 Changes to dietary, biological and knowledge measures among social status groups

This section presents the evidence relating to Hypothesis 5: that in response to dietary information and advice, higher social status groups will make more dietary changes than lower social status groups.

Nutrient density changes among social status groups

Comparison of nutrient density changes of the intervention and control participants in the three social status groups was undertaken next, to examine whether the intervention was more successful in any particular status group. No differences in response between status groups were found at the pre-specified 1% significance level.

There was a tendency for total fat intake to have been reduced most in the middle-low status group (F(i)=3.19; df=2,432; p=.042) (Figure 4.8); while polyunsaturated fat intake tended to increase most in the high status intervention group (F(i)=3.27; df=2,432; p=.039). Total carbohydrate intake

tended to increase the most in the middle-low status intervention group (F(i)=4.06; df=2,432; p=.018) (Figure 4.9), mainly due to slight relative increases in intakes of natural sugars and starch, and no reduction in refined sugar intake, which the high and middle-high status intervention groups tended to achieve (F(i)=2.57; df=2,432; p=.077).

Eating pattern changes among social status groups

There were no statistically differences among social status groups in modifications to intakes of the six food groups over the intervention period.

Eating pattern changes which contributed to nutrient density changes among social status groups

Although these nutrient density changes among social status groups did not achieve statistical significance, changes in relation to dietary fat and carbohydrate between social status groups will be briefly discussed. At follow-up, the middle-low status group appeared to consume less fat from red meat and eggs, processed meats and vegetables, but more from butter and margarine, while the high status group appeared to gain more fat from fresh meat and eggs, vegetables and savoury indulgences with a reduction in fat contributed by fat spreads. Increased consumption of fruit and bread and cereal foods and lack of reduction of soft drinks, cordials and added sugar, appeared to contribute to the increased density of dietary carbohydrate in the middle-low status group, while the high status group did appear to reduce their intake of soft drinks, cordials and added sugar but increased that of intake of wholegrain bread.

Changes in nutrition knowledge and in biological indices

Neither knowledge scores differed among social status groups over the intervention period. No differences in body weight, body mass index, or plasma cholesterol changes were observed among social status groups over the intervention period.

Figure 4.8 Fat density change among social status groups

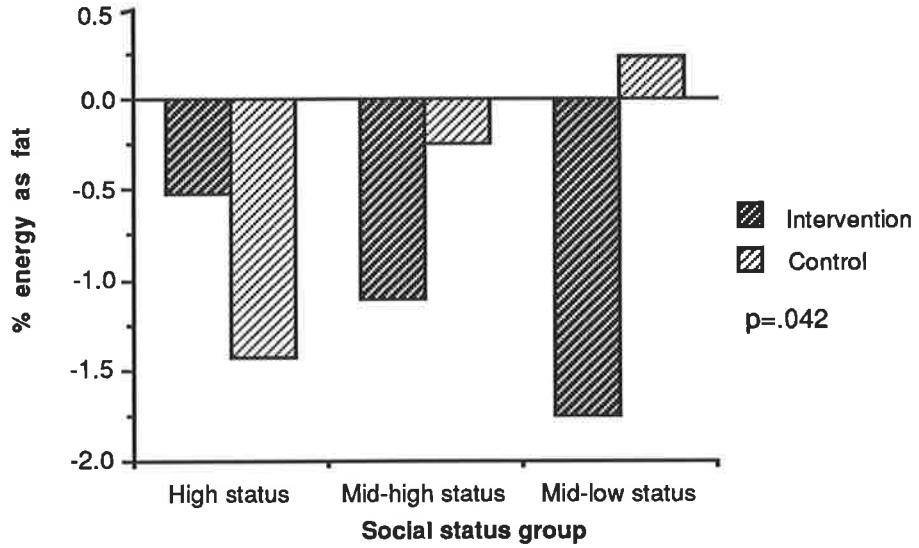
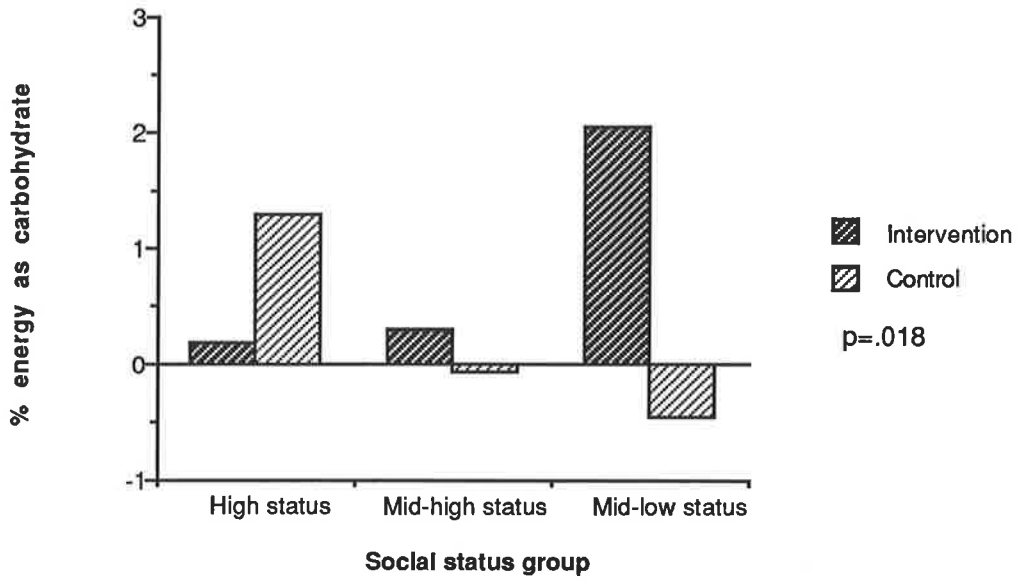


Figure 4.9 Carbohydrate density change among social status groups



4.4 Discussion

The sample recruited in the intervention trial represented a 20-30% sample within the population who were interested in receiving a blood cholesterol test and dietary advice and were able to participate in the trial. They were interested in nutrition and aware of the relationships between lifestyle and chronic diseases, had reported recent attempts at dietary behaviour change and had a healthy nutrient intake profile. The changes made were, by design, acceptable to individuals of average health and plasma cholesterol levels and the study had a low dropout rate.

4.4.1 Changes in the intervention group

Nutrient density changes

Hypothesised nutrient density changes to saturated fat, refined sugar and fibre and mineral densities did occur during this trial, albeit at modest levels, but hypothesised changes in fat, salt and vitamin densities did not occur. The magnitude of the changes which occurred are comparable to those which took place in population interventions such as the Stanford Three Community Study and the Victorian Food and Nutrition Project, but not in interventions with high risk groups such as the MRFIT study (114) or the Womens' Health Trial (116).

The Stanford Three Community study measured changes in fat and cholesterol containing foods in free living samples in two towns exposed to mass media nutrition education and persuasion. Changes in dietary cholesterol, saturated fat and polyunsaturated fat changes were calculated and compared with changes occurring in a control town. P:S ratios in both studies increased by about 0.1, although the Stanford baseline was around 0.3 compared to 0.6 for the present study. The change in saturated fat intake measured in the Stanford study was between 7 g/day and 10 g/day, while in the present study a drop of nearly 1% of energy from saturated fat represents about 80 kJ or 2

g/day saturated fat. The cholesterol reduction seen in the Stanford Study was of the order of 100-150 mg/day from 500-600 mg/day to under 400, while in the present study a smaller reduction of 18 mg/10MJ was seen; however the mean baseline level was already under 300 mg/day. Although participants in the intervention trial of the present study already had relatively healthier fat and cholesterol intakes, and these did not change as much as those in the Stanford study, the P:S ratio was of comparable magnitude although it was already a healthier level before the intervention.

Two surveys of the dietary intake of random samples of the population of the state of Victoria, Australia were carried out in 1985 and 1990. During the intervening 5 year period, a population level intervention program was carried out, which consisted of mass media and local health promotion; health education through schools, worksites and health professions; health advocacy supporting change in schools, worksites, agribusiness, supermarkets, grocery pricing, food labelling and advertising; and, community development (191). There was no control group, so changes could also have been influenced by secular trends in food intake over the five year period.

The changes seen were comparable to those in the present study; in the Victorian study fat and saturated density changes were larger, polyunsaturated fat density change was smaller and P:S ratio change was half that of the present study. Complex carbohydrate and potassium densities changed by similar amounts, while the increase in fibre density and the reduction in refined sugar density were larger in the present study, as were changes to magnesium, iron and zinc (192, 193). The changes observed in the present study over three months of personalised intervention were of a similar magnitude to those seen over five years of nutrition promotion in Victoria. Although total fat density did not change in the present study, levels were initially lower in this group compared to the level in the Victorian sample in 1985.

Food intake changes

The intervention targeted eating pattern change. Compared to the pattern recommended in the 12345+ FNP, initial assessment intakes of meats and indulgences were high, cereal intake was low and fruit and vegetables intakes were consumed at recommended levels. The food selection guide which was used as the basis for the intervention primarily targeted changes to this eating pattern. As shown in 4.3.3 (Table 4.8), most dietary change goals related to intakes of these food groups. Some dietary-change goals also related to changes within groups - increasing intake of low fat dairy foods, chicken, fish and legumes - and some related to other qualitative changes unrelated to number of food serves, such as reducing intake of salt, changing type of fat used, eating wholegrain foods instead of refined foods and using low fat rather than high fat foods. These changes were possible in the intervention trial due to the nutrient analysis that was included in the dietary feedback which indicated the foods that were contributing to high levels of dietary fat, saturated fat, cholesterol, salt and refined sugar.

Adherence reported by participants was greatest for nutrient-based changes and changes to dairy, cereal and meat food groups and poorest for changes to indulgence foods. Food intake data tended to show net change in only cereal and indulgence food groups, but there also tended to be changes within the meat group - increased consumption of chicken, fish and legumes - and within the fruit group - more fruit and less fruit juice. Participants who set goals to change their dairy food intake reported change although there was no net change, but some were attempting to increase and others to decrease their intakes, so no net change in dairy food intake should be expected. Also, the control group appeared to make similar changes to their intake of dairy foods as did the intervention group (of substituting high fat for low fat dairy foods). Participants tended to be successful in reducing their intake of indulgence foods, although they reported that they adhered less well to this goal. They were possibly more aware of their intake of indulgence foods and therefore of their relapses.

The study reported here showed no reduction in total fat intake, although this is one of the major dietary concerns in relation to chronic disease. This may have been because the mean fat density of the intervention sample was already below the level of 33% of energy contributed by fat recommended in the dietary feedback. This could have been set at the lower level of 30% recommended in the USA (1) and by some Australian health bodies if the low initial level had been known at the commencement of the study.

The intervention method may also have mitigated against a reduction in dietary fat density. An intervention study in the USA of women at high risk of breast cancer (194) examined dietary habits contributing to dietary fat intake reduction. Dietary habits related to substitution of low fat foods for high fat foods (including increased use of low fat milk and diet mayonnaise) and to avoidance of fat as a flavouring (including avoidance of fat spreads) contributed to more of the reduction in dietary fat intake than habits related to replacement of types of foods, avoidance of meat, and modifications of high fat foods by removing visible fat (including trimming fat from meat, use of low fat cooking techniques and removing the skin from chicken) (194).

The intervention methodology of the present study was mainly aimed at replacement and avoidance habits and may need to have incorporated some of the other types of changes for successful fat intake reduction. The relatively large increase in bread intake was accompanied by increased intake of fat spreads which contribution to fat intake and therefore mitigated against a reduction in fat intake. Targeting of reduction in fat intake using the 12345+ FNP may require increased use of bread without spread or low fat spreads, or use of potato, rice or pasta with low fat accompaniments.

It was suggested by Kristal and associates (194) that their food frequency questionnaire method may have been somewhat insensitive to subtle changes in use of fat such as a flavouring or trimming fat from meat. The questionnaire used in the present study was designed to detect many of the substitution and fat avoidance behaviours, although it did measure frequency

and did have a standard serve for fat spread, it did not estimate amount of fat spreads used by an individual. The data-base used also does not contain information on intra-muscular fat content of meats and therefore the methodology may not be sensitive to changes in fat content of meats. Therefore total fat intake change could have been slightly under-estimated.

Most previous reports of intervention studies have concentrated on foods contributing to fat density and energy intake changes; this study provides new information about contribution of foods to a whole range of nutrient density changes during an intervention. For example, increased intake of breads and cereals, accompanied by a rise in polyunsaturated fat spread use, appeared to contribute to increased P:S ratio, fibre, complex carbohydrate, potassium, magnesium, iron, zinc and folate densities. The beneficial effect of substituting fruit for fruit juice (including sweetened fruit juice drinks) on fibre and refined sugar densities was also demonstrated. Reduction of sweet indulgence foods appeared to contribute to reduced refined sugar and saturated fat densities.

Change in knowledge measure

Knowledge change has commonly been measured in dietary intervention trials, some meta-analyses of such trials have found that knowledge was correlated with dietary behaviour, as was found in the present study, while others have not (69, 73). The relationship of knowledge change with dietary change will be examined in Chapter 5.

Change in biological measures

Another intervention trial (195), which also intervened with normolipidaemic subjects but did aim to lower cholesterol levels, reported on change in cholesterol level. The intervention was much more intensive than was that of the present study, with 16 education or maintenance sessions over one year. Nutrition education with behaviour modification resulted in a reduction of plasma cholesterol of nine percent over a six month period,

although this reduction was not maintained over twelve months. Individuals with lower initial plasma cholesterol levels were found to be less enthusiastic about dietary change. No measure of dietary intake was performed. It is therefore not surprising that plasma cholesterol levels did not change during the present intervention trial for the following reasons: much of the sample did not have an elevated cholesterol level; the intervention method did not specifically recommend a set of dietary behaviours for the whole sample which would lead to cholesterol reduction; and, there was only one education session. Body weight would not have been expected to change for similar reasons. Measurement of cholesterol and body weight were useful in the present study for recruitment and motivation.

4.4.2 Social status variations in response to the intervention

Nutrient density differences at baseline among social status groups in the sample recruited for the intervention trial were similar to those described previously in the population study. This occurred despite the age and gender differences among social status groups, and despite the sample as a whole having heightened interest in and awareness of nutrition.

Dietary fat and carbohydrate responses to the intervention did differ slightly but non-significantly between the high and the middle-low status groups. However, fat density tended to be higher in the middle-low status groups at baseline, which may have contributed to the greater tendency of this group to reduce fat density. The greater response of the high social status group to the intervention which was hypothesised was not observed in this sample; social status category did not predict number or type of changes to nutrient density levels between groups.

Studies comparing the response among social status groups to dietary interventions have had mixed results (111). A study of the correlates of adherence to a low fat diet, which was a sub-study of the Women's Health Trial, found that women's educational status was strongly and positively correlated with adherence to a low fat diet during the trial, but not with

maintenance of the diet 12 months after the trial, in a sample of high overall social status (126).

Other studies have found no difference. Compliance with an intervention in breast cancer patients was found to differ little among educational status groups (196), and an intervention in Welsh men at high risk of heart attack also found no difference in dietary compliance among social class groups, although in this study lower status men had unhealthier dietary intakes to begin with and were less likely to achieve the study's dietary targets (197).

While the response rate was apparently lower in the suburbs of lower social status (20%) compared to those of higher status (29%), this may have been due to a higher proportion of non-English speaking residents in this area (supported by the names on the sample lists), and due to a higher level of population mobility. The Electoral Rolls used to select the sample are regularly updated, but as a certain proportion of the population moves each year, they can quickly become out of date, especially in areas of high mobility. Although no data was collected to support this impression, attempts to reach a selection of non-responders in both higher and lower status suburbs by phone indicated that a larger proportion of those in the lower status suburbs appeared not to be contactable by phone.

4.4.3 Limitations of the intervention trial

Although it did increase the efficiency of recruitment, allowing directly recruited participants to recruit friends and family members into the study did reduce the validity of the findings, by making interpretation of results less clear, in that family members may eat similar diets and replicate each others dietary changes. This clustering of participants also reduced the randomness of the allocation of participants to intervention and control conditions. However, this procedure may also have increased the generalisability of the findings, in that dietary change programs may be undertaken by couples, related people or friends who participate together. In this trial it was found that 20% of the respondent sample wished to participate with a companion.

Another methodological issue in this trial related to the control group. The control group in this study was not untouched - in order to control for seasonal and secular changes it was necessary that the control group fill out a dietary questionnaire and for the purposes of recruitment they also had a cholesterol test and had personal contact with study personnel. A second control group which was contacted only at time of follow-up would have allowed some estimation of the effect of this level of contact on dietary behaviour.

There were two main dietary differences between intervention and control groups at baseline - in dietary total and saturated fats. These differences may be caused by random differences in dietary intakes or due to differences in demographic make-up of the samples, such as the under-representation of younger males in the intervention group. Groups were not stratified according to age, sex, occupational prestige or dietary intake, although they were stratified by status of residential suburb. The analysis of differences between groups did adjust for age and sex as these differed somewhat between the intervention and control groups, however such adjustment was for linear relationships between confounders and outcome measures and may not have fully accounted for confounding. Other possible methodological causes of these differences between intervention and control groups were discussed in Section 4.3.1 and did not appear to explain them. Therefore differences at baseline were probably due to unadjusted demographic differences and randomly occurring differences.

The dietary variables in this dietary intervention trial were self-reported and therefore subject to the participants recording what they thought they should eat, rather than what they did eat. There was some bias evident in the reported reduction in energy intake, however this occurred in both intervention and control groups and in all social status groups, and was therefore controlled for. However, the intervention group may have had a stronger incentive to report a healthier diet at follow-up than did the control group. Further studies incorporating other methods of estimating compliance

(such as biological methods) which are free of this potential bias would be required to substantiate the changes found in this trial. However, reliable biological measures which reflect the range of dietary changes seen in this study are not presently available (135).

Expected plasma cholesterol change was calculated based on observed dietary changes in saturated fat, polyunsaturated fat and dietary cholesterol, and compared with observed blood cholesterol change as a measure of validity of the dietary methodology. An equation based on the work of Keys and others, and reported by Anderson and colleagues (198) calculates predicted blood cholesterol as 1.26*(2S-P)+1.5Z, where S represents saturated fats with 12, 14 and 16 carbon chains, P represents polyunsaturated fats and Z represents the square root of dietary cholesterol in mg/1000 kCals. Predicted serum cholesterol level was correlated with observed change in serum cholesterol level ($r=0.19$, $n=445$; $p<0.05$), providing some evidence of the reliability of the food frequency questionnaire in measuring changes in dietary fat components. This correlation is comparable with correlations of 0.12 and 0.13 between change in dietary saturated fat intake and change in plasma cholesterol seen in the two intervention communities of the Stanford Three Community Study. These correlations were also significant (199).

Apart from the possibility mentioned that the food frequency questionnaire might underestimate changes in fat intake (194), given the high level of repeatability of nutrient assessments of the questionnaire (153) the food frequency methodology should give good information about changes in eating pattern with minimal variance due to this high repeatability. Although the food frequency methodology is not recognised as necessarily the best method for assessing individual intake (135, 136), in this trial, as the interviewer was a dietitian, the feedbacks were checked with the participant and revising where necessary prior to giving them advice based on the dietary assessment methodology.

As discussed in Section 2.4, differences in nutrient intakes between social status groups may have been under-estimated due to the dietary

assessment methodology used if, for example, serve sizes or nutrient composition of foods differed among social status groups. However, except for the status groups making different changes to serve sizes or types of foods during the study -which may have occurred but may not have been detected - the differences that remained stable during the trial would not affect the detection of differences in response between social status groups.

CHAPTER 5

THE DIETARY INTERVENTION TRIAL: SOCIAL STATUS, KNOWLEDGE, BELIEFS AND ATTITUDES AS PREDICTORS OF SUCCESSFUL DIETARY CHANGE

5.1 Introduction

The work described in this chapter aims to examine the associations of social status and diet-related beliefs and attitudes with dietary behaviour change (Aim 2.2). It is hypothesised that the following knowledge, beliefs and attitudes will predict successful dietary change: strong positive belief that diet is a cause of disease; confidence in ability to maintain a healthy eating pattern; feeling of personal control over dietary intake; knowledge of a healthy eating pattern; and, having previously thought about how to make dietary changes and having previously made some dietary changes (Hypothesis 6). High social status is also re-examined in this context as a potential predictor of dietary change.

5.2 Method

In order to distinguish the characteristics of those who were successful in making dietary changes from those who were unsuccessful for the analysis, further analyses of the intervention group data only were carried out. The work described in this chapter is an extension of that described in Chapter 4 and investigates to a number of the same variables.

5.2.1 Determination of diet-changer groups

The measure of dietary change used here was a composite score across all food groups based on the recommendations of the 12345+ FNP (31, 187).

In detail, a "diet penalty score" was derived, based on departure from the ideal eating pattern described in the 12345+ FNP. This eating pattern is detailed in Table 5.1 over a range of energy intake levels; the ideal eating patterns for intakes greater than 10,000 kJ were extrapolated from the pattern at 10,000 kJ.

The diet penalty score was determined relative to the mean usual energy intake level calculated from the food frequency questionnaire. Usual energy intake level was calculated as the mean intake of the assessment and follow-up measures. Penalty points were given for the number of excess serves above the recommended from the meat, dairy, and indulgence food groups, or for the number of serves of meat, dairy, fruit, vegetable and cereal food groups below the recommended serve number. Extra serves of vegetables and breads and cereal foods were not penalised, extra serves of fruit were penalised only if there were 2 or more serves above the ideal. Two examples are given above in Table 5.2.

The ideal eating pattern also specifies more desirable types of meat, dairy, fruit, vegetables and cereal foods to eat within each group. Extra points were given for number of serves fewer than one serve of orange vegetables, one serve of green leafy and cruciferous vegetables, and one serve of starchy vegetables. Number of processed meat serves and number of serves of fruit juice per day greater than one serve per day were also added to the diet penalty score. One penalty point was given for eating white bread on a regular basis and one point for spreading butter on bread on a regular basis. A recommendation of 0.5 or less high fat dairy serves/day and 1.5 low fat dairy serves/day was also used in this study. If more than 0.5 serves/day of high fat dairy foods were eaten on average, between 0.5 and 1.5 points were given for the number of low fat dairy serves missed out on, of the total 2 serves recommended. For example, if 3 serves of high fat cheese were eaten, the person would score 1 point for eating one dairy serve more than the 2

Table 5.1 12345+ FNP recommended eating pattern at different energy intake levels [a] with extrapolation for intakes over 10,000 kJ.

Usual energy intake (kJ)	Recommended serves per day					
	Meats	Dairy	Fruits	Veg'bles	Cereals	Ind'nces
5500	1	2	3	4	5	0
6000	1	2	3	4	6	0
6500	1	2	3	4	6	up to 1
7000	1	2	3	4	6	up to 2
7500	1	2	3	4	7	up to 2
8000	1	2	3	4	8	up to 2
8500	1	2	3	4	9	up to 2
9000	1	2	3	4	10	up to 2
9500	1	2	3	4	11	up to 2
10000	1	2	3	4	12	up to 2
12500	1.5	2.5	4	5	15	up to 2.5
15000	1.5	3	5	6	18	up to 3
20000	2	4	6	8	24	up to 4
25000	2.5	5	7.5	10	30	up to 5

(a) (31, 187)

Table 5.2 Examples showing calculation of the diet penalty score.

	Energy intake	Meat serves	Dairy serves	Fruit serves	Veg'ble serves	Cereal serves	Ind'nce serves
Example 1							
Actual intake	8000	0.5	2	2	3	10	1
12345+ FNP		1	2	3	4	8	0-2
Penalty scores		0.5	0	1	1	0	0
							Penalty total = 2.5
Example 2							
Actual intake	15000	2	4	7	8	10	5
12345+ FNP		1.5	3	4	6	18	0-3
Penalty scores		0.5	1	2	0	8	2
							Penalty total = 13.5

recommended and would score an additional 1.5 points for not eating 1.5 serves of low fat dairy foods.

Diet penalty scores were constructed by summing all the diet penalty points described above separately for both the assessment and follow-up eating patterns. Assessment of the direction and magnitude of dietary change was therefore indicated by change in the diet penalty score: if the participant was successful with dietary change the score reduced; if he or she was unsuccessful, the score increased.

After exclusion of those with low assessment diet penalty scores (of less than six) implying eating habits needing no or little change, a good diet-changer was defined as one who changed their score by more than two points, and therefore made two or more dietary changes, while those who made less than two diet changes were defined as poor diet-changers. Thus the diet penalty score was independent of the number of dietary-change goals set.

5.2.2 Determination of diet-adherer groups

A dietary adherence score was constructed, based on the three records that the intervention subjects kept of how well they adhered to the dietary changes they were attempting, and on the final interview question about their assessment of overall compliance. As the numbers of changes attempted varied between one and five, and the number of records returned varied, adherence scores were constructed as the mean score for number of dietary change goals attempted and number of records returned, and the score was independent of number of dietary changes attempted.

Although questions were framed as number of adherence days out of seven, as the most frequent responses were five days a week or more, scores were collapsed down - by combining scores of zero, one and two, scores of three and four, and not combining scores of five, six and seven - to give a final score out of five. A successful diet-adherer was defined as one who assessed their adherence to eating pattern changes, on average, as six or seven days a week. Although the change in diet penalty score was also a self-

reported measure of dietary adherence, it measured this construct indirectly. Therefore the classification described above defined the "diet-adherer", to distinguish it from the classification based on the diet penalty score which defined the "diet-changer".

5.2.3 Belief and attitude scores

Dietary locus of control, dietary self efficacy, belief in the effect of various factors on health, belief that diet has a causal effect on various diseases, and dietary stage-of-change items were each scored on a relative scale from one to five. Separate items were later combined according to the results of factor analysis, and divided by the number of items which had been combined so they were still scored out of five.

Belief and attitude items were converted to variables by the use of factor analysis, in the same way as was done for these items in the survey study, described in Section 3.2. Factor analysis was repeated for diet and health belief scores, disease and health belief scores and dietary self efficacy scores, and calculated for the first time for the new dietary locus of control score on the data of this sample. Correlations between assessment and follow-up scores were calculated for belief and attitude scores, in order to assess their repeatability. Correlations were also calculated between the two knowledge scores, described in Section 4.2.11, in order to assess concurrence of measurement between these related, but different scores. The relationships between the diet penalty score and nutrient density levels were assessed by calculating their correlations.

The stage of change variable was derived by grouping the six categories from the questionnaire item into four groups which corresponded to precontemplation, contemplation, preparation and action stages (185, 186).

5.2.4 Other interview variables

Additional data described in Section 4.3.3 from the intervention interview and the follow-up interview with the intervention subjects were also

used to describe differences between diet-changers and diet-adherers. During the intervention interview, subjects were asked whether they had previously had a cholesterol test (scored as zero or one), how many family members were known to have had coronary heart disease (scored as the number), whether they had any reason prior to the intervention for wanting to change their diet (categorised as no reason, reason was for weight loss or cholesterol reduction, and other reasons). As outlined in Section 4.2.6, the interviewer also rated her perception of the subject's apparent confidence about making dietary changes, apparent control over dietary behaviour, apparent comprehension of dietary information given and number of questions asked during the interview (scored on a scale from one to five). These scores were recorded due to their relevance to the specific dietary-change goals made and dietary counselling received. The duration of the interview was also recorded.

At the follow-up interview, further questions were asked of the participants for the purpose of additional evaluation of their experience of the process of changing their eating pattern. Participants were asked whether they had received any support, help or information external to the study which aided dietary change (scored into categories), how many types of people they had spoken to about the dietary changes they were making (scored as number of categories of people), how easy they found dietary changes to make (scored between one and three) and how motivated they were by the pictorial representation of the ideal 12345+ eating pattern, the dietary feedback, receiving the dietary records, receiving their plasma cholesterol result, and having their weight measured and recorded (all scored between one and four). These measures were all analysed for differences between diet-changer and diet-adherer groups.

5.2.5 Statistical analyses

Analysis of variance was the analytical method for detecting differences in scores between diet changers and diet-adherers groups. Respondents with

low initial dietary scores who therefore required little change were excluded from this analysis, which excluded 29 people with initial scores of six or less, including those 15 respondents who were not attempting any dietary changes.

Analysis of variance of age and sex differences between groups was performed first, as these were potential confounders. Energy intake was also included as a covariate, as diet penalty scores were not adjusted for, or relative to energy intake. Those with larger energy intakes were found to have larger diet penalty scores and therefore had a greater potential to change their diet penalty scores.

The dependent variable, follow-up diet penalty score, was adjusted for initial diet penalty score, by including this as a covariate in the analyses. In this way, the follow-up score can be interpreted as change in diet penalty score. This method of adjustment reduces the unexplained variance (error) of the model. The same technique was used to assess change in knowledge scores, with initial knowledge scores as covariates.

Belief and attitude scores, adherence score, number of dietary changes attempted, intervention interview variables (family history of heart disease, previous cholesterol test, interviewer assessed variables and time of interview) and social status were assessed as potential predictors of ability to make dietary changes. They were also (except adherence score) assessed as potential predictors of self-assessed adherence to dietary change goals. Knowledge change was assessed for statistical association with dietary change and adherence.

Information gained during the follow-up interview was also analysed for differences between diet-changer and diet-adherer groups, in order to assess whether the individual's experience and evaluation of the study components was related to the success of the intervention. These variables cannot be construed as predictor variables as they were measured after the outcome measures and may have been influenced by the process and outcome of the intervention.

Regression modelling was performed on those predictor variables which did differ between diet-changer and diet-adherer groups. These variables were first regressed singly against final diet penalty score, with assessment diet penalty score and age as covariates. Next, all variables were fitted in the order in which they appeared in the study. First covariates were added (which were collected during the assessment period), then variables collected during the intervention interview, then variables collected during the intervention period and follow-up knowledge score (that would had an influence during the study), and finally variables from the follow-up interview. Accumulated analysis of variance was computed, which attributes variance in the dependent variable to each independent variable in the presence of the others which went before it, and therefore allows assessment of the additional contribution to explained variance in diet penalty score.

Questions about dietary stage-of-change yielded categories which were non-linear, and therefore not suitable for inclusion as predictor variables. Analysis of variance of change in mean follow-up diet penalty score with assessment score as a covariate was therefore calculated for each stage-of-change group, to investigate the number of changes made by each group. The same was done for groups according to their reason for wanting to change their diet prior to the intervention.

For the same reasons as discussed in Section 4.2.13, a significance level of 1% was used for the analyses carried out in this chapter. However, variables which were significantly associated with outcome measures at the lower significance level of 5% are also shown and were included in the regression modelling, as these may be of interest for generating hypotheses in the future.

5.3 Results

5.3.1 Description of the dietary change score

The mean assessment diet penalty score in the 220 intervention group subjects for whom follow-up data were available was 11.4 ± 5.68 (range of 2.7 to +39.4). Their mean follow-up diet penalty score was 10.0 ± 4.70 (range of 2.8 to +29.8). The mean change in diet penalty score was 1.36 ± 3.12 (range of -6.5 to +18.5). When those whose assessment diet penalty scores were 6 or less were excluded (n=29), i.e. those with little need for dietary change, the mean diet penalty score change was 1.70 ± 3.36 (range of -6.5 to +12.7, n=191).

The diet penalty score was not weighted to make one diet penalty score from one food group comparable in any way to one diet penalty score from another food group. This is illustrated in Table 5.3, which shows the contribution of dietary habits related to the 12345+ FNP food groups to the total diet penalty score. The largest contributors to both initial and follow-up diet penalty scores were intakes of breads and cereal foods, indulgence foods (including butter scores) and the four separate scores for vegetables; these together accounted for about 70% of the total initial and follow-up mean diet penalty scores. Comparison between initial and follow-up total scores also indicates that dietary improvements occurred, as the score decreased, and individual score comparisons show that reductions in the indulgence food and the bread and cereal food scores contributed most to the total reduction, as was described in Section 4.3. These scores do not relate exactly to the initial assessment serves shown in Table 4.7 for the intervention group, as the diet penalty score represents penalisation of both excess and insufficient intakes. Also the sum of the means in Table 5.3 does not equal the total (shown at the bottom of Table 5.3) as this represents the mean of sums.

Table 5.3 Mean diet penalty score associated with each category of food intake

Food grouping	Contribution to initial assessment penalty score	Contribution to follow-up penalty score
Meat	0.34	0.31
Processed meat	0.32	0.29
Dairy foods	0.08	0.21
High fat dairy foods	0.18	0.12
Fruit	0.13	0.06
Fruit juice	0.10	0.04
Vegetables	0.43	0.43
Orange vegetables	0.43	0.40
Leafy green and brassica	0.38	0.42
Starchy vegetables	0.38	0.41
Breads and cereal	3.71	3.48
White bread	0.42	0.33
Indulgences	1.99	1.36
Butter	0.28	0.20
Total	11.4	10.0

Initial diet penalty score was positively correlated with initial estimations of energy intake (r=0.67), refined sugar density (r=0.44), saturated fat density (r=0.35), mono-unsaturated fat density (r=0.25), total fat density (r=0.24), and alcohol density (r=0.15), and inversely correlated with protein (r=-.32), P:S ratio (r=-.30), polyunsaturated fat density (r=-.15), carbohydrate density (r=-.18), complex carbohydrate density (r=-.42), natural sugar density (r=-.34), fibre density (r=-.59), potassium density (r=-.50), calcium density (r=-.21), magnesium density (r=-.55), iron density (r=-.51), zinc density (r=-.35), beta-carotene density (r=-.53) and folate density (r=-.53). All correlations coefficients given were significant at the 5% significance level.

As nutrient densities are correlated with each other, the above correlation coefficients do not necessarily imply independent relationships,

however they do indicate that the diet penalty score is penalising the "unhealthy" nutrients: fat, saturated fat, alcohol and refined sugar densities, and is not penalising the "healthy" nutrients: carbohydrate, fibre, polyunsaturated fat and vitamins and mineral densities, as intended. Mono-unsaturated fat density has a neutral dietary role in that it is not specified in the dietary recommendations and was positively correlated with diet penalty score (as were total and saturated fat densities), while protein intake should not be too high or too low, and can therefore play a positive or negative role in the diet depending on intake level; protein density was negatively correlated with diet penalty score in this study.

Energy intake was positively correlated with diet penalty score, probably because higher energy intakes have more potential to receive higher scores (see Table 5.1). For example, someone on an intake of 10,000 kJ who is recommended to eat 12 carbohydrate serves has more potential to be penalised than someone on 5500 kJ, who is only recommended to eat 5 carbohydrate serves a day. To illustrate this correlation, those with energy intakes in the range 4000-6000 kJ had a mean initial diet penalty score of 8.31$\pm$2.6; those in the range 6000-8000 kJ, 8.49$\pm$3.2; those in the range 8000-10 000 kJ, 11.05$\pm$3.3; and, those in the range 10,000-20,000, 16.43$\pm$7.1. Therefore energy intake was included as a covariate in analyses involving diet penalty scores.

5.3.2 Knowledge, belief and attitude scores

Factor analysis of the means of the six initial and follow-up disease belief questions and confidence scores yielded the same factors as were found in the survey study. Factor analysis of the means of the seven initial and follow-up health belief questions yielded slightly different factors; for the sake of continuity, it was decided to combine these into the same three factors initially yielded.

Repeatability of belief and attitude scores were generally moderate to high, ranging from 0.47 to 0.71. Analysis of belief and attitude score changes

in intervention and control groups also showed that they did not change as a result of the intervention. It was concluded that these types of cognitive measures were stable during the intervention. Therefore initial assessment and follow-up scores were averaged for the analyses in Chapter 5 to give a single measure of the construct.

Factor analysis performed on the scores of the four locus of control questions gave two factors. The first factor was derived from one question, while the second factor was derived from three questions. However, this negates the validity of the scores, as they were designed to measure the same construct. The second locus of control factor was not repeatable, with a correlation coefficient of only 0.34, while the first locus of control factor had a correlation coefficient of 1.00. Hence the second factor was dropped as it was found to be an unreliable measure of unknown meaning, and the first factor only was included in subsequent analyses.

The two knowledge scores - the 12345+ knowledge score and the applied knowledge score - were only weakly correlated with each other (initial scores $r=0.14$, $p<0.05$; follow-up scores $r=0.27$, $p<0.01$), showing they are measuring different aspects of knowledge, as expected.

5.3.3 Knowledge, beliefs and attitudes in relation to success with dietary change and reported dietary adherence.

Knowledge, belief and attitude variables and variables collected during interviews which differed between good diet-changers and poor diet-changers are shown in Table 5.4. As shown, good diet-changers tended to be younger than poor diet-changers, had higher initial diet penalty scores (indicating they had more scope to change) but had slightly lower energy intakes. These confounding variables were included as covariates in further analyses; although age did not differ significantly between diet-changer groups, it was included as a covariate to adjust for any possible confounding which may still have occurred. There were no sex or social status group differences between good diet-changers and poor diet-changers.

Table 5.4 shows that follow-up knowledge scores increased by five to six percentage points more in good-diet changers than poor diet-changers, although only the applied score differed significantly ($p<0.01$) between groups. Mean adherence score and predicted confidence in ability to make dietary changes were higher in good diet-changers. All other belief and interview variables analysed did not differ between good and poor diet-changers. The good diet-changers reduced their diet penalty score on average by 4.4 (from 14.0 to 9.6), while the poor diet-changers increased their score on average by 1.3 (from 10.8 to 11.5), although these changes may incorporate some regression to the mean.

While belief in the health effects of diet, smoking and alcohol, and belief in the causal effect of diet on coronary heart disease were associated with initial diet penalty score ($p<0.01$), indicating association between these variables at initial assessment, they were not predictive of dietary change. Some variables differed slightly but failed to reach the 1% level of statistical significance: motivation due to cholesterol test result was reported in retrospect to be slightly higher by the good diet-changers; and, belief that diet has a causative role in the development of heart disease was also slightly higher in good diet-changers.

Differences between adherence groups are shown in Table 5.5. Those who reported greater adherence (defined as average reported adherence of 6 or 7 days a week) to dietary change goals were older than those who reported less adherence, but sex and social status profiles did not differ between adherence groups, as shown. Initial diet penalty score and energy intake did not differ between good diet-adherers and poor diet-adherers, so age was the only confounding variable included as a covariate in subsequent analyses.

Age was the only predictor variable which differentiated between diet-adherer groups at the 1% significance level. The good diet-adherers reported in retrospect that they had found the changes easier to make than the poor diet-adherers (see Table 5.5). Interviewer-assessed confidence about making

Table 5.4 Knowledge, belief, attitude and follow-up interview variables which differed between diet-changer groups.

	Mean scores				
	Good diet-changers (n=88)	Poor diet-changers (n=103)	df	F ratio	Prob (a)
Covariates:					
Age (years)	47.3	51.2	1,187	2.45	
Initial diet penalty score	13.8	11.1	1,187	29.2	***
Energy intake	8988	9086	1,187	13.0	***
Predictor variables:					
Belief in diet-heart disease (b)	4.64	4.50	1,183	4.19	*
Follow-up 12345+ knowledge (%)(c)	68.1	61.8	1,182	3.70	p=.056
Follow-up applied knowledge (%)(c)	59.3	54.1	1,171	7.87	**
Adherence score(b)	3.94	3.68	1,172	7.19	**
Interviewer-assessed confidence (b)	3.97	3.56	1,172	8.41	**
Interview variables:					
Motivation due to cholesterol test (d)	2.14	1.80	1,177	5.98	*

(a) probability: *p<0.05; **p<0.01; ***p<0.001
(b) Scored out of 5
(c) Relevant initial knowledge score also included as covariate
(d) Scored out of 4

Table 5.5 Knowledge, belief, attitude and follow-up interview variables which differed between diet-adherers

	Mean score				
	Good diet-adherers (n=90)	Poor diet-adherers (n=111)	df	F ratio	Prob [a]
Covariates:					
Age (years)	54.7	44.2	1,199	23.9	***
Predictor variable:					
Interviewer-assessed confidence [b]	3.97	3.70	1,193	4.35	*
Interview variables:					
Perceived ease of change [c]	2.73	2.32	1,194	20.1	***
Motivation of dietary records [d]	2.02	2.38	1,171	4.48	*
Outcome variable:					
Follow-up diet penalty score [e]	9.34	10.45	1,197	7.25	**

(a) probability: * $p<0.05$; ** $p<0.01$; *** $p<0.001$
(b) Scored out of 5
(c) Scored out of 3
(d) Scored out of 4
(e) Initial diet penalty score also included as covariate, as well as age

dietary change (as predicted by the interviewer) tended to be slightly higher in the good adherers than the poor diet-adherers. The motivation that receiving the diet record sheets provided the subject was scored from 1 (no motivation) through to 4 (a lot of motivation), and good diet-adherers on average reported only 'a bit' of motivation from receiving the diet record sheets, with the poor diet-adherers tending to receive slightly more motivation.

As a measure of the consistency of self-reported adherence scores, follow-up diet penalty score (adjusted for initial diet penalty score) was lower in the good diet-adherers than poor diet-adherers, indicating that this measure of self-reported dietary adherence gave a consistent indication of adherence with the other self-reported measure of adherence gained from the change in responses to the food frequency questionnaire (see bottom column of Table 5.5). The question regarding the subject's perception of how easy dietary change was for them was predictive of adherence score and this may be a good proxy measure of adherence to dietary goals (also shown in Table 5.5).

Multivariate linear regression modelling was performed in order to assess the independent predictive effects of study variables on success with dietary change and is shown in Table 5.6. The variables which had been found to differ between diet-changer groups or diet-adherer groups were regressed against follow-up diet penalty score, with age, initial diet penalty score and energy intake as covariates. Age was again included as a covariate due to its association with other variables in the model, and its tendency to be associated with dietary change. Variables were added into the model in the order in which they were measured in the study. Due to missing values for some variables, the sample size was reduced to 158 for this analysis.

The accumulated model, which indicates the variance accounted for by each variable in the presence of those added in before it, is shown in Table 5.6. The only variable which predicted diet change at the 1% significance level was the interviewer-assessed confidence score.

The variance explained by the covariates was 62.1%: initial score (57.1%) and also energy intake (5.5%) were the strongest predictors of follow-up diet penalty score. The predictor variables accounted for an additional 6.6% of the variance in diet penalty score change including: initial 12345 knowledge score (1.0%), initial applied knowledge score (0.7%), predicted confidence (2.1%), adherence (1.0%), follow-up 12345 knowledge score (0.7%) and follow-up applied knowledge score (1.1%).

Table 5.6 Knowledge, belief and attitude variables as predictors of follow-up diet penalty score.

	ß (a)	df	F ratio	Prob (b)
Covariates:				
Initial diet penalty score	0.681	1,157	211.1	***
Age (years)	0.024	1,156	3.05	p=0.06
Energy intake (log(e) kJ)	5.47	1,155	19.5	***
Initial 12345+ knowledge score (%)	-.030	1,154	5.18	*
Initial applied knowledge score (%)	-.030	1,153	3.90	*
Predictor variables - intervention				
Predicted confidence (c)	-.734	1,152	10.2	***
Predictor variables - process				
Adherence (c)	-.704	1,148	5.50	*
Followup 12345+ knowledge score (%)	-.021	1,148	4.68	*
Followup applied knowledge score (%)	-.041	1,148	5.86	*

(a) regression co-efficient showing linear association with follow-up diet penalty score, constant=2.22
(b) probability: * p<0.05; ** p<0.01; *** p<0.001
(c) scored out of 5

Calculation of the reduction in variance in final diet penalty score associated with addition of both knowledge scores together into the regression equation indicated that, although the two measures of change in nutrition knowledge were not independently associated with dietary change, together they were significantly associated (F ratio=5.35; df=2, 149; p<0.01).

Table 5.7 Change in diet penalty score among 'stage-of-change' groups

Stage-of-change group	n	Mean initial diet penalty score	Mean follow-up diet penalty score	Adjusted mean follow-up diet penalty score
Pre-contemplation	10	14.4	12.6	10.5
Contemplation	39	15.3	12.5	10.0
Preparation	92	10.2	9.0	9.8
Action	86	10.6	9.7	10.2
F ratio		9.98	6.60	0.39
df		3,216	3,216	3,214
p value		<0.001	<0.001	0.76

Table 5.7 shows dietary change in 4 groups defined according to how they answered a question relating to 'stage-of-change', a concept which should predict readiness for behaviour change. Theoretically, the first group, in the precontemplation stage, would not be thinking about behaviour change, and would be unlikely to make any effort to change, however there were only ten participants classified into this group. The next group, in the contemplation stage, would have thought about changing their intake, but still be weighing up the costs and benefits. The other two groups, in the preparation and action stages, would already be changing their behaviour and should be most likely to take up suggestions. In this study, those in the precontemplation and contemplation stages appeared to have the highest initial assessment and follow-up diet penalty scores, but the follow-up diet penalty scores were not statistically significantly different, when adjusted for initial score.follow-up diet penalty scores, but the follow-up diet penalty scores were not statistically significantly different, when adjusted for initial score.

A variable was derived from the question about whether the participants in the intervention group had any reason to change their dietary behaviour prior to the intervention. This variable was used to categorise participants into those who wanted to change their diet to alter their weight or cholesterol level, those with some other reason, and those who stated that they had no reason to change their diet prior to the intervention. No differences in degree of change in diet penalty score were found among these three groups ($F=0.15$; $df=2,215$; $p=0.86$).

5.4 Discussion

The study reported in this chapter provided information about personal determinants of dietary change in an intervention trial from which inference about cause and effect can be made; many studies of personal determinants of behaviour change have been cross-sectional studies using a retrospective measure of change. The inclusion of social status as a potential predictor of dietary change was also important, as it is a characteristic which may potentiate or inhibit dietary behaviour change. Four sets of analyses were reported in this chapter: comparing beliefs, attitudes and social status of good and poor diet-changers and also of good and poor diet-adherers; multivariate modelling of all of these variables; and, a comparison of diet penalty change scores of people in differing stages of change.

Dietary adherence can be measured in different ways, including measurement of food intake by food records, food frequency questionnaire or dietary recall methods; nutritionist's subjective rating of dietary change by participants; measurement of biomedical indices specific to dietary changes targeted such as blood cholesterol or serum nutrient concentration; and, self-reported adherence (72). The present study used two measures of dietary adherence or dietary change: one was a self-assessed measure of adherence to

specific dietary goals at the time of performing the behaviour; the other was derived from pre-test and post-test retrospective self-reports of usual dietary behaviour over the preceding three month period, which were converted to a score of dietary change defined according to the principles underlying the design of the nutrition education instrument used in the intervention. The measure of self-reported adherence was used to define good and poor "diet-adherers", while dietary change measured by the food frequency questionnaire was used to define good and poor "diet-changers". Change in body weight and plasma cholesterol levels were also measured, but these could not be used as measures of adherence as they were not specifically related to the dietary changes targeted.

The number of self-reported adherence days was predictive of dietary change measured by change in diet penalty score. Although both measures were self-reported and were reporting somewhat different outcomes, they do provide some evidence of consistency between the two measures.

There were differences in the variables which predicted dietary adherence and dietary change. Age alone predicted adherence to dietary goals, while dietary change was predicted by change in applied knowledge score, adherence score and interviewer-assessed confidence score. The intervention included instructional, motivational and behavioural techniques, and the adherence score can be seen as a measure of adherence to behaviour change goals, knowledge change as a cognitive response, while interviewer-assessed confidence reflected some other component. In the regression model, interviewer-assessed confidence score and both knowledge scores together were associated with dietary change, while adherence score was not independently associated.

Put another way, change in knowledge was associated with dietary change, but was not associated with adherence score. This suggests that those who adhered to the dietary change goals they had set did not have improved nutrition knowledge, as did those who made overall dietary changes in line with the tenets of the food selection guide used as the instructional tool.

However, causality between knowledge change and behaviour change could not be established in this trial as they were measured simultaneously. In the present study, different intervention methodologies were not compared, but the different methodologies used may possibly have had additive effects in bringing about behaviour changes. This was found in a school intervention in which self-monitoring and health education produced an effect greater than did health education alone, although the main changes were cognitive (120).

While a questionnaire-derived measure of general dietary self-efficacy was not related to dietary adherence or change, the interviewer-assessed confidence score was. This assessment was made directly after dietary goals had been agreed upon, hence its predictive potency may have been conferred by its specificity to the proposed dietary changes agreed to. The participant-reported self efficacy questions were descriptive of specific situations in which dietary adherence might be difficult, but not of specific dietary changes related to the goals which they had set. In future studies participants could be asked to assess their own confidence about attempting specific dietary change goals.

Self efficacy has been shown to increase during a weight loss program, and change in self-efficacy was correlated with weight change, in the study from which the scale used in the present study was adapted (93). However, in the present study, self efficacy when joining the study was hypothesised to predict change, rather than to change itself, on the basis that participants with a high level of confidence that they can make dietary change are more likely to attempt a larger number of changes, and to be successful making them.

Locus of control was originally formulated as a general construct, and then specified in relation to health behaviours (98). However, this health-specific scale was not found to predict health-related behaviours in many studies and it was suggested that scales specific to various behaviours be formulated (98). As no validated scale was available, questions from a weight-loss locus of control scale were adapted for the present study (100), although in that study the scale was not found to correlate with weight loss but was found to correlate with adherence to the full duration of the weight loss

program. While the two factor scores in the present study were not internally consistent and it was decided not to use them, the single question which was used has high face validity ("whether I eat healthy food or not is entirely my decision"). This question did not distinguish diet-changers or diet-adherer groups.

Participants at different stages of dietary change did not act as hypothesised by the stage-of-change model (103), as there were no differences in number of changes made among groups. This implies that the sample as a whole may have been equally motivated to make changes, most people may have taken some steps to change and thought about the benefits of dietary change and how to overcome barriers, or that the intervention methodology facilitated dietary change regardless of readiness to change. As most of the participants fell into the preparation and action stages, and few were in precontemplation or contemplation stages, the former explanation is likely, although this study provides no direct evidence to support either proposition.

Little work has been done applying stage-of-change theory to dietary behaviour change (103); much of the research to date has been on smoking behaviour (101). Diet and smoking behaviour are different in that smoking is a single discrete behaviour, while healthy dietary behaviour can be defined according to many parameters (low fat diet, high fibre diet, diet for growing children, etc) and as many discrete behaviours (e.g. using fat in cooking, trimming the fat from meat, using high fibre bread, eating three pieces of fruit daily etc). Stage-of-change theory may work best when applied to such single behaviours or groups of defined behaviours.

Several of the beliefs and attitudes measured in the intervention study were found to be associated with dietary fat and fibre densities in the cross-sectional survey study reported in Chapter 3, implying that they might predict dietary change. Belief measures derived from the Health Belief Model were also found to differ between diet-changers and non-changers in a study using a retrospective report of dietary change (80). In the intervention trial reported

here only belief that diet can cause heart disease tended to differ between good and poor diet-changers; other health-related beliefs did not.

Health belief, locus of control and stage-of-change constructs may have lacked predictive power in this study due to the high level of belief in the whole sample that diet and health are important, as was discussed in Section 4.3.1. It seems that these constructs may have predicted participation in the study, rather than behaviour during the study. Social status may also have predicted participation in the study. Diet-related health beliefs, health locus of control and knowledge about diet and heart disease were found to predict study participation in a comparison of people who did and did not join a dietary intervention program for the prevention of heart disease (200), while social status and self-motivation, but not confidence, were associated with attendance at an 18 session health promotion program (201). In a less motivated sample, beliefs, locus of control and stage-of-change may have predicted dietary behaviour change.

At the follow-up interview, good diet-changers rated the motivation they had received from measurement of their cholesterol level higher than did poor diet-changers. However, when participants were asked whether they had any reason for wanting to change their intake at the beginning of the intervention interview, those who mentioned having any reason, and those who mentioned weight or cholesterol reduction as a reason, had similar dietary change and adherence scores as those who had no reason to change their eating pattern. It therefore seems likely that those who did feel they had changed their eating pattern may have also felt they should have reduced their weight or cholesterol level.

In the present study, social status and gender did not differ between good and poor diet-adherers or diet-changers. Age did not differ between diet-changers, but good diet-adherers were 10 years older on average than poor diet-adherers. The results of Section 4.3.5 suggested that social status would not predict dietary change, as there were no major differences in the responses of high and middle-low status groups. The analysis reported in this chapter

confirms that the amount of change did not differ between status groups. This finding and others discussed in Section 1.6, that those of lower social status comply with dietary intervention equally to those of higher social status, provide evidence supporting the model of adherence of McCann and colleagues (72). It is proposed in their model that the influence of social factors on adherence is interdependent with the influences of other factors including personal attributes, health care provision, social network and the food choice environment (72). Therefore social status may not be an inhibitory factor if other areas of influence, including confidence, information, access and family and social environments, are supportive.

As hypothesised, knowledge change was associated with, and interviewer-assessed confidence was predictive of dietary change. But social status, dietary locus of control, general self efficacy and dietary stage-of-change were not predictive. There were, however, some problems with the measurement of the locus of control construct, also formulation of the stage-of-change may have been improved with pre-testing. Health-related beliefs, locus of control and the stage-of-change construct appear to have predicted participation in the study rather than performance during the study.

The ability of this study to discover predictive or explanatory relationships between knowledge, beliefs and attitudes and dietary behaviour change may have been limited by the general nature of the measures of knowledge, beliefs and attitudes, the complex nature of the dietary intervention and the gross, summary nature of the behaviour change measure. The design of the study, which included some clustering of participants, also constrained interpretation of the study findings, as was discussed in Section 4.4.

CHAPTER 6

DISCUSSION

6.1 Future research directions

From the research reported and the literature reviewed in this thesis, three main areas for future research are suggested. The first involves developing predictors and definitions of dietary behaviour; the second involves furthering knowledge about effective nutrition intervention; and, the third involves measurement issues including that of assessing food intake in different social status groups.

6.1.1 Predictors and definitions of dietary behaviour

Research into cognitive predictors of dietary behaviour has generally found low levels of prediction (73), possibly due to the complexity of dietary behaviour. Other researchers have suggested that affective influences may be more salient - related to affective attitudes such as feelings about food (202), taste preferences and food acceptability (73). However, these have been found to be difficult to measure (73, 202). There are many ways of defining dietary behaviour (73) and the level of prediction possible appears to be dependent on the definition used. While cognitive factors have been shown to predict behaviours which are closely related to them quite well, as discussed in Sections 1.5 and 3.4, the large number of dietary behaviours that may be involved in quite a simple nutrition intervention means that more general predictors of dietary change are necessary to aid understanding in this area.

In the work described here, subjects were asked about how important they thought "a healthy diet" or "eating the wrong foods" were for health. The subjects' responses to these questions were associated with the density of fat

and fibre in their diet in the survey study, but were not predictive of behaviour change in the intervention trial. However, change in belief about specific dietary behaviours, such as the optimal number of various food serves per day was associated with behaviour change. Also, reported adherence to specific dietary change goals predicted overall behaviour change. These results appear to indicate that measures of beliefs and attitudes may be more likely to predict behaviour change if they refer to the change targeted.

In the survey study reported here, a variable that was relatively strongly associated with dietary intake was the variable concerning the importance given to health relative to freshness, tastiness, cost and convenience as considerations when making food choices. Bayton, described in (73), suggested that seven categories of attitude and belief can be used to determine food choices (nutrition, economic, sensory-aesthetic, personableness, appropriateness, convenience and health apprehensions). This framework may provide a context for understanding determinants of food choice behaviour and may therefore provide a useful research direction.

In the intervention trial reported here, an interviewer-assessed rating of participant's confidence about making specific dietary changes was predictive of change. This was a standard measure, in that it was a rating in response to a standard question, but it does not have proven reliability between different observers. However, it may be useful in future research. This finding also suggests that asking participants to rate their own confidence about immediate, prospective and specific dietary changes may be a useful predictor of these changes in future intervention studies.

Change in the scores of knowledge-related variables also tended to be associated with dietary change in the intervention trial. Although these changes could have been caused by rather than predictive of behaviour change (as discussed in Section 5.4), they did provided an index of increased knowledge or awareness of the general message of the 12345+ FNP and an index of increased belief that dietary behaviours specified by the 12345+ FNP were part of a healthy eating plan. The usefulness of these measures, for future

research studies considering these factors, was due to their close relationship with the food selection guide used and to the different aspects of nutrition knowledge that they measured.

Other directions for future research into relationships between cognitive factors and dietary behaviours which arise from the studies reported here and general considerations in the literature include the following. Firstly, consideration should explicitly be given to balancing the need for cognitive measures related to specific dietary behaviours (which increases prediction and reduces generalisability) against the need for cognitive measures related to more general dietary pattern (which decreases prediction and increases generalisability). Secondly, the specificity of these cognitive factors to dietary behaviours should be balanced against maintenance of overall construct validity, for example, does a dietary locus of control score relate to the general locus of control construct? While the items used in these studies were based on validated items where possible, they were not retested for these aspects of validity. Investigation to ensure that they adequately represent the domains under examination (content validity) and that they represent the constructs under examination at all (construct validity) (73) would be recommended before use in studies based on the models from which these variables were derived. Thirdly, studies investigating relationships between cognitive variables and reported dietary behaviour should examine whether the effects of social norms bias the conclusions reached (203, 204).

Fourthly, as was shown in the survey study reported in this thesis, behaviours related to dietary fat intake may be predicted by different factors than those predicting dietary fibre intake, which may be different again from those predicting intake of other nutrients (although only to the extent that these nutrient intake levels are independent). Further research in this area is needed to elucidate what the sets of influence are and how they relate to sets of dietary behaviours (or nutrient outcomes).

In light of the above, more research into the relationships between dietary behaviours and nutrient intake levels is warranted. If the dietary

behaviours that are most associated with intakes of specific nutrients could be identified, perhaps in groups of people (according to age, sex, social status, ethnicity) then personal predictors could be examined in relation to these behaviours. This could also lead to shortened food frequency lists for specific nutrients or as an index of some aspect of healthy eating, such as those previously developed (205, 150). For example, if there were five behaviours that predicted fat intake quite well in young males, then they could be questioned about their frequency of performing these behaviours and potential predictors of these same behaviours. Such an approach would be valuable in understanding dietary change.

In measuring sets of dietary behaviours, these should be closely related to nutrient outcomes, which are the basis for nutrition promotion and disease prevention. For example, it has been reported that women tended to have higher dietary fat and salt density levels than men despite having a number of healthier dietary habits (155), such as lower usage of discretionary salt and more dietary habits associated with usage of low fat foods. This anomaly occurred due to their relatively larger intake of sweet indulgence foods and full-fat dairy products such as pastries, confectionery, and cheese (155). In the survey study reported here, higher social status groups had lower prevalence levels of fat-related dietary habits, including use of low fat milk and grilling rather than frying, but differed little in dietary fat density levels, due to some compensatory behaviours such as greater use of cheese and due to similar intake levels of several high fat or high sugar foods (cakes, biscuits, jams, lollies, sweetened drinks, fat spreads, icecream and other milk-based desserts as well as meat and chicken).

In identifying sets of dietary behaviours as markers for nutrient intake levels for the purposes of nutrition intervention, these would be useful if related to the parameters of the intervention, for example the 12345+ FNP in the intervention trial reported here. However, methods of grouping foods in food selection guides should also be related to consumers' notions of food classifications. This issue is discussed in detail by Axelson and Brinberg (73).

Two ways of defining behaviour change for the purpose of investigating predictors of such change arise from the work of this thesis. The first involves overall dietary behaviour. In this case, dietary behaviour could be defined according to a pattern of overall intake, that is, it could be worded according to a description of a recommended healthy eating pattern, such as the 12345+ FNP. The second involves identification of predictors of specific nutrient intakes. In this case, questions about the prospects of making changes could be worded in terms of a set of dietary behaviours known to be related to intake of this nutrient.

Questions about the prospects of making changes could then be related to defined dietary patterns, rather than to such general phrases as 'eating a healthy diet' or even 'a low fat, high fibre diet'. Much may be gained by taking time to specify that consumption of a certain number of serves of meat, dairy, fruit, vegetables, cereals, indulgences and even the types of foods chosen within these groups, is what is meant by a healthy diet. In this manner the complexity of dietary behaviour could be acknowledged and dealt with rather than being oversimplified.

Questions about diet- and health-related beliefs, attitudes, stage-of-change and other potential personal predictors of dietary behaviour could therefore be framed in terms of defined behaviour patterns. This strategy may be time consuming, but research study participants could perhaps be asked to read information at home. Behavioural research may have been more successful in predicting smoking cessation, possibly due to the more easily defined nature of smoking behaviour - one either smokes or one does not smoke - healthy dietary behaviour is more difficult to define specifically.

In the analysis of predictors of dietary behaviour change reported here, an overall marker of the healthiness of dietary intake in relation to the food selection guide used in the intervention was developed to quantify dietary change. The disadvantage of this method is that weighting of the relative merits of different changes is difficult; in this study, they were weighted according to the standard serve sizes of food selection guide. Change in one

serve (60-100g) of meat was seen to be equivalent to change in one serve (1/3 cup) of vegetables or one slice of bread. Different weightings may be desirable in other studies.

However, the diet penalty score was correlated with relevant nutrient intake levels and could be useful in future research. It may also have potential as a teaching tool for nutrition education. Sub-scores could be developed which correlated most strongly with particular nutrient intakes, for example a score for intake of high fat dairy foods, processed meat foods and fat spreads may be a marker for fat density, and a score for intake of wholegrain cereals, fruits and vegetables may be a marker for fibre density. Such sub-scores could also be very useful in nutrition education settings.

6.1.2 Intervention trials

The work described in this thesis did not attempt to compare different types of intervention methods. It was found that enhancing motivation, providing information, and setting goals for behaviour change did produce dietary change in a counselling setting, however, other settings may be more effective at delivering these and other strategies and a different intervention approach may have produced greater change. In addition, the 76% of the population who did not wish or were unable to be involved in the intervention trial may also have been reached by other means. Further research is required to answer these questions.

Social marketing principles provide a framework for developing and implementing health promotion intervention strategies (206), in particular, the choice of communication channels and mixtures of products, prices, places and promotion characteristics. It emphasises segmentation of the market into different target groups to improve the responsiveness of interventions to the needs and interests of these groups. The results of the work reported here and in other Australian studies indicates that such social marketing principles have applications in Australian nutrition promotion due to the differing dietary behaviours of groups defined by age and sex (e.g., 55, 64, 65, 66), social status

(described in Section 1.4) and awareness and interest in nutrition (described in the Australian context in Section 1.5.3).

Different mixes of behavioural, motivational and instructional components (76) may be useful for different target groups. It is possible, from the association between increase in knowledge scores and reported dietary changes discussed in Chapter 5, from the poor knowledge about nutrition in the general population reported in Section 1.5.3, and due to the apparent complexity of dietary behaviour, that instructional techniques should form an integral part of nutrition promotion. This emphasis on education has been seen as consistent with the aims of a liberal society to empower individuals (206). Nutrition promotion should also seek to determine and address the causes of social status differences in dietary intakes as reported in Chapter 2. This may involve broader issues described in the purview of health education of Glanz and colleagues as community, institutional and public policy factors (68).

Interviewer-assessed confidence in ability to make dietary changes was predictive of dietary adherence or change in the intervention trial. Further research aiming to discover more effective methods of intervention could consider whether this apparent confidence could be enhanced by the choice of intervention methodology and whether this would then lead to enhanced behaviour change, as was found in a weight loss intervention (93).

This thesis also did not aim to validate the 12345+ FNP as an intervention tool. However, some useful research directions for development of this instrument can be suggested. Further study of the use of the 12345+ FNP to lower salt and fat intakes is required, possibly with more emphasis on and information about low salt and low fat products. In the studies reported here, fat intake was poorly associated with beliefs and attitudes, and fat and salt intakes did not change during the intervention trial. This may indicate the influence of external factors on the intake levels of dietary fat and salt, such as the occurrence of fat (shown in this study) and salt (208) in many staple foodstuffs and the availability and acceptability of a whole range of low fat and low salt alternatives. A study to test this hypothesis could compare the effects

of changing personal cognitive factors (such as knowledge) with changing external factors (such as availability of low fat and low salt foods). Salt and fat intakes may be difficult to reduce due to their close association with taste preferences; these have been described as strong predictors of food choice (73), and investigation of these relationships could also provide further research directions.

Another question of importance to public health is whether the results reported in the intervention trial are generalisable to prevention settings. The stages of development of health promotion programs have been described by several authors (209, 210, 211) as involving hypothesis development, methods development, controlled intervention (or efficacy) trials, defined population (or effectiveness) trials and demonstration and implementation studies. The intervention trial reported in this work can best be seen as developmental and the results cannot be extrapolated to field settings as appropriate parameters of cost, time, personnel, expertise and technology were not set.

Further development and evaluation of appropriate methods would be necessary for use of such a nutrition promotion program in a field setting by a health educator, community nurse or general practitioner. This should include development of the following: a shortened dietary assessment technique (as described in the preceding section); a standard protocol for health professional use; determination of cost and time requirements; and, development of appropriate referral methods. Such a trial would potentially lead to improved nutrition education for the general community.

In the context of market segmentation and characterisation of target groups, the stage-of-change concept may have use as a descriptor of the study sample, as used by DiClemente and colleagues in their smoking intervention trial (101). In future studies of dietary behaviour, questions about readiness to change dietary behaviour and previous changes attempted could be used to characterise the sample for the purposes of comparison with other studies and determining generalisability of the study findings. This would be additional to

the possible role of stage-of-change variables as predictors of behaviour change.

6.1.3 Food assessment methodology

Two studies could overcome possible mis-representation by the food frequency questionnaire of dietary differences between high and low social status groups, which might have occurred due to differences in food composition and differences in usual serve sizes. A study of serve sizes used by high and low social status groups could be done, using weighed food records. The difficulty with such a study would be in recruiting a representative sample to take part in this study. Data from the National Dietary Survey of 1983 (132), which used food models to gain approximate serve sizes could possibly be accessed for information on representative food serve sizes for social status groups, although such information should be constantly updated.

A study of the composition of foods available in high and low status suburbs could be undertaken by sampling and analysing foods from shops in these areas, particularly meats which may differ markedly in fat content. Again, representative data would be needed. In the food frequency questionnaire analysis, the composition data used are based on the best available information regarding the usual composition of the most representative food commonly consumed. The composition of even fairly standard foods may differ according to brand or quality, for example, a butcher in a higher status suburb might sell leaner fat mince than a butcher in a lower status suburb. If the composition of some foods did differ markedly between status groups the nutrient composition of these foods in the data base could be adjusted based on social status to gain more accurate status group estimates.

6.2 Public health implications

6.2.1 Associations of social status, beliefs and attitudes with dietary intake and their influence on dietary behaviour change

Dietary intakes of lower social status groups were generally less aligned with population-level dietary recommendations than those of higher status groups, in both the samples which were studied. Although health authorities in Australia have considered dietary intakes to differ across social groups (16, 25) and the findings of this study provide evidence that this does occur, the differences appeared to be of limited importance when considering the relatively low degree of compliance of all social groups with dietary guidelines. In public health terms, generalisation of these results implies that substantial changes in food choices are required across all social groups in the community in order to achieve the community nutrient intake levels targeted by health authorities (25).

Specific targeting of lower social status groups to the exclusion of a widespread population approach to nutrition promotion does not seem justifiable based on the results of the population survey study. However, the differences found among social status groups in eating patterns in both studies and in participation rates in the intervention trial suggest that higher and lower social status groups should be targeted differently by nutrition education programs, and that the content and style of programs should be tailored to the dietary habits, knowledge, beliefs and attitudes and general social situation of the group targeted. The dietary areas that could specifically be included when working with lower status groups include promotion of the use of low fat dairy foods instead of full fat varieties, the use of grilling rather than frying of meat, reduction of the use of discretionary sugar and soft drinks, replacement of low fibre breads and cereals by wholegrain varieties and increased use of fruit.

The higher and lower social status groups were found to be equally amenable to dietary change, suggesting that interested people of all social status groups do respond to a mixture of instructional, behavioural and motivational techniques targeting dietary behaviour change. However, a large proportion

(80%) of the population from lower status suburbs and a moderately large proportion of those from higher status suburbs (71%) did not take part in the intervention trial and it appeared that non-participants had lower levels of belief in diet-disease relationships. These groups may therefore be harder to reach with interventions relying on a high level of dietary awareness and interest, which may be especially applicable to those living in lower social status suburbs.

While beliefs and attitudes were associated with dietary fat and fibre densities in the cross-sectional survey study reported here, these relationships differed between nutrients. This suggests that nutrition education programs should use strategies which are appropriate to the dietary changes targeted. Increased dietary fibre density may be achieved using awareness-raising, motivation and information transfer, while decreasing dietary fat density levels may require a broader range of strategies at the personal, community and public policy levels.

Nutrition knowledge and interviewer-assessed confidence were most strongly and independently associated with dietary behaviour change; the items from which these measures were derived were worded in relation to the targeted behaviour changes. Beliefs and attitudes which were worded in relation to more general notions of healthy diet were not predictive of dietary behaviour change. These findings have implications for further research into determinants of dietary behaviour. In relation to nutrition education, this issue underlines the need for nutrition education programs to clearly delineate the dietary behaviours targeted.

6.2.2 Chronic disease risk

In relation to chronic disease aetiology, coronary heart disease is the only condition for which we have some generally accepted estimate of the magnitude of dietary change required to bring about a definable difference in mortality (8, 198). Predicted atherogenicity of the diets of occupational status quintiles was previously calculated (211) using the formula of Anderson and

colleagues (198). The difference in nutrient intake constituted a difference of only 0.85% of total plasma cholesterol between the top and bottom occupational prestige quintiles, which translated into an estimated CHD mortality difference of 1.7% between the top and bottom social status groups (198). Lower status groups in Australia have been reported as having 22% and 50% excess CHD mortality in males and females respectively (36). The atherosclerotic process is, of course, not the only mechanism whereby diet can influence cardiovascular risk, but it is a major component. The nutrients that can influence this process, notably the amount and type of dietary fats and cholesterol, are also influential in other areas related to cardiac risk such as thrombogenesis and hypertension (1).

The conclusion that diet may play only a limited role in determining the differential in cardiovascular mortality between social groups is supported by the work of Dobson and colleagues (34) who found no difference in serum cholesterol level (one of the major markers of dietary risk) between occupational categories in the National Heart Risk Factor Survey of Australia in 1980. This finding was confirmed in further surveys in 1989 (12) Differences across social groups did exist in blood pressure, triglyceride, cigarette smoking, body mass and exercise but only when comparing the professional group to all other occupational categories in 1980 (34) and in 1989-90, lower status groups have been found to participate less in leasure-time exercise activities, to be more overweight and to smoke more in Australia than higher status groups (12). Thus, at least in the case of coronary heart disease in Australia, lifestyle factors other than those related to serum cholesterol levels appear to be contributing most to the increased risk of chronic diseases in lower status groups. However, other non-lifestyle factors, including aspects of material and social deprivation such as poor quality housing, living environment, psychosocial factors such as stress, low income, unemployment and deprivation in early life also may affect disease risk (50). It should also be remembered that inference about the contribution of dietary intake to social status differentials in disease rates is limited by the time-lag

between the dietary exposure and the disease outcome and would properly require longitudinal data.

The effects of dietary differences across social status groups on cancer and other chronic disease rates cannot be estimated at this time. The higher relative dietary intakes of fruits and vegetables and the lower dietary fat, saturated fat and cholesterol densities of higher status groups compared to lower status groups have directions of association consistent with diet-disease relationships for coronary heart disease, stroke, hypertension and oesophageal and stomach cancers, which have higher mortality rates in lower social status groups. The associations of dietary fat and fibre with social status are not, however, consistent with the apparently higher mortality rates of colon and breast cancers found in higher status groups.

6.2.3 Conclusions

The results of the studies and literature presented here do not support the contention that dietary differences between higher and lower social status groups contribute significantly to the mortality differential of coronary heart disease across social status groups in the general Australian population. No estimation of the contribution of diet to social status differentials in other diet-related diseases with social status gradients could be made, however, and two of these diseases (colon and breast cancers) have apparently higher mortality rates in higher status groups.

While all social status groups were found to require nutrition intervention in order to achieve dietary targets, those of lower social status did have greater need of dietary change. Interventions targeting these groups in Australia should consider appropriate methods of reaching these groups and should target dietary changes appropriate to their eating patterns. Methodological issues relevant to the issue of determining associations of dietary behaviour with personal diet-related beliefs and attitudes which may also have application in nutrition education practice are also discussed.

Appendix 2.1 The questionnaire used for the survey study (reduced by 15%)

[redacted]

Health

Concerns

Study

CSIRO DIVISION OF HUMAN NUTRITION
KINTORE AVENUE, ADELAIDE, S.A. 5000
phone: (08) 224 1875

ABOUT THIS STUDY

This study is one of a series of investigations asking people what they do, and what they are concerned about, regarding their health. In this booklet there are questions about what you think is true and questions about what you do. These questions are about health, what maintains it, what damages it, and what makes it difficult for you to look after your health. The study results will be used to help health and government planners and workers provide a better and fairer health system.

HOW TO FILL OUT THIS BOOKLET

So that you give your most honest opinion, without being biased too much by the questions that we ask, would you please work through the questionnaire **from beginning to end without reading it through first.**

Your answers will be treated **in the strictest confidence.** The code number on each book is used to identify respondents so they are not sent reminder notices. No personal details will be revealed to anyone, and all identifying information (names and addresses) will be destroyed when the project is completed.

Please answer all questions carefully and return the book to us as soon as possible.

Thankyou.

Q-1 In general, how good has **your** health been in the last year? **(Please circle one)**

Very good | (Good) | Fair | Poor | Very poor — 2 — 6

Q-2 How much do you agree with the view that it is better to live life to the fullest now, rather than worry about your health? (Please circle **one**)

Strongly agree | Agree | (I can get the best of both) | Disagree | Strongly disagree — 3

Q-3 What do you think are the **main things** that could make you sick, or shorten your life? (Please describe in your own words)

HEART DISEASE CANCER — 31 — 8-9

Q-4 How much of an **effect** do you think the following things have on the **health of people like yourself**? (who live and work in the same ways that you do)

(Circle **one** for **each**)

Eating the wrong foods	Bad effect	(Moderate)	No effect	Don't know	2
Smoking	(Bad effect)	Moderate	No effect	Don't know	1
Air and chemical pollution	Bad effect	(Moderate)	No effect	Don't know	2
Working in a dirty job, with dust or chemicals	Bad effect	(Moderate)	No effect	Don't know	2
Drinking too much alcohol	Bad effect	(Moderate)	No effect	Don't know	2
Not having a good doctor	Bad effect	Moderate	(No effect)	Don't know	3
Having parents who have or had poor health	Bad effect	Moderate	(No effect)	Don't know	3
Not keeping weight under control	Bad effect	(Moderate)	No effect	Don't know	2
Excess stress caused by work, lack of work or work at home	Bad effect	(Moderate)	No effect	Don't know	2
Lack of exercise or physical activity	Bad effect	(Moderate)	No effect	Don't know	2
Problems within the family	Bad effect	(Moderate)	No effect	Don't know	2
Not living in a clean, safe house and neighbourhood	Bad effect	Moderate	(No effect)	Don't know	3
Bad luck	Bad effect	Moderate	(No effect)	Don't know	3
Worries caused by not having enough money	Bad effect	(Moderate)	No effect	Don't know	2 — 23

Q-5 For people like yourself, how often do you think the following conditions are **mainly caused** by eating the wrong foods? (Circle **one** for **each**)

	Never	Sometimes	Often	Always	Don't know
Heart disease			✓		
Indigestion		✓			
Poor fitness		✓			
Bad teeth		✓			
Poor mental outlook		✓			
Allergies		✓			
High cholesterol level			✓		
Stress	✓				
Bowel cancer		✓			
Diabetes	✓				
Poor concentration	✓				
High blood pressure					✓
Overweight			✓		
Stroke			✓		

Q-6 About how often do you exercise?

Please circle **one** number.

1. Less than once a week
2. Once or twice a week
3. Three times a week or more
4. **NOT AT ALL**-->go to Question-9 below

Q-7 About how long do you exercise for each time?

Please circle **one** number.

1. Less than 20 minutes
2. 20-30 minutes
3. More than 30 minutes

Q-8 How much of the exercise you do makes you puff and sweat?

Please circle **one** number.

1. None of it
2. Some of it
3. Most or all of it

Q-9 Have you ever smoked on a regular basis?
Please circle **one** number.

1. Yes
2. No

Q-10 Do you currently smoke cigarettes?
Please circle **one**, and write in amount.

1. Yes, I smoke_____cigs/day
2. No, I don't smoke at all

Q-11 Do you think your current eating habits are as healthy as you want them to be?

(please circle **one**)

YES--> Turn to Page 4
NO--> Go to Questions 12 and 13

Q-12 What makes it difficult for you to eat a healthier diet?

LACK OF TIME
WIFE'S COOKING

Q-13 How often have these things stopped you from eating a healthier diet?
(Circle **one** for **each**)

	Rarely a problem	Sometimes a problem	Often a problem	
There is not enough money to spend on healthier food	✓			
You get bored with the taste of healthy food			✓	
There is not enough information on food labels		✓		I don't read labels
There is no healthy food at or near your workplace			✓	I don't go to work
Your friends don't eat healthy food which makes it harder for you		✓		
You would have to have a different meal to the rest of the family	✓			I live alone
You would have to learn new cooking methods and recipes				✓ I don't cook
You are short of time to cook interesting healthy food				✓ I don't cook
There is little choice of interesting healthy foods where you shop				✓ I don't shop
Transport would be difficult if you wanted to look around for interesting healthy foods				✓ I don't shop
The healthier foods are often not available at the local shops		✓		I don't shop

YOUR EATING HABITS

This section is about the kinds of foods **you usually** eat. On the next few pages you will find lists of foods, separated by questions about your dietary habits.

Read through each list of foods and record **about** how often **you usually** eat these foods. We realise that your food intake may vary from time to time, so just try to give us the best overall picture of your diet that you can.

We are interested in **YOUR** diet, not that of someone else in your household.

THIS IS HOW TO ANSWER

We are going to ask you **"About how often do you usually eat these foods?"**
Use the following simple code to write your answer in the space next to each food.

If you **NEVER** have a food ..... write **N**
If you **RARELY** have a food (less than once a month) .... write **R**

If you usually eat a food

About once a **MONTH** ..... write **1M**
About twice a **MONTH** ..... write **2M**
About three times a **MONTH** ..... write **3M**

About once a **WEEK** ..... write **1W**
About twice a **WEEK** ..... write **2W**
About three times a **WEEK** ..... write **3W**
and so on ..... **(4W, 5W, 6W, etc)**

About once a **DAY** ..... write **1D**
About twice a **DAY** ..... write **2D**
and so on ..... **(3D, 4D, 5D, etc)**

<u>Standard serves</u>
Alongside each food there is a "standard serve" size. The "standard" serve is **not** necessarily a "normal" serve, it is simply there to help us measure food intake. If you usually eat **more** or **less** than the standard serve size for a particular food, please indicate on the **COMMENTS** line **how much** more, or less, is eaten at **a time.**

For example, if when you eat icecream you have **one** "scoop" instead of our "standard" serve of **two** "scoops", indicate how often icecream is eaten, and then write **"one scoop only"** on the **comments** line.

On the opposite page you will see some examples of how to fill out the questionnaire. Please read these carefully before you start to fill out the answers for your diet.

.....

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	**R**	1 2 **M** 3	1 2 **W** 3 **and so on**	1 2 **D** 3 **and so on**

HERE ARE SOME EXAMPLES

		COMMENTS
Custard	1/2 cup	3W
Boiled egg	1 egg	3M 2 eggs
Cucumber	3 slices (each 0.5 cm thick)	R
Tea	1 cup	4D
Beetroot - canned	2 slices	2M 1 slice

The person above has, on average :-

- **A standard** serve of custard **three times a week**
- **Two** boiled eggs **three times a month**
- **Rarely** eats cucumber
- **Four** cups of tea **every day**
- **Half a standard** serve **(1 slice)** of beetroot - canned, **twice a month**

We realise that some people have an **exact** idea of how often they eat particular foods, whilst others only have an **approximate** idea. Be as accurate as you can but do not spend too much time choosing your answers.

PLEASE GIVE AN ANSWER FOR EVERY FOOD.

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CEREAL FOODS, CAKES and BISCUITS		*COMMENTS*
Breakfast cereal	1 cup	1D
Plain bran (raw)	1 tbspn	N
Wheatgerm	1 tbspn	R
Bread roll (NOT hamburger buns)	1 roll	1D
Fried rice	1 cup (cooked)	2M
Boiled rice	1 cup (cooked)	N
Pasta (spaghetti, noodles etc)	1 cup (cooked)	2W
Sweet bun/Doughnut	1	1W
Crispbread/Cracker	2	R
Salted biscuits	3	3W
Plain biscuits	2	2D
Fancy biscuits (eg choc-coated)	2	2W
Crumpet or Muffin	1	2W
Light cake (eg sponge)	1 small cake or 1 slice large cake	1W
Rich cake (eg cheesecake)	1 small cake or 1 slice large cake	1W
Pavlova (Meringue-type dessert)	2 small or 1 slice large	1M
Milk pudding (eg rice, sago)	1/2 cup	N
Steamed sponge - suet	1/4 small pudding	N

6

59

Q-1 *How many slices of bread do you **usually** eat? **Remember the bread in toast and sandwiches.*** 60 - 62
If you do not eat bread, write 'none'. 4 slices/day OR _____slices/week 028

Q-2 *What type of bread do you **usually** eat? (Circle **one** number)*

1 Wholemeal or mixed grain
2 Brown
3 White
4 About half the time wholemeal and half white
5 About half the time wholemeal, half brown
6 About half the time brown, half white
7 Other breads (e.g. rye, low salt)
please specify type_____
8 I do not eat bread

3

Q-3 *Which of the following do you **usually** spread on bread or crackers? (Circle **one answer**)*

1 Butter
2 Polyunsaturated margarine
3 Low-salt or salt-free butter
4 Low-salt or salt-free margarine
5 I don't use anything
6 I don't eat bread or crackers
7 Table or cooking margarine
8 Low-salt or salt-free table or cooking margarine
9 Something else : please name.....

2

If you eat breakfast cereal, please answer the next three questions. (If not, go to next page).

Q-4 *What types of breakfast cereals do you **most commonly** eat?*

Please name : WEETBIX 0057

Q-5 *How many cups of milk do you **usually** add to breakfast cereal?*
(Circle the number closest to the amount you have)

1 None
2 About a half a cup
3 About one cup
4 About one and a half cups
5 About two cups
6 More than two cups.....how many?_____

3

Q-6 *How many teaspoons of sugar or honey do you **usually** add to breakfast cereal?*
(Note: 1 dessertspoon = 2 teaspoons)

Write the number of teaspoons you have here : 2 02 71

7

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 M 3	1 2 W 3 and so on	1 2 D 3 and so on

HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

DAIRY FOODS and EGGS		*COMMENTS*
Glass of plain milk	medium glass	1M
Glass of flavoured milk	medium glass	R
Milk shake	regular size	R
Thick shake	regular size	R
Cheese	30 grams (1 slice)	2W
Low-fat Cottage Cheese	100 gm (1/2 carton)	N
Cream	1 tbspn	1W
Yoghurt	200 gm (1 carton)	R
Icecream	2 scoops (SUMMER)	1W
	(WINTER)	1W
Custard	1/2 cup	R
Fried egg	1 egg	2M
Boiled egg	1 egg	R
Omelette/Scrambled eggs	2 eggs	1M

ocl 113

Q-1 *When you drink milk or add it to tea/coffee etc, do you **mostly/always** use: (Circle **one** number)* 6

1 Whole milk
2 Reduced-fat milk (e.g. Skimmer, Tone)
3 Powdered, skimmed milk
4 Something else: please describe _____

1

Q-2 *Do you have milk :*

	*(Circle **one** for each)*		
in your tea?	YES	NO	DON'T DRINK IT
in your coffee?	YES	NO	DON'T DRINK IT
in your coffee substitute?	YES	NO	DON'T DRINK IT

1
1
0

Q-3 *Do you make your cocoa or chocolate with : (Circle **one** number)*

1 Mostly milk?
2 Mostly water?
3 About half and half?
4 I do not drink cocoa or chocolate.

2

Q-4 *How many **teaspoons** of sugar do you usually have in each cup of :*

	*(Circle **one** number for each drink)*							
Tea?	0	1	2	3	4	5	6	0
Coffee?	0	1	2	3	4	5	6	0
Coffee substitute?	0	1	2	3	4	5	6	0
Cocoa/chocolate?	0	1	2	3	4	5	6	

Q-5 *Do you eat **low-salt** cheeses? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Rarely or never
4 I do not eat cheese

3

Q-6 *Do you eat **low-fat** cheeses? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Rarely or never
4 I do not eat cheese

3

Q-7 *When you eat yoghurt which type is it? (Circle **one** number)*

1 Plain (eg not fat-reduced)
2 Plain, low-fat
3 Fruit flavoured (not fat-reduced)
4 Fruit flavoured, low-fat
5 I do not eat yoghurt

3

17

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 W 3 and so on	1 2 D 3 and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

MEATS		*COMMENTS*
Steak	1 medium	1W
Pork chop	1 chop	1M
Lamb chop	2 chops	1M
Roast pork	2 slices	R
Roast beef/veal	2 slices	1W
Roast lamb	2 slices	1W
Pork sausages	2 thick or 3 thin	R
Beef sausages	2 thick or 3 thin	1W
Frankfurters/Saveloys	2 thick or 3 thin	1W
Bacon	2 rashers	1M
Ham	3 thin or 2 thick slices	3W
Fritz/Devon	3 slices (1 cm thick)	N
Salami/Mettwurst	3 slices (1 cm thick)	N
Liver	1/2 liver (150 gm)	R
Kidney	2 kidneys	R

18

Q-1 *If you eat the following meats, how are they usually cooked? (Circle one for each food)*

Steak	(fried)	grilled	microwaved	don't eat
Lamb chops	(fried)	grilled	microwaved	don't eat
Pork chops	(fried)	grilled	microwaved	don't eat
Beef sausages	(fried)	grilled	microwaved	don't eat
Pork sausages	(fried)	grilled	microwaved	don't eat
Bacon	(fried)	grilled	microwaved	don't eat

Q-2 *When you eat meat with fat on it, do you eat : (Circle one number)*

1 All of the fat
2 Most of the fat
3 About half of the fat
(4) Little or none of the fat
5 I do not eat meat

4

69

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 W 3 and so on	1 2 D 3 and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

MIXED DISHES		*COMMENTS*
Hamburger WITH bun	1 medium	1W
Hamburger patty (WITHOUT bun)	1 medium	N
Pizza	1 small or 4 slices larger pizza	1M
Ylros	1 roll	N
Sausage roll	1 large, 2 small	R
Meat pie	1 pie	1W
Meat pie (home made)	1 indiv. pie OR 1 slice large pie	N
Pastie	1	R
Crumbed veal (schnitzel)	1 large piece	1M
Stew/Casserole	1 cup	2M
Curry/Goulash	1 cup	1M
Chinese meat & veg dish	1 cup	1M
Savoury pies/pastries (eg quiche)	1 indiv. pie OR 1 slice large pie	R
Mince meat (eaten as such)	1 cup	R
Mince meat dishes (eg shepherds pie)	1 piece (8x8x4cm)	R
Spicy mince added to pastas (eg spag. sauce)	1/2 cup mince	1N

70

eol 117

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CHICKEN, FISH and SEAFOOD -		*COMMENTS*
Roast chicken	1 drumstick/2 wings or 2 slices breast	
Boiled chicken	as above	
Fried, barbecue chicken	as above	
Chicken or fish patty	2 patties	
Fish fried	1 piece	
Fish without batter (steamed/grilled)	1 piece	
Canned fish (tuna, salmon etc)	1/3 cup	
Salted fish (eg herring,anchovy)	1/2 cup	
Seafood (prawns, crab, lobster etc)	1/2 cup	
Mornay dishes	1 cup	

6

Q-1 *If you eat fried fish, in which of the following is it **usually** coated? (Circle **one** number)*

1 Batter
2 Breadcrumbs
3 Flour
4 Other coating: please name.....
5 Fried without coating
6 I don't eat fried fish

Q-2 *Which of the following is **usually** used to fry or roast your meat and fish? (Circle **one** number)*

1 Butter
2 Dripping or lard
3 Cooking or table margarine
4 Polyunsaturated table margarine
5 Vegetable oils (olive, sunflower)
6 Cooked in own juices (eg oven bag, dry roasted etc)
7 I never eat fried or roasted meat or fish
8 Something else: please describe.....

37

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

FRUIT		*COMMENTS*
Orange, Mandarin, Grapefruit	1 medium	3M
Apple, Pear	1 medium	2W
Banana	1 medium	2M
Mixed fruit salad	1 cup	1M
Dried fruit (apple/apricot etc)	4-5 pieces	R
Raisins, sultanas or currants	1/3 cup	2M
Fruit canned in syrup or stewed fruit	100 grams	1M
Fruit canned in water (eg low cal fruit)	100 grams	N
Fruit pie or pastry or fritters	1 small pie or 1 slice large	2M

38

The fruits listed below are only available for a short time during the year. Therefore we only want you to record how often you have them when they are IN SEASON.

HOW OFTEN DO YOU EAT THESE FOODS WHEN THEY ARE IN SEASON?

Berries	3/4 cup	R
Melon (not watermelon)	1/4 small melon	R
Peach	1 medium	1M
Plum	3-4 plums	2M
Nectarine	1 medium	2M
Apricot	3 apricots	2M
Grapes	about 20	1M
Avocado	1/2 an avocado	N

eoi 88

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

The following list of foods contains some vegetables that **may** be eaten much **more** frequently at **some** times of the year than others (eg in the warmer or cooler weather). Please fill in how **often** each food is eaten in **BOTH** the warmer months of the year (**SUMMER**) and the cooler months (**WINTER**).

For example- If you usually have:

A standard serve of peas about **twice** a **week** during the **warmer** months of the year and about **every day** during the **cooler** months:

and:

Two medium potatoes (roasted) a **week** throughout the **year**:

You would write.....

		Summer	Winter
Green peas	1/3 cup	2W	1D
Potato - roasted	1 medium	1W	1W 2 med pot

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

FRESH or FROZEN VEGETABLES

		Summer	Winter
Potato - fresh & mashed (with milk)	1/3 cup	2M	1W
Potato - boiled/baked (not mashed)	1 medium	1M	1W
Potato - roasted	1 medium	1M	1W
French Fries/Hot chips	17-18 chips	2M	1W
Carrots (fresh/frozen)	1/3 cup	2W	2W
Turnip, Swede (fresh/frozen)	1/3 cup	N	N
Broad beans (fresh/frozen)	1/2 cup	R	R
Green beans (fresh/frozen)	1/3 cup	1W	1W
Haricot, Lima beans (fresh/frozen)	1/3 cup	N	N
Green peas (fresh/frozen)	1/3 cup	1W	1W

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FRESH or FROZEN VEGETABLES (continued)

		Summer	Winter
Cabbage	1/3 cup	R	2M
Brussel sprouts (fresh/frozen)	5-6	R	2M
Silver beet/Spinach (fresh/frozen)	1/3 cup	R	2M
Broccoli (fresh/frozen)	1/3 cup	R	2M
Cauliflower (fresh/frozen)	1/2 cup	R	2M
Egg plant (aubergine)	2 slices (each 0.5 cm thick)	N	N
Sweetcorn (fresh/frozen)	1 small cob	R	1W
Zucchini (courgettes) (fresh/frozen)	2 medium sized	R	1M
Zucchini salad	1/3 cup	N	N
Taboull salad	1/3 cup	N	N
Tomato	1 medium	3Bm 3W	1W 12M 3 medium
Lettuce	2 small leaves	1D	1W
Cucumber	3 slices (each 0.5 cm thick)	R	R
Coleslaw	1/2 cup	R	R
Celery (fresh/frozen)	one 15cm stick	1M	R
Capsicum (Green Pepper) (fresh/frozen)	2 strips (each 0.5 cm thick)	1M	1M
Potato salad	1/3 cup	R	R
Beetroot	2 slices	1D	2M
Sprouted bean shoots	1/3 cup	1M	R
Pumpkin	1/3 cup	1M	2M

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HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

OTHER VEGETABLES		*COMMENTS*
Potato - canned	2-3 small	1W
Fried mixed vegetables (e.g. stir fried)	1/2 cup	R
Carrots - canned	1/3 cup	2W
Onion - fried	1/4 cup	1W
Onion (raw, baked, boiled)	1 medium	1W
Green beans - canned	1/3 cup	2W
Haricot, Lima beans - canned	1/3 cup	N
Baked beans in tomato sauce	1/3 cup	2M 1M 2 tbls
Green peas - canned	1/3 cup	1W
Green peas - dried	1/3 cup	R
Lentils - dried/canned	1/3 cup	N
Soyabeans - dried/canned	1/3 cup	N
Chick peas - dried/canned	1/3 cup	N
Sweetcorn - canned	1/3 cup	1W
Mushrooms - fresh	6 - 7 small ones	R
Mushrooms - canned	6-7 small ones	2M
Olives	3 medium	N
Gherkins/Pickled onions	3 pieces	1W

59

Q-1 *When your vegetables are cooked which of the following methods is the one **most commonly** used? (Circle **one** number)*

60

1 Boiled in a little water
2 Boiled in a lot of water
3 Steamed
4 Cooked in a pressure cooker
5 Microwaved

1

Q-2 *Is salt added to the cooking water when **boiling** the following foods? (Circle **one** for each food)*

Vegetables	USUALLY	SOMETIMES	NEVER	1
Pasta and rice	USUALLY	SOMETIMES	NEVER	3

Q-3 *If salt is added to the cooking water when **boiling** foods, is the water : (Circle **one** number)*

1 Lightly salted
2 Medium salted
3 Heavily salted
4 Salting is highly varied
5 Salt is not added to cooking water

1

Q-4 *How often do you add salt to meals **after** they are cooked? (Circle **one** number)*

1 Rarely or never
2 Sometimes
3 Always or nearly always

1

Q-5 *When you add salt **after** your meals are cooked, how much do you **usually** add? (Circle **one** number)*

1 A light sprinkle
2 A medium sprinkle
3 A heavy sprinkle
4 Salting is highly varied
5 I do not add salt to cooked foods

2

Q-6 *When frying or roasting vegetables, which do you (or the person who cooks your food) use **most** often? (Circle **one** number)*

1 Butter
2 Dripping or lard
3 Cooking or table margarine
4 Polyunsaturated margarine
5 Vegetable oils (olive, sunflower etc)
6 I never eat fried or roast vegetables
7 Something else : please describe.....

2

Q-7 *When you use canned vegetables, are they **low-salt** varieties? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Never or rarely

3

Q-8 *When you use canned or packet soups, are they **low-salt** varieties? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Never or rarely

3

68

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

		COMMENTS
SOUPS, NUTS and SNACKS		
Potato crisps, Twisties etc	1 small bag or 14-15 pieces	1W
Peanuts (fresh)	9-10 nuts	2W
Nuts - salted & cooked	9-10 nuts	R
Other unsalted nuts (fresh walnuts/brazils etc)	5-6 nuts	R
Soup	1 cup (WINTER)	1W
	(SUMMER)	1M

69

Write an example of the type of soup you most often eat (eg canned tomato; homemade pea and ham) CANNED TOMATO 0952

CONFECTIONERY, JAMS and SAUCES		
Chocolate	1 small bar	2W
Chocolate covered bar (eg Mars/Bounty)	1 bar	1W
Individually wrapped lollies; toffees	4-5 lollies	1W
Packet lollies (eg Lifesavers/Polos)	1 small packet	1M
Ice blocks or lollies	1 medium	R
Muesli bar/Health bar	1 bar	1W
Honey, jam, marmalade	1 tbspn	R
Vegemite, marmite etc	1/2 teaspoon	1M
Thick sauces (tomato/HP etc)	2 tbspn	1D

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HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY HAVE THESE FOODS?

		COMMENTS
BEVERAGES		
Glass of cordial	medium glass	2W
Glass of cola (eg Coca-Cola)	medium glass	R
Glass of fizzy drink - includes mineral water with juice	medium glass	1W
Fruit drink (eg Fruit Box)	1 carton	1D
Pure fruit juice	medium glass	R
Tea	1 cup	2D
Coffee	1 cup	2D
Coffee substitute	1 cup	N
Cocoa/Chocolate (Milo/Ovaltine etc)	1 cup	R
Water	medium glass	1D
Mineral water	medium glass	R
Low-alcohol beer	medium glass 230 mls	4
Beer	medium glass 230 mls	R
Alcoholic cider	medium glass 230 mls	N
Wine	1 wine glass	N
Sherry	1 sherry glass	N
Port	1 sherry glass	1M
Spirits (whisky, brandy etc)	1 nip	1M
Liqueur	1 small nip	1M

6

62

If you have any **other** foods or drinks that we have **not** mentioned, at least once a month, please write them down here and tell us **how often** you have them using the same response scale as before (eg **1D, 3M** etc).

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	**R**	1 2 **M** 3	1 2 **W** 3 and so on	1 2 **D** 3 and so on

FOODS AND DRINKS I CONSUME THAT HAVE NOT BEEN MENTIONED:
(e.g. scones, pancakes, salad dressing, sunflower seeds, pumpkin seeds, pita, falafel, homous, dim sim, staminade, tofu, commercial meat substitutes (e.g. TVP, nutmeat)).

Name of Food	Your usual serve size	How often do you eat it?	
SALAD DRESSING	1 teaspoon	1W	63
	0925	013	col 8

VITAMIN AND MINERAL SUPPLEMENTS 14 x 0.

If you take any vitamins or minerals, or any other dietary supplements, such as fibre tablets, lecithin, kelp, yeast, 'slimming' products, etc, please fill in the table below. (Check the label on the box or bottle if you are unsure of some of the answers).

BRAND (e.g. Nyal)	NAME OF PRODUCT (e.g. vitamin C pills)	SIZE OF DOSE (e.g. 250 mg)	NUMBER OF DOSES (e.g. 2 per day, now and again, with a cold, with my period)

Q-1 Have you tried to **change** the food you eat, or your diet, in the last year or so ?

Please circle **one** answer 2
NO---> Go to Question-6 at the top of the next page.
(YES)---> Go to Question-2 below. 6

Q-2 Which foods on the list below have you tried to **change** your intake of, in the last year? If you have eaten more of this food, **circle more**, if you have eaten less, **circle less** and if you have not changed, **circle same**. (Circle **one** for **each** food)

Fruit	(More)	Less	Same	1
Vegetables	(More)	Less	Same	1
Wholegrain bread	(More)	Less	Same	2
White bread	More	(Less)	Same	2
Cheese	More	(Less)	Same	3
Full cream milk	More	Less	(Same)	2
Red meat	More	(Less)	Same	1
Chicken	(More)	Less	Same	2
Fish	More	(Less)	Same	3
Low fat milk	More	Less	(Same)	3
Vegetable oil	More	Less	(Same)	2
Polyunsaturated margarine	More	(Less)	Same	3
Butter	More	Less	(Same)	3
Food additives	More	Less	(Same)	3
Salt added to foods	More	Less	(Same)	3
Foods high in salt	More	Less	(Same)	2
Sugar added to food and drink	More	(Less)	Same	2
Foods high in sugar	More	(Less)	Same	2
Fried foods	More	(Less)	Same	25

Q-3 Please list any other foods you have tried to eat more of: 88
88 26-29

Q-4 Please list any other foods you have tried to eat less of: 88
88 30-33

Q-5 If you have tried to change the foods you eat, what were your main **reasons for changing?**
Please describe these **in your own words:** HEART DISEASE / CHOLESTEROL.
01
02 34-39
88.

Q-6 Have you **ever** tried to change your diet or the food you eat?

Please circle **one.**

NO--> Go to Question-8 below.
YES--> Go straight on to Question-7.

3

Q-7 When you are trying to eat healthier food, how confident would you be that you could do so in the following situations? (Circle **one** for **each**)

You see some delicious, unhealthy food in the shop	Not at all confident	Somewhat confident	**Very confident**	I don't shop	3
Someone at a party offers you food you shouldn't eat	Not at all confident	**Somewhat confident**	Very confident	I don't go to parties	2
You feel worried or depressed	Not at all confident	**Somewhat confident**	Very confident		2
You are alone and there is no-one watching you	Not at all confident	**Somewhat confident**	Very confident		2
You are tired	Not at all confident	**Somewhat confident**	Very confident		2
You feel like over-indulging when out for a special occaison	**Not at all confident**	Somewhat confident	Very confident	I don't go out	1
You are out to lunch with friends and don't want to be different from them	**Not at all confident**	Somewhat confident	Very confident	I don't go out	1

Q-8 THINGS ABOUT FOOD. Different people choose food for different reasons, such as:

healthiness, convenience, tastiness, price and freshness

What would you say are the 3 most **important considerations** for you when you choose food? Pick from the list above, or **choose your own words:**

1. The most important thing is: tastiness 03
2. The second most important thing is: healthiness 01
3. The third most important thing is: freshness 05

Q-9 THINGS IN FOOD. Some people also look for or avoid different **nutrients and chemicals** in food. Are there any particular nutrients, chemicals or substances in food that you:

a) try to avoid fats 02

b) especially look for fibre 61

(please write them in)

54-57

BACKGROUND

(office use only)

Your answers to these questions are not directly related to food, but we believe age, sex and other social factors can strongly influence what food people eat. Your answers to these questions are very important to us, and will only be used to group people together.

58

Q-1 Are you? (tick one) 1. Male ☑ 2. Female ☐

1 sx

Q-2 What is your marital status? **Please tick one box**

1. Never married ☐
2. Married ☑
3. Divorced ☐
4. Separated ☐
5. Widowed ☐
6. De Facto (living with some one for 5 years or more) ☐

Q-3 How old are you?

46 years

2 ms 46

Q-4 How much do you weigh?

____kg, or 12 st 5 lb

079 kg

Q-5 How tall are you?

176 cm, or ____ft ____in

176 cm

075 kg

Q-6 What is your ideal weight? (The weight **you** would most like to be)

____kg, or 11 st, 10 lb

Please answer the following questions for both yourself and your spouse/partner if you have one.

Q-7 Do a) you and b) your spouse/partner currently have a full time or part time job of any kind?

Please **tick one** box in each column for :	a) Yourself	b) Your partner (if you have one)
Yes, for payment or profit	✓	✓
Yes, unpaid work (family business, voluntary) work, unpaid helper etc.)		
Yes, but temporarily absent on holidays, sick leave, strike or temporary stand-down		
No, do not have a job, and not retired		
No, retired from paid work		

1 self

1 spouse

Q-8 What is or was the usual occupation of: a) yourself CHEMICAL CONSULTANT 24 self

Give full title, for example Fast Food Cook, 1st Class Welder, Civil Engineering Draftsman, Coal Miner, Accounts Clerk, Extruding Machine Operator

56 spouse

b) your partner (if you have one) FURNITURE WORKER 76

2.4 cons. engineer
3.2 man consult
2.4 chem eng

Q-9 Please name the **country** you were **born** in AUST 01

Please name the **country** your spouse/partner was **born** in AUST 01 77-78

Q-10 How **old** were a) you when you **left school**? 18 years 18

b) your spouse/partner when he/she left school? 15 years 15

83-84

Q-11 What is the highest **trade or any qualification** obtained by a) you, or b) your spouse since leaving school?

Please **tick** one box for yourself, and one for your spouse/ partner	a)Yourself	b)Your partner (if you have one)
1. Still at school or tertiary institution		
2. No qualification since leaving school		✓ 4
3. Yes, a trade or technical certificate		2
4. Yes, a degree or diploma	✓	
5. Yes, a higher degree		

85-86

Q-12 In which income level does **your household** fall?

We would like to know this so we can group people according to their income to see what effect this has on food intake. As with the rest of the information you give, the numbers you supply will be completely confidential and will not be recorded with your name.

Please **add up the incomes of yourself and partner or spouse, plus any other persons contributing to the household income in 1988, or '87/'88.** Do not deduct tax, superannuation, or health insurance. A household consists of persons living and eating together as a domestic unit. A person who lives alone is also a household.

Please **tick** the appropriate box. If unsure please estimate.

- ☐ No income
- ☐ $1- 4,000
- ☐ $4,001 - 11,000
- ☐ $11,001 -18,000
- ☐ $18,001 - 32,000
- ☑ $32,000 - 49,000
- ☐ $49,001 and over
- ☐ I do not wish, or am unable to give this information

6

87

Q-13 How many people are supported by this income?

Number of adults 2 Number of dependent children 2 2

88-89

YOUR COMMENTS

Thank you very much for your help. We realise that you have given up some of your time to answer our questions. We would like you to know that we appreciate this help.

Are there any nutritional problems that you think require more reseach? If so, describe them below. We might be able to incorporate your suggestions in our future work. (Unfortunately we do not have the resources to answer personal diet queries). Do you have any comments you wish to make about any of the questions we asked in this study? If so, write them below.

32
88 x 2

88 x 6

21
81
8

Appendix 2.2 Comparison of the demographic profile of the study sample with that of the Australian population

Variable	Group	Sample (1989) (%)	Australia (1986) (%) [a]	Variable	Group	Sample (1989) (%)	Australia (1986) (%)
Sex	Males	45	49	Occup-	Managerial	10	13
	Females	55	51	ation [c]	Professional	16	13
					Para-		
Age	18-19	2	5		professional	12	7
	20-29	20	23		Trades	15	16
	30-39	23	22		Clerical	19	17
	40-49	20	16		Sales	12	11
	50-59	14	13		Semi-skilled		
	60-69	11	11		manual	6	9
	70-79	7	7		Un-skilled		
	80+	3	3		manual	10	14
Country	Australia	74	73	Educ-	Qualified	50	33
of	Other			ation [d]			
Birth	English						
	speaking[b]	14	9	Employ	Unemployed		
				-ment	males	2	6
Income	0-$4,000	1	2		Unemployed		
	$4-11,000	12	11		females	8	4
	$11-18,000	13	16		Males not in the		
	$18-32,000	28	23		labour force	19	22
	$32-49,000	20	21		Females not in		
	$49,000+	14	17		the labour force	36	52
	Refusal	13	11				

(a) Figures drawn from the Australian Census, June 1986 (131)
(b) Includes New Zealand, the UK, Ireland, Canada, the USA and South Africa.
(c) Occupation, includes only those respondents in the labour force.
(d) Education, this group includes those with trades, technical certificates, diplomas and degrees. The figure for the Australian population is derived from Census figures, calculated the total number of from people with a qualification divided by the number in the population over 20 years of age.

Appendix 2.3 Macronutrient, cholesterol, sodium and fibre intakes in occupational prestige quintiles

MEN	High status	High-middle status	Middle status	Low-middle status	Low status
Number	83	70	74	73	84
Energy (kJ)					
Mean	9070	10080	9820	9840	10270
SD	*2370*	*3620*	*3540*	*3690*	*3390*
Total fat (g)					
Mean	85.8	99.7	94.7	95.6	101
SD	*29.3*	*44.6*	*38.7*	*41.4*	*37.7*
Saturated fat (g)					
Mean	32.2	38.3	35.7	35.7	38.9
SD	*11.7*	*21.6*	*16.7*	*18.6*	*16.8*
Monounsaturated fat (g)					
Mean	30.9	35.3	33.5	34.4	36.7
SD	*10.9*	*15.7*	*14.5*	*14.9*	*14.8*
Polyunsaturated fat (g)					
Mean	15.6	18.0	17.4	17.5	17.0
SD	*7.69*	*8.17*	*8.36*	*9.85*	*8.12*
Carbohydrates (g)					
Mean	256	284	285	290	283
SD	*73.1*	*98.8*	*113*	*134*	*98.6*
Starch (g)					
Mean	130	144	141	147	140
SD	*45.8*	*54.9*	*52.4*	*82.5*	*53.3*
Natural sugars (g)					
Mean	72.4	71.9	68.5	66.7	69.3
SD	*31.5*	*42.8*	*35.2*	*33.8*	*36.7*
Refined sugars (g)					
Mean	53.1	68.0	75.2	76.3	74.1
SD	*33.5*	*46.4*	*65.6*	*64.1*	*46.6*
Protein (g)					
Mean	83.9	93.0	86.9	91.5	95.3
SD	*21.0*	*37.7*	*29.2*	*33.4*	*32.3*
Alcohol (g)					
Mean	13.6	9.81	10.6	8.38	15.1
SD	*18.0*	*11.4*	*12.6*	*12.0*	*27.8*
Median	10.2	6.99	7.16	5.98	12.1
Cholesterol (mg)					
Mean	254	307	291	311	324
SD	*111*	*213*	*129*	*178*	*149*
Sodium (mg) (a)					
Mean	3010	3330	3300	3460	3520
SD	*878*	*1290*	*1310*	*1290*	*1200*
Fibre (g) (b)					
Mean	26.1	24.2	24.4	24.9	23.5
SD	*10.7*	*9.44*	*9.98*	*11.1*	*9.84*

(a) The RDI for sodium is 900-2300 mg/day (25)
(b) The recommended intake for fibre is 30g/day (25)

Appendix 2.3 Macronutrient, cholesterol, sodium and fibre intakes in occupational prestige quintiles (cont)

WOMEN	High status	High-middle status	Middle status	Low-middle status	Low status
Number	87	94	92	76	91
Energy (kJ)					
Mean	7850	7920	7550	7570	8740
SD	*2330*	*2240*	*2490*	*2550*	*3040*
Total fat (g)					
Mean	75.2	73.2	71.3	75.1	84.3
SD	*25.6*	*26.9*	*30.9*	*27.7*	*33.8*
Saturated fat (g)					
Mean	28.1	28.0	27.3	27.9	32.6
SD	*11.8*	*12.4*	*15.0*	*11.8*	*16.6*
Monounsaturated fat (g)					
Mean.	26.8	26.5	25.4	27.5	30.3
SD	*8.74*	*10.4*	*11.3*	*10.2*	*12.1*
Polyunsaturated fat (g)					
Mean	14.0	13.1	12.7	13.6	14.3
SD	*6.44*	*5.81*	*5.35*	*6.27*	*6.72*
Carbohydrates (g)					
Mean	221	226	219	211	240
SD	*75.0*	*69.3*	*68.3*	*79.4*	*95.7*
Starch (g)					
Mean	107	107	107	103	115
SD	*34.5*	*36.8*	*35.5*	*37.4*	*42.9*
Natural sugars (g)					
Mean	70.2	74.7	65.1	61.3	66.3
SD	*32.1*	*27.1*	*29.9*	*33.9*	*31.1*
Refined sugars (g)					
Mean	44.6	44.9	47.5	46.9	58.2
SD	*36.0*	*34.9*	*34.4*	*30.8*	*47.3*
Protein (g)					
Mean	77.6	80.6	73.0	74.8	80.6
SD	*23.7*	*23.2*	*26.8*	*27.8*	*26.0*
Alcohol (g)					
Mean	6.46	6.70	4.95	3.91	4.61
SD	*9.50*	*11.4*	*7.33*	*6.69*	*12.03*
Median	4.92	4.53	3.25	2.99	5.55
Cholesterol (mg)					
Mean	233	243	209	234	271
SD	*1012*	*109*	*110*	*112*	*128*
Sodium (mg) (a)					
Mean	2710	2590	2580	2590	2910
SD	*790*	*775*	*969*	*1050*	*987*
Fibre (g) (b)					
Mean	25.3	24.6	23.6	22.0	23.4
SD	*8.17*	*8.27*	*8.47*	*9.02*	*9.74*

(a) The RDI for sodium is 900-2300 mg/day (25)
(b) The recommended intake for fibre is 30g/day (25)

Appendix 2.4 Micronutrient intake levels across occupational prestige quintiles

MEN	High status	High-middle status	Middle status	Low-middle status	Low status	RDI level [a]
Number	83	70	74	73	84	
Energy (kJ)						
Mean	9070	10080	9820	9840	10270	
SD	*2370*	*3620*	*3540*	*3690*	*3390*	
Retinol (ug)						
Mean	575	606	730	616	653	750 [b]
SD	*660*	*480*	*870*	*480*	*430*	
Beta-carotene (ug)						
Mean	5220	5040	4610	5270	5030	[b]
SD	*2380*	*2480*	*2490*	*3380*	*3610*	
Vitamin C (mg)						
Mean	145	133	153	150	130	40
SD	82.2	79.8	95.1	92.6	92.9	
Thiamin (mg)						
Mean	1.49	1.55	1.56	1.61	1.52	1.1
SD	*0.47*	*0.50*	*0.56*	*0.61*	*0.51*	
Riboflavin (mg)						
Mean	2.12	2.27	2.17	2.17	2.36	1.7
SD	*0.67*	*1.18*	*0.96*	*0.86*	*0.95*	
Niacin (mg)						
Mean	21.7	22.1	21.9	23.3	23.1	18-20
SD	*5.99*	*6.20*	*7.35*	*8.64*	*7.53*	
Folate (ug)						
Mean	242	234	247	244	242	200
SD	*80.8*	*81.4*	*91.0*	*90.7*	*89.6*	
Calcium (mg)						
Mean	985	1120	1030	983	1130	800
SD	*350*	*722*	*546*	*494*	*570*	
Zinc (mg)						
Mean	12.3	13.1	12.5	12.7	13.6	12-16
SD	*3.18*	*4.86*	*4.11*	*4.41*	*4.57*	
Iron (mg)						
Mean	14.3	14.5	14.4	14.7	14.5	7
SD	*3.74*	*4.15*	*4.30*	*5.03*	*4.55*	
Magnesium (mg)						
Mean	360	360	352	342	365	320
SD	*102*	*120*	*123*	*120*	*126*	
Potassium (mg)						
Mean	3680	3700	3610	3640	3750	1950-
SD	*940*	*1340*	*1260*	*1320*	*1250*	5460

(a). RDI levels given are those that apply to the majority of age groups in the population (29)
(b). Vitamin A RDI calculated as (retinol + beta-carotene/6)

Appendix 2.4 Micronutrient intakes across occupational prestige quintiles (cont)

WOMEN	High status	High-middle status	Middle status	Low-middle status	Low status	RDI level [a]
Number	87	94	92	76	91	
Energy (kJ)						
Mean	7850	7920	7550	7570	8740	
SD	*2330*	*2240*	*2490*	*2550*	*3040*	
Retinol (ug)						
Mean	647	641	502	654	858	750 [b]
SD	*790*	*720*	*600*	*840*	*1200*	
Beta-carotene (ug)						
Mean	6110	5720	5650	5550	4920	[b]
SD	*3130*	*2900*	*2790*	*3410*	*2690*	
Vitamin C (mg)						
Mean	157	157	149	127	145	30
SD	*90.0*	*63.4*	*80.9*	*74.2*	*80.3*	
Thiamin (mg)						
Mean	1.47	1.43	1.39	1.31	1.44	0.8
SD	*0.58*	*0.43*	*0.46*	*0.52*	*0.53*	
Riboflavin (mg)						
Mean	2.10	2.14	1.92	1.91	2.15	1.2
SD	*0.91*	*0.72*	*0.86*	*0.69*	*0.86*	
Niacin (mg)						
Mean	19.9	20.1	18.7	18.6	20.2	12-14
SD	*6.85*	*6.36*	*6.24*	*6.56*	*6.99*	
Folate (ug)						
Mean	243	243	230	209	231	200
SD	*79.6*	*66.4*	*83.9*	*77.8*	*87.1*	
Calcium (mg)						
Mean	940	1010	907	874	974	800
SD	*433*	*392*	*473*	*367*	*481*	
Zinc (mg)						
Mean	11.6	11.6	10.7	10.5	11.6	12-16
SD	*3.64*	*3.21*	*3.89*	*3.96*	*3.87*	
Iron (mg)						
Mean	13.4	13.4	12.7	12.1	13.2	12-16
SD	*3.76*	*3.54*	*3.81*	*4.22*	*4.42*	
Magnesium (mg)						
Mean	343	343	318	297	324	270
SD	*112*	*89.5*	*100*	*99.6*	*115*	
Potassium (mg)						
Mean	3540	3720	3400	3320	3510	1950-
SD	*1000*	*930*	*1110*	*1160*	*1160*	4560

(a). RDI levels given are those that apply to the majority of age groups in the population (29)
(b). Vitamin A RDI calculated as (retinol + beta-carotene/6)

Appendix 4.1 Recruitment letter for the intervention trial

10th February, 1991

Dear Sir or Madam,

I am writing to invite you to take part in the **"Food and Cholesterol Study"**. The purpose of the study is to improve the health of the community by finding better ways of helping people to eat healthier food. It would not take up a lot of your time, and you would have the chance to learn more about food and health. Your name was randomly chosen from the Electoral Rolls.

If you do decide to take part, you will be asked questions about the food you eat and your thoughts on food and health. You will also be asked to come in to the city for **two free cholesterol tests**, three months apart. Your eating pattern will be computer-checked and you will be given **information from a food expert** (dietitian) about how healthy your eating pattern is.

If you are interested in being in the study, **either phone me on 224 1875** between 9 am and 5 pm, or **write your name, address and phone number on the tear-off slip** below, and post it to us in the envelope provided - you do not need a stamp. Please let us know by 30th February, or within one week, if possible.

Public transport or parking costs for the cholesterol visits can be reimbursed.

Yours faithfully,

Alison Smith, Study Co-ordinator

---------- please tear off

Yes, I am interested to know more about the Food and Cholesterol Study.

Name: .....

Address: .....,

.....

Phone (day)_____(after hours)_____

Appendix 4.2 Cover letter, information sheet and consent form sent out to intervention and control groups in the intervention trial

1st March,1991

Dear ,

Thank you for agreeing to take part in the Food and Cholesterol Study. This letter is to confirm you appointment,

date: .....

time: .....a.m.

The appointment will be at the CSIRO Division of Human Nutrition on Kintore Ave, Adelaide, in Clinic 2 on the second floor. Please show this letter to the receptionist when you arrive, and she wi direct you to us.

The map over the page should help you find us. If you come in by car, parking is difficult in this area after 8.30 am. David Jones car park is close to us, just off North Tce in Gawler Place and is free if you leave by 10 am. We will reimburse you for parking fees or public transport costs related to your visit.

Please remember not to eat or drink anything except small amounts of water for 12 hours before your appointment time. Tea, coffee or any other fluids or foods may affect your blood cholesterol level. You will be offered a light breakfast after your blood test.

Please fill out the food booklet (enclosed) and read the information sheet and bring them back with you when you come in for your blood test. The booklet will probably take about 2 hours to fill out, so allow yourself enough time when you are feeling fairly relaxed and calm!

We hope you enjoy participating in the Food and Cholesterol Study. If you have any queries, my phone number is 224 1875 (best in the afternoons).

Yours faithfully,

Alison Smith, Study Co-ordinator.

Appendix 4.2 (cont)

INFORMATION SHEET
CSIRO DIVISION OF HUMAN NUTRITION
"FOOD AND CHOLESTEROL STUDY"

The purpose of this study is to improve the health of the community by finding better ways of helping people in all walks of life to eat healthy food.

1. People invited to take part in the study have been chosen randomly from the Electoral Rolls.

The study will involve:

2. Filling out a booklet about what food you usually eat, and some other things (such as your age) which we know influence the food people eat, but we need to know more about how they do so.

3. Fasting overnight for 12 hours (no food or drink apart from small amounts of water) and then giving a 10 ml blood sample which is analysed for cholesterol level. The blood sample is taken by a qualified nursing sister. The cholesterol result is given to all participants within 3 weeks, at no cost. We will also measure participants' height and weight.

4. Participants are then randomly chosen to be either in a group that comes in for a second, 1 hour interview to receive information about their cholesterol level and food intake straight away, or into a group that receives only their cholesterol level straight away, and waits three months for information about their food intake, after the follow-up visit 3 months later. Cholesterol results will be sent to participants within 2-3 weeks. The group that receives the dietary advice is also asked to briefly record their progress with dietary change.

5. Three months later at the end of the study, participants will be asked to fill in another booklet about usual food intake and come in again for another blood cholesterol test.

6. At the end of the study, all participants will receive their final cholesterol result and written information about how their food intake compares to the healthy eating guidelines, and how they could improve the way they eat. Information on difficulties involved in changing food intake will also be sought.

I have read and understood the information given to me about this study.

Signature of Volunteer: ..... Date:__ / __ / __

Appendix 4.2 (cont)

CONSENT FORM
CSIRO DIVISION OF HUMAN NUTRITION
SOCIAL NUTRITION AND EPIDEMIOLOGY PROGRAM

1. I..... (please print) hereby voluntarily consent to take part in the research project entitled: "Food and Cholesterol Study".

2. I acknowledge that I have read and understand the attached Information Sheet entitled "Food and Cholesterol Study" which I have dated and signed.

3. I am aware that this study will involve me physically and mentally in the manner described in the attached Information Sheet.

4. I understand that any samples obtained from me will be used for research purposes only, and that while information gained during this study may be published, I will not be identified and my personal results will not be divulged.

5. I recognise that this research is aimed at improving the health of the general community and that I may not necessarily benefit personally from the research findings.

6. I understand that I am free to withdraw from the project at any stage.

Signature of Volunteer ..... Date__ / __ / __

Signature of Witness ..... Date__ / __ / __

Name of Witness .....

Address of Witness .....

.....

Appendix 4.3 Clinic assessment form

Name ..... Time _ _:_ _ - - - - - -
ID: _ _ _ _ Date _ _/_ _/_ _

Allocated to: Intervention/Comparison group -

* Do they suffer from:

Heart disease	Yes No	-
High blood pressure	Yes No	-
Diabetes	Yes No	-
*Are they (females <45,50)Pregnant	Yes No	-

*On medications (including OC) Yes No -

*If yes, please name ..... --
--
--

*Time ate last	_ _ _ _ am/pm	-
*Time of last drink	_ _ _ _ am/pm	-
*Taken 10ml blood sample?	Yes No	-
*Weight	_ _ _ . _ kg	- - - -
* Height (first visit)	_ _ _ . _ cm	- - - -

Pre/post 1/2 -

.....

Appendix 4.4 The format of the intervention interview

ID _ _ _ _ ----
Date _ _ / _ _/91 -- -- --

Thank you for coming in today.

1. *Have you ever had a cholesterol test before?* 1. No 2. Yes -
   (If yes) What were the results? _ _._ mmol/L, year: _ _ --- --
   _ _._ mmol/L, year: _ _ --- --
   And did you do anything to change it? 1. No 2. Yes -
   What? 1. Medication
   2. Low fat diet
   3. Take supplements
   4. Weight loss
   5. Other
   6. Exercise -

2. *Have you any family history of heart disease?* 1. No 2. Yes -
   In which family members? Mother (no) -
   Father (no) -
   Sibling (no of brothers and sisters) -
   Aunt/Uncle (no aunts, uncles) -
   Grandparents (no) -

3. *Would you say that you are on any special diet?* 1. No 2. Yes -
   What type of diet? 1. Weight reduction 6. Vegetarian
   2. Cholesterol lowering 7. Therapeutic
   3. General better diet 8. Naturopathic
   Other _____ -

4. *If no to all of the above . . .*
   Have you ever tried changing your diet? 1. No 2. Yes -
   What changes? 1. Weight reduction 4. General health
   2. Weight increase 5. Circumstantial
   3. Cholesterol 6. Vegetarian
   Other _____ -

5. *Have you presently any reason for wanting to change the way you eat, or the type of food you eat?* 1. No 2. Yes -
   1. Weight loss 5. Getting older
   2. General health 6. Vegetarian
   3. Cholesterol 7. Adequate nutrition
   4. General health 8. Family members diet
   Other _____ -

**Now go through the dietary feedback*

6. Which foods or habits would you like to try and change, and think that you could succeed? (Write in their suggestions)

1. -- --

2. -- --

3. -- --

4. -- --

5. -- --

7. What do you think will be the main problems in making these changes to the way you eat?

1. --

2. --

3. --

4. --

8. Can you think of any ways of getting around these problems?

9. Are you thinking of changing anything else to make you healthier, such as...

Smoking	1. trying to cut down	
	2. trying to give up	
	3. Don't smoke	
	4. No	--
Doing more exercise	1. Yes	
	2. No	--
Changing your alcohol intake	1. Yes,	
	2. No	--
Cutting down on tea or coffee	1. Less tea	
	2. Less coffee	
	3. Decaff or substitute	
	4. No	--

Subjective notes

Did they seem to be a person who feels they should be able to control their food intake?

Not at all 1 2 3 4 5 Very controlled

Did they acknowledge other significant influences on what food they eat?

Not at all 1 2 3 4 5 Very influenced

Did they seem confident that they could manage the changes suggested?

Not at all 1 2 3 4 5 Very confident

How well did they seem to follow?

Not at all 1 2 3 4 5 Very well

Did they ask many questions?

None at all 1 2 3 4 5 A very great number

How long was the interview? _ _ minutes

Any other notes of interest:

Revised FFQ? 1. No 2.Yes --

Appendix 4.5 The format of the followup interview for the intervention group

ID _ _ _ _ Date _ _/_ _/92 Classify as 1. changer 2. not changer 1 2

1. How much of the time over the past two and a half months do you feel you have stuck with the changes to your eating habits?

	0	1	2	3	4	5	6		
1.	0%	10%	25%	50%	75%	80%	100%	NA	_
2.	0%	10%	25%	50%	75%	80%	100%	NA	_
3.	0%	10%	25%	50%	75%	80%	100%	NA	_
4.	0%	10%	25%	50%	75%	80%	100%	NA	_
5.	0%	10%	25%	50%	75%	80%	100%	NA	_

2. Have you changed anything else in the way you eat? _ _ _ _ _ _

3. How easy have you found it to stick with?
Difficult Sometimes one or other Easy _

4. Do you intend to keep up these changes in the next 12 months?
No Some Yes all _

5. How confident are you that you will be able to do this?
Not very A bit Fairly A lot _

6. Did you refer to the 12345+ diagram or think about it during the last 3 months?
Not much A bit Fair bit A lot _

7. How much did:
a)the personalised feedback motivate you to change the way you eat?
Not much A bit Fair bit A lot _
b)receiving the record sheet motivate you to change the way you eat?
Not much A bit Fair bit A lot _

8. How much did having a cholesterol test motivate you to change the way you eat?
Not much A bit Fair bit A lot _

9. Were you hoping to reduce your cholesterol level?
1. No 2. Yes 1 2

10. How much did being weighed motivated you to change the way you eat?
Not much A bit Fair bit A lot _

11. Were you hoping to lose weight?
1. No 2. Yes 1 2

12. Are you happy with the amount of weight you have lost? 1. Yes 2. No 1 2

13. Was there anything outside of the study that helped you to change the way you eat?
1. Spouse, family 4. Community awareness
2. Will power 5. Media
3. No 6. other advice (GP, WW, etc) _____
7. Family history 8. Other information (cookbook)
9. Therapeutic diet _

14. Did you talk to anyone about the changes you were making? 1. No 2. Yes 1 2
Who did you talk to?

2. Spouse, partner	0 1	3. Parents	0 1
4. Children	0 1	5. Friends	0 1
6. Workmates	0 1	7. Neighbours	0 1
8. Siblings	0 1		

Appendix 4.6 The format of the follow-up interview for the control group

ID _ _ _ _ Date _ _/_ _/92

1 Had you ever had a cholesterol test before the one you had for this study?

1. Yes if so, what was it _ _ . _ _ and when (year) 19 _ _ 1 2
2. No _ _ . _ _
19_ _

2. How did you feel about your test result from this study?

Pleased Neutral/Don't know Not pleased 1 2 3

3. Did you do anything to try and change your cholesterol level?

1. No 1 2
2. Yes 1. Medication_____
   2. Diet (6)
   3. Supplements
   4. Weight loss
   5. Other
   6. Exercise
   7. Went to doctor _

4. Was there anything else which caused you to change your eating habits in the last three months?

1. No 1 2
2. Yes, if so, what

1. Holiday	7. Wt diet	13. More food
2. Stress	8. More junk	14. Circumstances
3. Prev wt diet	9. Less meat	15. Illness
4. Allergy	10. Social	16. Therapeutic
5. Gen health	11. Barley,etc	
6. More care	12. Inc Healthy food	

_ _

5. Did filling out the booklet cause you to change your eating habits at all?

1. No 2. Yes 3. More awareness, but no specific change 1 2

6. Did you change anything else which might be better for your health?

1. No 2. Yes, if so, what:

Smoking	1.less 2.same 3.more	1 2 3
Exercise	1.less 2.same 3.more	1 2 3
Alcohol	1.less 2.same 3.more	1 2 3
Tea, Coffee,	1.less 2.same 3.more	1 2 3

(If no to all dietary change questions)

8. Have you ever tried changing your diet, or the food that you eat?

1. No
2. Yes . . .

1. Weight reduction	2. Cholesterol reduction
3. Weight increase	4. General health improvement
5. Disease, allergy, diabetes	6. Changed living circumstance

_

9. Have you presently got any reason for wanting to change the way you eat?

1. No 2. Yes 1 2

What reason?

1. Weight loss	2. Feel better
3. Reduce cholesterol	4. Disease, diabetes

_

Has this respondent's first booklet been revised? 1. No 2. Yes 1 2

Appendix 4.7 Questionnaire booklet used in the intervention trial (reduced by 15%)

CSIRO DIVISION OF HUMAN NUTRITION

FOOD AND CHOLESTEROL STUDY

ALISON SMITH
Phone: 224 1800

ABOUT THIS STUDY

This study is designed to find out some things we need to know , to help people to eat healthier food. This is important because it may help to stop people having heart attacks and getting some cancers.

In this booklet there are questions about what food you eat, about your social background and about some of the ways you think about food and health. We know that some of these things are likely to influence the foods people eat, and we need to get a clearer understanding of them.

All the information you give us will be treated in the strictest confidence. No personal details will be given to anyone, and, all personal identifying information (such as names and addresses) will be destroyed at the end of the project. We do ask for some personal information (eg your age and income). This is not meant to be an invasion of privacy, but it is important because social background does affect what diseases people get and what food they eat.

Please answer all the sections carefully and return the booklet to us when you come in for your cholesterol test.

Thank-you.

ALISON SMITH
CSIRO
DIVISION OF HUMAN NUTRITION
KINTORE AVENUE
ADELAIDE, S. AUST. 5000

Telephone: 224 1800

YOUR HEALTH

Q-1 *How bad an **effect** do you think the following things have on the **health of people like yourself**?* Circle **one** number on **each line**

	No effect	Slight effect	Moderate effect	Bad effect	Very bad effect
Eating unhealthy foods high in fat and low in fibre	1	2	3	4	5
Smoking 20 cigarettes a day	1	2	3	4	5
Living in a polluted area	1	2	3	4	5
Working in a dirty job, with dust or chemicals	1	2	3	4	5
Drinking more than 4 glasses of alcohol every day	1	2	3	4	5
Being 10 kg or 20 lb overweight	1	2	3	4	5
Exercising less than twice a week	1	2	3	4	5

Q-2 **Health experts say that eating too much fatty food and not enough wholemeal bread, cereals, fruits and vegetables can cause bad health.**
How likely do you think it is that such eating habits contribute to these health problems? Please circle one number in each line.

	Very unlikely	Fairly unlikely	Slightly likely	Moderately likely	Very likely
Heart disease	1	2	3	4	5
High cholesterol level	1	2	3	4	5
Overweight	1	2	3	4	5
Diabetes	1	2	3	4	5
High blood pressure	1	2	3	4	5
Stroke	1	2	3	4	5

YOUR OWN EATING HABITS

This section is about the kinds of foods **you usually** eat. On the next few pages you will find lists of foods and questions about what you eat.

Read through each list of foods and write in how often **you usually** eat these foods. We know you may eat differently from day to day, so just try to give us the best overall picture that you can.

THIS IS HOW TO ANSWER

The opposite page has examples of how we would like you to fill in the questions. We are going to ask you **"About how often do you usually eat these foods?"** Use the code you can see on the top of the opposite page to write your answers.

If you **NEVER** have a food ..... write **N**
If you **RARELY** have a food (less than once a month) ..... write **R**

If you usually eat a food

About once a **MONTH** ..... write **1M**
About twice a **MONTH** ..... write **2M**
About three times a **MONTH** ..... write **3M**

About once a **WEEK** ..... write **1W**
About twice a **WEEK** ..... write **2W**
About three times a **WEEK** ..... write **3W**
and so on ..... **(4W, 5W, 6W, etc)**

About once a **DAY** ..... write **1D**
About twice a **DAY** ..... write **2D**
and so on ..... **(3D, 4D, 5D, etc)**

Serve sizes

If you usually eat **more** or **less** than the serve size shown for a particular food, please write on the **COMMENTS** line how much more, or less, is eaten at a time.

For example, if you usually eat one scoop of icecream instead of our standard serve of two scoops, write **one scoop only** on the comments line.

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

HERE ARE SOME EXAMPLES

		COMMENTS
Custard	1/2 cup	3W
Boiled egg	1 egg	3M 2 eggs
Cucumber	3 slices (each 0.5 cm thick)	R
Tea	1 cup	1D 4 cups
Beetroot - canned	2 slices	2M 1 slice

The person above has :

- **Half a cup** of custard **three times a week**
- **Two** boiled eggs **three times a month**
- **Rarely** eats cucumber
- **Four** cups of tea **every day**
- **1 slice** of beetroot - canned, **twice a month**

We realise that some people have an **exact** idea of how often they eat particular foods, whilst others only have an **rough** idea.

Be as accurate as you can but do not spend too much time choosing your answers.

PLEASE GIVE AN ANSWER FOR EVERY FOOD.

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CEREALS		***COMMENTS***
Porridge/Oatmeal	1 cup (cooked)	.....
Muesli	1/2 cup	.....
Other breakfast cereal	1 cup	.....
Plain bran (raw)	1 tablespoon	.....
Wheatgerm	1 tablespoon	.....
Bread roll (NOT hamburger buns)	1 roll	.....
Fried rice	1 cup (cooked)	.....
Boiled rice	1 cup (cooked)	.....
Instant noodles	1 cup (cooked)	.....
Other pasta (spaghetti, macaroni etc)	1 cup (cooked)	.....

Q-1 *How many slices of bread do you **usually** eat? **Remember the bread in toast and sandwiches.** If you do not eat bread, write 'none'.*

_____slices/**day** OR _____slices/**week** . . .

Q-2 *What type of bread do you **usually** eat? (Circle the number beside **one** answer)*

1 Wholemeal or mixed grain
2 White
3 About half the time wholemeal and half white
4 Other breads (eg rye, Hi-Fibe)
(please specify type).....
5 I do not eat bread

Q-3 *Do you eat **low-salt** types of bread? (Circle **one** answer)*

ALL or MOST OF THE TIME **OCCASIONALLY** **RARELY/NEVER**

Q-4 *Which of the following do you **usually** spread on bread or crackers? (Circle **one** answer)*

1 Butter
2 Polyunsaturated margarine
3 Table or cooking margarine
4 Reduced-fat margarine (eg Era)
5 Dripping/Lard
6 I don't use anything
7 I don't eat bread or crackers
8 Something else : please name.....

Q-5 *Do you **usually** use regular or reduced-salt butter or margarine (Circle **one** answer)*

1 I usually use the **regular** variety 2 I usually use the **reduced-salt** variety

Q-6 *What types of breakfast cereals do you **most commonly** eat?*

Please name : .....

Q-7 *If you eat **muesli** is it:- (Circle **one** answer)*

1 Plain, untoasted muesli 2 Toasted muesli

Q-8 *How many cups of milk do you **usually** add to breakfast cereal, porridge or muesli? (Circle the number closest to the amount you have)*

1 None
2 About a half a cup
3 About one cup
4 About one and a half cups
5 About two cups or more (please state how much.....)

Q-9 *What type of milk do you **usually** add to cereals, porridge or muesli? (eg whole milk, Skimmer, Tone, powdered skim, Shape, goat's milk, condensed/evaporated milk etc)?*

Type of milk added:.....

Q-10 *How many teaspoons of sugar or honey do you **usually** add to cereal, porridge or muesli? (Note: 1 dessertspoon = 2 teaspoons)*

Write the number of teaspoons you have here : .....

Q-11 *Do you add salt to your porridge? (Circle **one** number)*

1 Yes
2 No
3 I don't eat porridge

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CEREAL FOODS		***COMMENTS***
Crumpet or Muffin	1	.....
Croissant	1	.....
Fruit Loaf/Currant bread	1 slice	.....
Sweet bun/Doughnut	1	.....
Crispbread/Cracker	2	.....
Salted biscuits	3	.....
Plain sweet biscuits	2	.....
Fancy biscuits (eg choc-coated)	2	.....
Cake	1 small cake or 1 slice large cake	.....
Milk pudding (eg rice, sago)	1/2 cup	.....
Steamed sponge - suet	1/4 small pudding	.....
Fruit Pie	I small pie	.....

Q-1 *What type of cake do you **most commonly** eat? (eg fruit cake, cheesecake, sponge cake, iced sponge, tea-cake etc)*

Please name : .....

Q-2 *Do you have milk :*

*(Circle **one** for each)*

in your tea?	YES	NO	DON'T DRINK TEA
in your coffee?	YES	NO	DON'T DRINK COFFEE
in your coffee substitute?	YES	NO	DON'T DRINK COFFEE SUBSTITUTE

105 eol

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

HOW OFTEN DO YOU USUALLY HAVE THESE DRINKS?

BEVERAGES		***COMMENTS***
Carton of flavoured milk (eg iced coffee, strawberry etc)	small carton (300 ml)	.....
Cocoa	1 cup	.....
Milo/Drinking Chocolate etc	1 cup	.....
Glass of milk (as such)	1 glass	.....
Milk shake/Thick shake	regular size	.....
Tea	1 cup	.....
Herbal tea	1 cup	.....
Coffee	1 cup	.....
Decaffeinated coffee	1 cup	.....
Coffee substitute (eg Caro)	1 cup	.....

Q-1 *Do you make your cocoa/chocolate/Milo/Akta-Vite with : (Circle **one** number)*

1 Mostly milk?
2 Mostly water?
3 About half and half?
4 I do not drink these drinks.

Q-2 *What type of milk do you **usually** add to tea/coffee /cocoa/chocolate etc? (Please state the type of milk used eg whole milk, Skimmer, Tone, powdered skim, Shape, goat's milk, condensed milk, evaporated milk etc).*

Type of milk added.....

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Q-1 *How many **teaspoons** of sugar or honey do you usually have in each cup of :*

*(Circle **one** number for each drink)*

Tea?	0	1	2	3	4	5	6
Coffee?	0	1	2	3	4	5	6
Coffee substitute?	0	1	2	3	4	5	6
Milo, drinking choc, etc?	0	1	2	3	4	5	6
Cocoa?	0	1	2	3	4	5	6

Q-2 *When you eat cheese, do you have the **reduced-salt** types? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Rarely or never
4 I do <u>not</u> eat cheese

Q-3 *When you eat cheese, do you have the **reduced-fat** types? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Rarely or never
4 I do <u>not</u> eat cheese

Q-4 *When you eat yoghurt which type is it? (Circle **one** number)*

1 Plain (eg not fat-reduced)
2 Plain, low-fat
3 Fruit flavoured (not fat-reduced)
4 Fruit flavoured, low-fat
5 Frozen yoghurt
6 I do <u>not</u> eat yoghurt

Q-5 *When you eat ice-cream, diet-ice or similar is it **usually**? (Circle **one** number)*

1 Low calorie
2 Regular ice-cream
3 Other (please state.....)

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

DAIRY PRODUCTS and EGGS			***COMMENTS***
Cheese	30 grams (1 slice)		.....
Low-fat Cottage Cheese	100 gm (1/2 carton)		.....
Cream	1 tablespoon		.....
Yoghurt	200 gm (1 carton)		.....
Icecream	2 scoops	(SUMMER)	.....
		(WINTER)	.....
Vitari	1 cone	(SUMMER)	.....
		(WINTER)	.....
Ice Block/Icy Pole	One	(SUMMER)	.....
		(WINTER)	.....
Custard	1/2 cup		.....
Fried egg	1 egg		.....
Boiled egg	1 egg		.....
Omelette/Scrambled eggs	2 eggs		.....

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

MEATS		***COMMENTS***
Steak (eaten as such)	1 medium	
Pork chop	1 chop	
Lamb chop	2 chops	
Roast pork/Pork fillet	2 slices	
Roast beef/veal	2 slices	
Roast lamb	2 slices	
Sausages	2 thick or 3 thin	
Frankfurters/Saveloys	2 thick or 3 thin	
Bacon	2 rashers	
Ham	3 thin or 2 thick slices	
Luncheon meat/Fritz/Devon	3 slices (1 cm thick)	
Continental sausage (Salami/Mettwurst/Cabanossi)	3 slices	
Pate/Liver paste	1 tablespoon	
Liver	1/2 liver (150 gm)	
Kidney	2 kidneys	
Brains	1/2 cup	

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

MIXED DISHES		***COMMENTS***
Hamburger WITH bun	1 medium	
Hamburger patty (WITHOUT bun)	1 medium	
Pizza	1/2 small or 1/4 large pizza	
Sausage roll	1 large, 2 small	
Meat pie	1 pie	
Meat pie (home made)	1 indiv. pie OR 1 slice large pie	
Pastie	1	
Crumbed veal (schnitzel)	1 large piece	
Stew/Casserole/Curry/Goulash (with meat or chicken)	1 cup	
Stew/Casserole/Curry/Goulash (without meat or chicken)	1 cup	
Chinese meat & veg dish	1 cup	
Savoury pies/pastries (eg quiche)	1 indiv. pie OR 1 slice large pie	
Mince meat (eaten as such)	1 cup	
Mince meat dishes (eg shepherds pie)	1 piece (8x8x4cm)	
Spicy mince added to pastas (eg spag. sauce)	1/2 cup mince	

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CHICKEN, FISH and SEAFOOD -		***COMMENTS***
Roast/Barbecue chicken	2 slices breast or 1 drumstick/2 wings	.....
Boiled chicken	as above	.....
Crumbed, fried chicken	4 small pieces	.....
Fried fish	1 piece	.....
Fish without batter (steamed/grilled/boiled)	1 piece	.....
Canned fish (tuna, salmon etc)	1/3 cup	.....
Fish fingers	3-4 fingers	.....
Seafood (prawns, crab, lobster etc)	1/2 cup	.....
Mornay dishes	1 cup	.....

Q-1 *If you eat the following meats, how are they usually cooked? (Circle one for each food)*

Steak	**FRIED**	**GRILLED/BAKED**	**MICROWAVED**	**DON'T EAT**
Chops	**FRIED**	**GRILLED/BAKED**	**MICROWAVED**	**DON'T EAT**
Sausages	**FRIED**	**GRILLED/BAKED**	**MICROWAVED**	**DON'T EAT**
Bacon	**FRIED**	**GRILLED/BAKED**	**MICROWAVED**	**DON'T EAT**

Q-2 *When you eat meat with fat on it, do you eat: (Circle one number)*

1 All of the fat
2 Most of the fat
3 About half of the fat
4 Little or none of the fat
5 I do not eat meat

COOKING METHODS

Q-1 *Do you take the skin off chicken? (Circle one number)*

1 Always or nearly always
2 Sometimes (about half the time or less)
3 Rarely (less than a quarter of the time)
4 Never
5 I do not eat chicken

Q-2 *If you eat fried fish, in which of the following is it usually coated? (Circle one number)*

1 Batter
2 Breadcrumbs
3 Flour
4 Other coating; please name.....
5 Fried without coating

Q-3 *Please choose one type of oil or fat from the list below for each of the next three questions.*

1 **Vegetable oils (olive, sunflower etc)**
2 **Cooking or table margarine**
3 **Butter**
4 **Dripping/ lard/meat juices**
5 **Polyunsaturated margarine**
6 **Nothing**

From the list above write which type of fat or oil is most ***commonly*** *used :*

(a) When roasting or frying meats or fish.....

(b) When roasting or frying vegetables.....

(c) On vegetables when served .....

Q-4 *Is butter or margarine added to your potatoes when they are mashed? (Circle one number)*

1 Yes, always

2 Yes, occasionally

3 Never

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

Some vegetables may be eaten more frequently at some times of the year than others (eg in the warmer or cooler weather). Please fill in how often each food is eaten in BOTH the warmer months of the year (**Summer**) and the cooler months (**Winter**).

For example- If you usually have:

A serve of peas about twice a week during the **warmer** months of the year and about every day during the **cooler** months:

and:

Two medium potatoes (roasted) a week throughout the year:

You would write.....

		Summer	Winter
Green peas	1 cup	2W	1D
Potato - roasted	1 medium	1W	1W 2 potatoes

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

SEASONAL VEGETABLES		Summer	Winter
Potato - fresh & mashed (with milk)	1/3 cup	.....	.....
Potato - fresh, boiled	1 medium	.....	.....
Potato - roasted	1 medium	.....	.....
French Fries/Hot chips	17-18 chips	.....	.....
Carrots (fresh/frozen)	1/3 cup	.....	.....
Turnip, Swede(fresh/frozen)	1/3 cup	.....	.....
Broad beans (fresh/frozen)	1/2 cup	.....	.....
Green beans (fresh/frozen)	1/3 cup	.....	.....

SEASONAL VEGETABLES (continued)		Summer	Winter
Green peas (fresh/frozen)	1/3 cup	.....	.....
Cabbage	1/3 cup	.....	.....
Brussel sprouts (fresh/frozen)	5-6	.....	.....
Silver beet/Spinach (fresh/frozen)	1/3 cup	.....	.....
Broccoli (fresh/frozen)	1/3 cup	.....	.....
Cauliflower (fresh/frozen)	1/2 cup	.....	.....
Pumpkin	1/3 cup	.....	.....
Sweetcorn (fresh/frozen)	1 small cob	.....	.....
Zucchini (courgettes)	1 medium sized	.....	.....
Onion - fried	1/4 cup	.....	.....
Onion (raw, baked, boiled) (fresh/frozen)	1 medium	.....	.....
Tomato - fresh	1 medium	.....	.....
Tomato - grilled/fried	1/2 medium	.....	.....
Lettuce	2 small leaves	.....	.....
Cucumber	3 slices (each 0.5 cm thick)	.....	.....
Coleslaw	1/2 cup	.....	.....
Celery (fresh/frozen)	one 15cm stick	.....	.....
Capsicum (Green Pepper) (fresh/frozen)	2 strips (each 0.5 cm thick)	.....	.....
Mushrooms - fresh	6-7 small ones	.....	.....
Bean sprouts	1/3 cup	.....	.....
Fried mixed vegetables (eg stir fried)	1/2 cup	.....	.....

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CANNED and DRIED VEGETABLES		*COMMENTS*
Potato - canned	2-3 small	.....
Potato - packet (powdered)	1/3 cup (cooked)	.....
Potato salad	1/3 cup	.....
Carrots - canned	1/3 cup	.....
Beetroot - canned	2 slices	.....
Green beans - canned	1/3 cup	.....
Three bean mix - canned	1/3 cup	.....
Baked beans in tomato sauce	1/3 cup	.....
Green peas - canned	1/3 cup	.....
Lentils - dried/canned	1/3 cup	.....
Zucchini salad	1/3 cup	.....
Sweetcorn - canned (including creamed corn)	1/3 cup	.....
Mushrooms - canned	6-7 small ones	.....
Mushrooms - canned in sauce	1/3 cup	.....
Olives	3 medium	.....
Gherkins/Pickled onions	3 pieces	.....

Q-1 *When you use canned vegetables, are they **reduced-salt** varieties? (Circle **one** number)*

1 Always or nearly always
2 Sometimes
3 Never or rarely
4 Only for some vegetables (please state which.....)

Q-2 *Is salt added to the cooking water when **boiling** the following foods? (Circle **one** for each food)*

Vegetables	USUALLY	SOMETIMES	NEVER
Pasta and rice	USUALLY	SOMETIMES	NEVER

Q-3 *If salt is added to the cooking water when **boiling** foods, is the water : (Circle **one** number)*

1 Lightly salted
2 Medium salted
3 Heavily salted
4 Salting is highly varied
5 Salt is not added to cooking water

Q-4 *How often do you add salt to meals **after** they are cooked? (Circle **one** number)*

1 Rarely or never
2 Sometimes
3 Always or nearly always

Q-5 *When you add salt **at the table**, how much do you **usually** add? (Circle **one** number)*

1 A light sprinkle
2 A medium sprinkle
3 A heavy sprinkle
4 Salting is highly varied
5 I do not add salt at the table

Q-6 *When your vegetables are cooked which of the following methods is the one **most commonly** used? (Circle **one** number)*

1 Boiled in a little water
2 Boiled in a lot of water
3 Steamed
4 Cooked in a pressure cooker
5 Microwaved
6 Stir-fried

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

FRUIT		*COMMENTS*
Orange, Mandarin, Grapefruit	1 medium	.....
Apple, Pear - fresh/baked	1 medium	.....
Banana	1 medium	.....
Fresh fruit salad	1 cup	.....
Dried fruit (apple/apricot etc)	4-5 pieces	.....
Raisins, sultanas or currants	1/3 cup	.....
Fruit in syrup or stewed	1/2 cup	.....
Fruit canned in water(low-cal)	1/2 cup	.....

Some fruits are also seasonal, and people may eat a lot of them at certain times of the year

HOW OFTEN DO YOU EAT THESE FOODS WHEN THEY ARE IN SEASON?

SEASONAL FRUITS		*COMMENTS*
Berries - fresh/frozen	3/4 cup	.....
Melon (not watermelon)	1 large slice	.....
Peach/Nectarine - fresh	1 medium	.....
Plum - fresh	3-4 plums	.....
Apricot - fresh	3 apricots	.....
Grapes - fresh	about 20	.....
Pineapple - fresh	1 slice	.....
Avocado	1/2 an avocado	.....

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
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			and so on	and so on

OTHER FRUITS *Are there any other fruits you eat regularly which have not been mentioned (eg kiwi fruit, mangoes etc)? Please write them below.*

Name of food	Usual serve size	How often do you eat it?
.....	.....	.....

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

NUTS and SNACKS		*COMMENTS*
Potato crisps, Twisties etc	1 small bag or 14-15 pieces	.....
Peanuts (fresh)	9-10 nuts	.....
Nuts - salted & cooked	9-10 nuts	.....
Other unsalted nuts (fresh walnuts/almonds etc)	5-6 nuts	.....

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

SOUPS		*COMMENTS*
Canned soup (eaten as such)	1 cup (WINTER)	.....
	(SUMMER)	.....
Packet soup (eaten as such)	1 cup (WINTER)	.....
	(SUMMER)	.....
Homemade soup (eaten as such)	1 cup (WINTER)	.....
	(SUMMER)	.....

Write an example of the type of soup you most often eat (eg canned tomato; homemade pea and ham)

.....

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY EAT THESE FOODS?

CONFECTIONERY, JAMS and SAUCES		*COMMENTS*
Chocolate	1 small bar (50 grams)	.....
Chocolate covered bar (eg Mars/Bounty)	1 bar	.....
Individually wrapped lollies; toffees	4-5 lollies	.....
Packet lollies (eg Lifesavers/Polos)	1 small packet	.....
Muesli bar/Health bar	1 bar	.....
Honey, jam, marmalade	1 tablespoon	.....
Vegemite, marmite etc	1/2 teaspoon	.....
Thick sauces (tomato/HP etc)	1 tablespoon	.....
Polyunsaturated Mayonnaise/ Salad Cream	1 tablespoon	.....
Regular Mayonnaise/ Salad Cream	1 tablespoon	.....
Low calorie salad dressings	1 tablespoon	.....
Polyunsaturated salad dressings	1 tablespoon	.....

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W and so on	1 2 3 D and so on

ABOUT HOW OFTEN DO YOU USUALLY HAVE THESE FOODS?

BEVERAGES		*COMMENTS*
Glass of cordial	medium glass	.....
Glass of cola (eg Coca-Cola)	medium glass	.....
Glass of other soft drink includes mineral water with juice	medium glass	.....
Glass of low-calorie soft drink	medium glass	.....
Fruit drink (eg Fruit Box)	1 carton (250 ml)	.....
Pure fruit juice	medium glass	.....
Vegetable juice	small glass	.....
Water/Spring water	medium glass	.....
Plain mineral water	medium glass	.....
Low-alcohol beer	medium glass 230 mls	.....
Beer	medium glass 230 mls	.....
Alcoholic cider	medium glass 230 mls	.....
Wine	1 wine glass	.....
Wine Cooler	1 wine glass	.....
Sherry/Port/Liqueur	1 standard serve	.....
Spirits (whisky, brandy etc)	1 nip	.....

If you have any other foods or drinks that we have not mentioned, once a month or more, please write them down here and tell us how often you have them.

HOW TO ANSWER

NEVER	RARELY	Times a MONTH	Times a WEEK	Times a DAY
N	R	1 2 3 M	1 2 3 W	1 2 3 D
			and so on	and so on

FOODS AND DRINKS I CONSUME THAT HAVE NOT BEEN MENTIONED:
(eg, Lebanese or other ethnic foods, scones and pancakes, vegetarian foods)

Name of Food	Your usual serve size	How often do you eat it?
_____	_____	.....
_____	_____	.....
_____	_____	.....
_____	_____	.....
_____	_____	.....

Q-1 *Where do you (or the person who does most of the shopping) usually shop , when you buy the following foods? Please name the type of shop, the shopping centre or street, and about how often you shop there(if you don't usually buy these foods, please write* ***"don't buy"*** *next to that food).*

	Name of shop (eg Woolworths, local deli)	Where is it? (road, suburb)	How often?
Meat and Chicken	.....	.....	.....
Fish	.....	.....	.....
Fruit and Vegetables	.....	.....	.....
Groceries	.....	.....	.....
Lunch	.....	.....	.....
Takeaway meals	.....	.....	.....

CHANGING EATING HABITS

Q-1 Where have you found out most about healthy eating and nutrition?
Please circle :

1. TV Programs
2. TV Advertising
3. Womens magazines
4. Health magazines
5. Newspapers
6. Family
7. Friends
8. Other (please name) _____

Q-2 *In the last 6 months, have you tried to make any of these changes to the food you eat ?*
Please circle YES or NO

Eat less fatty meat?	YES	NO
Eat less cheese or full cream milk	YES	NO
Eat more pieces of fruit a day	YES	NO
Eat more serves of vegetables a day	YES	NO
Eat more wholemeal breads each day	YES	NO
Eat more wholegrain cereals each day	YES	NO

Q-3 *If you* ***wanted to eat healthier*** *food, how confident are you that you* ***could do it*** *in these situations?*

	Not at all Confident	Slightly Confident	Moderately Confident	Quite Confident	Very Confident
You see some delicious unhealthy food in a shop	1	2	3	4	5
Someone at a party offers you food you know you shouldn't eat	1	2	3	4	5
You are out for a meal with friends and don't want to be different to them	1	2	3	4	5
You feel worried or depressed	1	2	3	4	5
You are alone and no-one is watching you	1	2	3	4	5
You are tired	1	2	3	4	5

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FOOD AND HEALTH

Q-1 *Some people like to choose what food they eat, and only eat healthy food. How much do you personally agree or disagree tha these sentences are true for you?*
*Please circle **one** number for each sentence.*

	Strongly Disagree				Strongly Agree
Whether I eat healthy food or not is entirely my decision	1	2	3	4	5
People who like the taste of healthy food are just lucky	1	2	3	4	5
If I try, I can eat only healthy food	1	2	3	4	5
I usually eat whatever I get, I don't fuss over whether the food I eat is healthy or not	1	2	3	4	5

Q-2 *For a healthy eating pattern, how many serves a day do you think you **should** eat of these foods? (Circle **one** number for each food)*

	NUMBER OF SERVES				
BREADS AND CEREALS (1 slice of bread or 1 bowl of cereal)	1	2	3	4	5 or more
FRUITS (1 medium piece)	1	2	3	4	5 or more
MILK AND DAIRY FOODS (1 large glass of milk or 40g cheese)	1	2	3	4	5 or more
VEGETABLES (about 1/3 cup)	1	2	3	4	5 or more
LEAN MEATS, CHICKEN AND FISH (about 2 slices roast, 1 chop, 1medium fillet of fish etc)	1	2	3	4	5 or more

IDEAL HEALTHY EATING

Imagine yourself in an ideal world, where you had a lot of spare time, and as much money as you needed. You could eat anything you wanted to, **as long as it was very healthy**. *Please write down the healthiest food and drink for **one day** that you can imagine (even if you don't really like the food). For serve size, please state number of pieces, or small, medium or large serve size, eg 2 slices of bread, 1 small chop, 300 ml of milk, 1 apple etc.*

MEAL	SERVE SIZE	TYPE OF FOOD AND DRINK
BREAKFAST	_____	_____
	_____	_____
	_____	_____
MORNING TEA	_____	_____
	_____	_____
LUNCH	_____	_____
	_____	_____
	_____	_____
	_____	_____
AFTERNOON TEA	_____	_____
	_____	_____
DINNER/TEA	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
SUPPER	_____	_____
	_____	_____

DIETARY CHANGES, SMOKING AND EXERCISE

Q-1 *Some people are trying to change the food they eat.* ***Please circle the number that goes with the sentence that is most true for you.***

1 I am not thinking about eating healthier food

2 I think that I will need to start eating healthier food one day

3 I think that I should start eating healthier food soon, but I am not quite ready

4 I am thinking about how to get started with eating healthier food

5 I have already started to eat healthier food (e.g., looking for different foods at the shops; finding recipes for healthy food; eating more healthy foods and less unhealthy food)

6 I usually do eat healthy food

Q-2 (a) *About how often did you exercise for fun or fitness in the last 2 weeks (by exercise we mean brisk walking, jogging, swimming, cycling, keep-fit exercises, team sports etc)? (Please circle* ***one*** *number)*

1 Less than once a week
2 Once or twice a week
3 Three times a week or more
4 **NOT AT ALL**→go to Question 3 below

Q-2 (b) *About how long did you exercise for* ***each*** *time? (Please circle* ***one*** *number)*

1 Less than 20 minutes
2 20-30 minutes
3 More than 30 minutes

Q-3 (a) *Have you* ***ever*** *smoked on a regular basis? (Please circle* ***one*** *number)*

1 YES
2 NO

Q-3 (b) *Do you* ***currently*** *smoke cigarettes, pipes or cigars? (Please circle, and write in* ***amount****)*

1 YES, I smoke_____cigarettes, cigars and pipes/day

2 NO, I don't smoke at all

BACKGROUND

Please answer these questions carefully so that we can find out more about social background and food intake. Everything you tell us will be kept completely confidential.

Q-1 Your sex: (Please circle one)

1 Male
2 Female

Q-2 Your present age: .....YEARS

Q-3 What is your usual occupation? Even if you are retired or not currently employed, please write down what your usual occupation would be. Please be specific.

.....

Q-4 Are you (please circle):

1 Employed full time
2 Employed part time
3 Nor employed outside the home
4 A student
5 Retired
6 Unemployed

Q-5 If you live with a spouse or partner, what is his or her usual occupation? If retired or employed in home duties, please give their previous occupation

.....

Q-6 Is your spouse or partner (please circle):

1 Employed full time
2 Employed part time
3 Not employed outside the home
4 A student
5 Retired
6 Unemployed

Q-7 What country were you born in?

.....

Q-8 How many adults do you live with? (Please circle one number)

..... adults

Q-9 How many dependant children do you have?

..... children

Q-10 What is your marital status (please circle one)?

1 Single
2 Married or de facto
3 Divorced or separated
4 Widowed

Q-11 How much education have you had? (Please circle all those you have done)

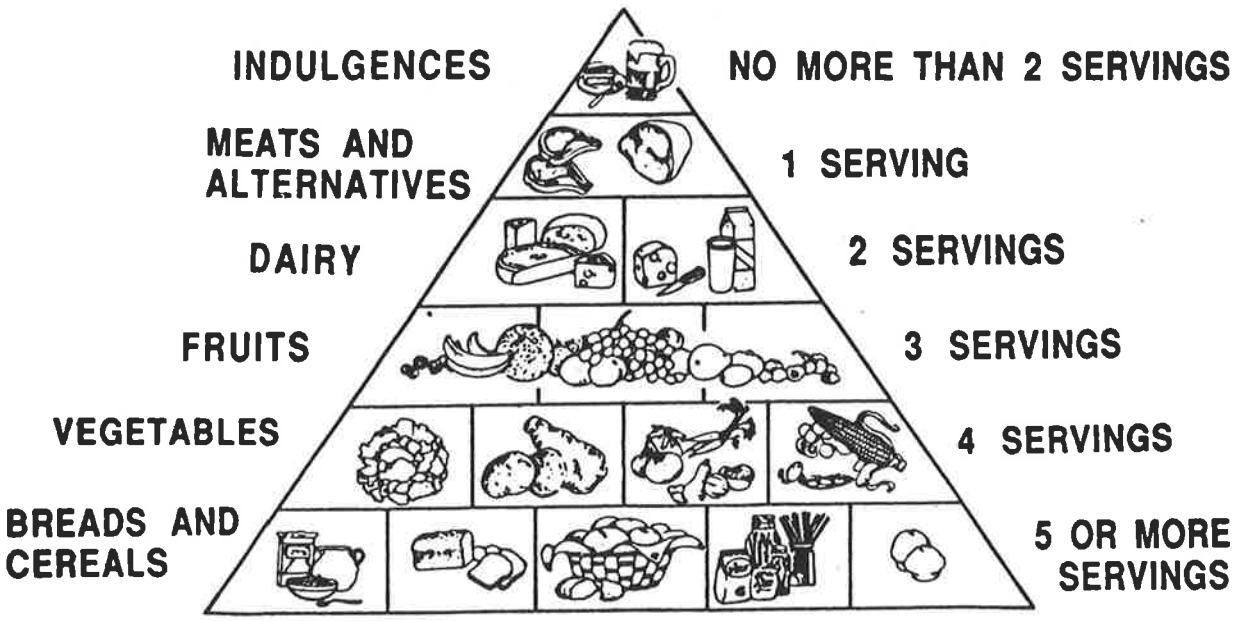
1 Primary school
2 1-3 years of high school
3 4 years of high school
4 5 years of high school
5 Trade or technical school
6 University or college diploma
7 University or college degree

Q-12 What is the total income (before tax) of all the members of your household, including pensions and benefits? (Please circle one number)

1 up to $8,000 per year
2 $8,001-$13,000 per year
3 $13,001-$16,000 per year
4 $16,001-$25,000 per year
5 $25,001-$32,000 per year
6 $32,001-$40,000 per year
7 $40,001-$60,000 per year
8 $60,001 or more
9 I don't know or don't wish to answer

Appendix 4.8 The "Personalised Healthy Eating Record" which included the intervention materials in the intervention trial

FOOD AND CHOLESTEROL STUDY



YOUR PERSONALISED HEALTHY EATING PLAN

NAME:

Thank you for taking part in the Food and Cholesterol Study. The information that you provide us with will be very useful to help us find out more about what people eat, why they eat what they do, and how we can do better at helping people to eat healthier food.

Your participation is important, because the more that is known about what all sorts of people need to help them eat healthy foods, the better we will be able to help people stay healthy and avoid disease.

This booklet contains your personalised healthy eating plan. You will find information on your weight and cholesterol level together with the recommended levels for good health. Your intake of nutrients including fats, sugars, proteins, carbohydrates, fibre, vitamins and minerals are listed; together with recommended daily nutrient intake levels. We have also computed your usual daily eating pattern, which can be compared to the recommended healthy eating pattern. Finally we will discuss the steps that you personally could take to bring your food intake pattern is closer to the healthy eating guidelines.

I look forward to working with you to help you learn more about food and health. I also look forward to your assistance in helping us to learn more about helping people to eat well, feel better and keep fit and healthy.

Yours faithfully,

Alison Smith
Nutritionist, Study Co-ordinator

Nutrient intake feedback inserted here, example shown.

DAILY INTAKE OF	YOUR INTAKE	IDEAL INTAKE see note (a)	AVERAGE AUSTRALIAN INTAKE
Kilojoules (Energy)	6653	see note (b)	7,700 (Women) 9,700 (Men)
PERCENTAGE OF ENERGY FROM:			
Protein	17%	less than 17%	17%
Carbohydrates			
Total	38%	at least 55%	44%
Starch, natural sugars	33%	at least 48%	32%
Refined sugars	5%	less than 12%	11%
Fats:			
Total	31%	less than 33%	35%
Saturated (animal)	13%	less than 10%	14%
Cholesterol (mg)	331	less than 300	280
Alcohol (gm)	34	less than 20 (F) less than 40 (M)	4 11
Fibre (gm)	22	at least 30	21
Sodium (salt) (mg)	1543	less than 2,300	3,300
Calcium (mg)	864	at least 800 see note (c)	1000
Iron (mg)	15.2	at least 7 see note (d)	14.3 (M) 12.7 (F)

(a) This ideal intake is based on amounts recommended by the Australian National Health and Medical Research Council and the Australian Better Health Commission.

(b) Your energy needs will depend on your age, sex, height, and level of exercise.

(c) Women need only 800 mg per day before menopause, but at least 1000 mg per day after menopause.

(d) Women need at least 12 mg iron per day before menopause, but only 7 mg per day after menopause.

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Followed by analysis of food groups contributing to high intake levels, example shown.

FOODS CONTRIBUTING TO YOUR NUTRIENT INTAKE

Your nutrient intake has been checked for every nutrient for which Australian recommendations have been set.

This page shows any nutrients for which your daily intake was too high or too low.

If your intake of any nutrient is too high, a list of the foods which are contributing to this high intake will be printed.

If your intake of any nutrient is lower than recommended, a list of good food sources of this nutrient will be printed

---

Your intake was found to be SOMEWHAT HIGHER than recommended for:

*CHOLESTEROL
64% came form red meat
19% came from cheese, yoghurt and milk
10% came from butter, margarine and salad dressings

* SATURATED FAT
46% came from cheese, yoghurt and milk
30% came from butter, margarine and salad dressings
7% came from red meat

Your intake was found to be somewhat lower than recommended for:

* STARCH AND NATURAL SUGAR
good sources are: whole-grain cereals, starchy vegetables, fruit

*FIBRE
good sources are: whole-grain cereals, vegetables, fruit

Followed by eating pattern and comparison with the 12345+ eating pattern, example shown.

FOOD	SERVES PER DAY		RECOMMENDED SERVES PER DAY
Red meat	0.4		
Meat dishes and stews	0.1		
Chicken, fish and seafood	0.3		
Eggs and quiche	0.0		
Processed meat and sausages	0.0		
TOTAL MEAT AND EGGS.....		0.8	1
Cheese, yoghurt and milk	0.9		
Milk added to cereals and drinks (cups)	1.4		
TOTAL CHEESE, YOGHURT AND MILK.....		2.3	2
Fruit	1.6		
Fruit and vegetable juices	0.1		
TOTAL FRUIT AND JUICES.....		1.7	3
Vegetables, carrot and pumpkin	0.0		
Vegetables, leafy green	1.7		
Vegetables, starchy	0.3		
Vegetables, salad	0.3		
Beans, lentils and vegetarian dishes	0.0		
Other vegetables	1.2		
TOTAL VEGETableS.....		3.5	4
Soup	0.1		
Bread, slices	2.0		
Bread rolls	0.1		
Crispbreads, crumpets and crackers	0.2		
Cereals, rice and pasta	1.5		
TOTAL BREAD AND CEREALS.....		3.8	6
Butter and margarine	2.3		

	SERVES	INDULGENCES	
Hot drinks	3.0	0.0	
Sugar added to cereal, hot drinks (tsp)	4.0	0.5	
Low calorie dressings, sauce, vegemite	0	0	
Salad dressing	0	0	
Nuts	1.0	0.5	
Crisps	0.0	0.0	
Takeaway foods	0	0	
Vitari and iceblocks	0.1	0.0	
Icecream	0.1	0.0	
Plain biscuits, honey, jam	0.1	0.1	
Fancy biscuits, cakes, buns	0	0	
Lollies and "health" bars	0	0	
Chocolate	0	0	
Soft drinks	0.0	0.0	
Alcoholic drinks	3.3	1.6	
TOTAL INDULGENCES.....		2.8	0-1

YOUR HEALTHY EATING PLAN page 6

The eating habit changes listed below should be manageable for you; they will also give you a healthier eating pattern. I am looking forward to finding out about your progress with these changes to your eating habits, over the next two and a half months.

Step 1.

Step 2.

Step 3.

Step 4.

We would like you to keep a record for one week of your progress with these changes. Please keep this record on the loose pages labelled "YOUR HEALTHY EATING RECORD" and send them back to us in the freepost envelope provided. You will also be sent a second Healthy Eating Record in one months time and a third towards the end of the study in two months time.

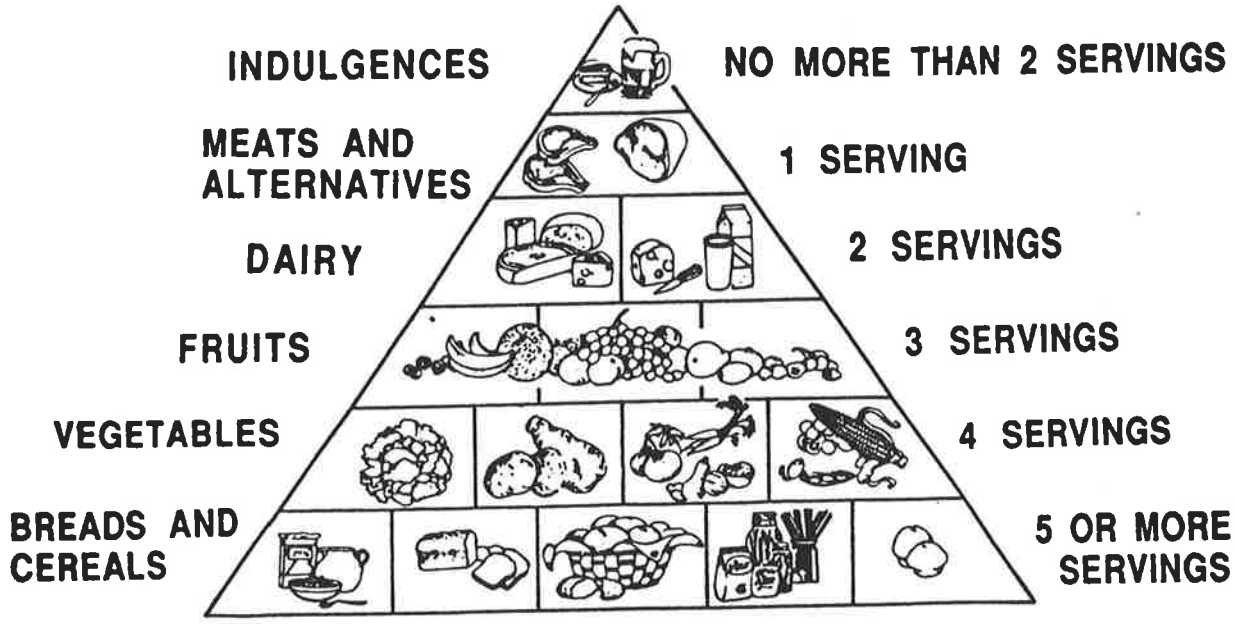
The next three pages give you more information about the 12345+ healthy eating pattern.

YOUR NOTES

THE 12345+ HEALTHY EATING PLAN page 7

What should I eat to stay as healthy as possible?
How can I reduce the fat, sugar and salt that I eat, increase the fibre, vitamins and minerals and still eat good, tasty food?

The picture below shows how to eat healthy food, as recommended by medical and nutritional experts, and the Commonwealth Department of Health.



BASED ON YOUR USUAL INTAKE OF _____Kilojoules (_____Calories), EACH DAY YOU SHOULD EAT:

1 serve from the red meat group,
2 serves from the milk and dairy foods group,
3 serves from the fruit group,
4 **or more** serves from the vegetable group,
_ serves from the wholegrain bread and cereal group, and
_ serve(s) **or less** from the "indulgence" group.

We have called this the **1,2,3,4, 5+ Healthy Eating Plan**.
Food groups and serving sizes are explained on the next page.

WHAT ARE THE FOOD GROUPS AND SERVE SIZES? page 8

1. MEAT GROUP - ONE SERVE A DAY

This includes lean red meats. Poultry, fish, eggs and legumes such as dried peas and beans can also be used. Red meat should preferably be eaten at least 3-4 times a week, but only in small serve sizes. The meat should be cooked using no extra fat if possible, eg, grilled, baked, microwaved.

SERVE SIZES
60g (cooked weight) of lean red meat
Two eggs (only once a week)
2/3 cup (cooked weight) dried peas, beans or lentils
120g fish, seafood, poultry or veal

2. DAIRY GROUP - TWO SERVES A DAY

This includes milk, cheese and yoghurt. These should be low-fat where possible although some low-fat cheeses, such as cottage or ricotta cannot be counted as they have very little calcium.

SERVE SIZES
1 large glass milk (300ml)
40g (1oz) cheese, 200g carton of yoghurt (plain or fruit)

3. FRUIT - THREE SERVES A DAY

This includes raw, stewed or canned and dried fruits. Only one serve of fruit juice a day should be included as it does not provide any fibre.

SERVE SIZES
1 piece of medium sized fruit (apples, orange, banana etc)
3 pieces of smaller stone fruits (apricots, plums etc)
10-12 small grapes or berry fruits, 4-6 pieces of dried fruit
1/3 cup of stewed or canned fruit (sugar-free or low)

4. VEGETableS - FOUR SERVES A DAY

This should include vegetables (raw) or lightly cooked without fats. Frozen vegetables are fine but avoid vegetables canned with salt or brine. At least one serve should come from each of the *STARCHY, DARK-GREEN LEAFY AND CRUCIFEROUS, RED-YELLOW* and *OTHER* vegetable groups listed below.

SERVE SIZES

STARCHY
1 medium potato
1/2 sweet potato
1/3 cup parsnip

DARK-GREEN LEAFY OR CRUCIFEROUS VEGETableS
1/3 cup of cabbage, spinach, broccoli, cauliflower, brussel sprouts

RED-YELLOW
1/3 cup carrot or pumpkin

OTHER VEGETableS
1/3 cup of zucchini, lettuce, salad vegetables, peas, green beans, broad beans, lentils

5. BREAD and CEREALS - FIVE OR MORE SERVES EACH DAY page 9

At least three quarters of these should be wholemeal. Choose those with lower salt and sugar contents.

SERVE SIZES	*1 slice of bread or 1/2 roll*	*1/2 cup cooked rice*
	1 cup of breakfast cereal (30g)	*1 cup pasta*
	1 slice bread or 1/2 yeast bun	*2 wheatflake biscuits*

6. INDULGENCES OR EXTRA FOODS

THE 12345+ HEALTHY EATING PLAN allows most people to have **two serves of "indulgence foods" a day,** unless they already eat very little. "Indulgence foods" include all extra foods like cakes, biscuits, soft drinks, alcoholic drinks, nuts, potato crisps, icecream, fats, oils and cream. Sample serves contain approximately 600 kilojoules or 150 Calories.

SERVE SIZES *2 standard alcoholic drinks or soft drinks*
1 piece of cake or 1 bun
1 Tablespoon of fat spread or oil, (except that used sparingly on bread)
4 Tablespoons of cream
2-3 biscuits
30g of chocolate, toffees or nuts
3 Tablespoons of jam or honey or 8 teaspoons of sugar

Many other foods could be listed but are similar to foods already shown, so use similar amounts.

7. SAMPLE MENU

An example of a 1,2,3,4,8 healthy eating pattern (with 1 "indulgence"):

		SERVES
Breakfast:	*1 serve of breakfast cereal and 2 slices toast*	3 Bread & Cereals
	300 ml of low fat milk	1 Milk serve
Morning tea:	*1 muffin, a cup of tea or coffee*	2 Bread & Cereals
Lunch:	*1 cup rice with stir-fried vegetables*	
	OR a salad sandwich	2 Cereal,1 Vegetable
	1 piece of fruit, glass of water	1 Fruit serve
Afternoon tea:	*1 piece of fruit, glass of water or tea or coffee*	1 Fruit serve
Evening meal:	*1 grilled chop or a small steak (60-100g)*	1 Meat serve
	1 medium potato (or more)	1+Vegetable serves
	1/3 cup carrots	1 Vegetable serve
	1/3 cup broccoli	1 Vegetable serve
	1 piece of canned fruit, 1 scoop of icecream	1 Fruit, 1/2 "Indulgence"
	1 glass of beer or wine	1/2 "Indulgence"
Supper:	*1 thin slice cheese with 3-4 crackers*	1/2 Milk, 1 Cereal
Plus	*Milk for tea and coffee*	1/2 -1 Milk serves

Appendix 4.9 Age-adjusted nutrient densities of males and females in the survey and intervention samples

	Males			Females		
	S	I	t value	S	I	t value
Number	391	475		199	288	
Energy (kJ)	9293	9553	1.14	7431	7860	1.89
Percent of energy from:						
Protein	15.7	15.5	0.09	16.8	16.4	2.02*
Fat	35.5	32.1	7.03***	35.3	32.1	7.57***
Saturated	13.1	12.0	4.03***	13.0	11.7	5.44***
Mono-unsaturated	12.5	11.1	6.77***	12.5	11.0	8.15***
Poly-unsaturated	6.01	5.93	0.40	5.98	6.19	1.25
Carbohydrates	44.5	48.3	6.55***	44.7	49.2	9.76***
Refined sugars	8.59	10.4	3.55***	7.21	8.00	2.04*
Natural sugars	10.8	12.8	3.85***	12.9	15.5	5.88***
Alcohol	3.80	2.70	2.67**	2.30	1.38	3.61***
Cholesterol (mg/10MJ)	282	253	3.14**	284	251	4.35***
Fibre (g/10MJ)	24.9	26.8	2.13*	29.9	33.4	4.17***
Sodium (mg/10MJ)	3430	2850	11.0***	3450	2940	11.0***
Potassium (mg/10MJ)	3890	4460	6.71***	4560	5230	7.99***
Calcium (mg/10MJ)	1010	1160	5.23***	1130	1260	4.69***
Magnesium (mg/10MJ)	365	404	4.68***	414	458	5.39***
Iron (mg/10MJ)	15.0	15.0	0.00	16.6	16.6	0.00
Zinc (mg/10MJ)	13.2	12.4	3.81***	14.2	13.3	4.50***
β-carotene (ug/10MJ)	4730	4890	0.79	6520	7180	2.29*
Folate (ug/10MJ)	247	249	0.29	292	307	1.92

S: survey sample; I intervention sample

* $p<0.05$; ** $p<0.01$; *** $p<0.001$ referring to the difference between mean nutrient density levels of the intervention and survey samples

Appendix 4.10 Proportions of males and females in three agegroups reporting recent dietary change: comparison between the survey and intervention samples.

	Males						Females					
	Age 18-39		Age 40-59		Age 60+		Age 18-39		Age 40-59		Age 60+	
	S	I	S	I	S	I	S	I	S	I	S	I
Sample size	176	67	142	71	76	62	216	98	152	97	106	93
Consumption level changed (% of sample):												
Increased fruit	39	52	27	49	17	44	45	66	39	60	21	60
Increased vegetables	40	33	23	27	16	34	44	47	39	58	19	53
Red'd high fat dairy	36	39	27	39	30	39	46	45	48	59	24	69
Increased bread	25	22	23	30	16	29	30	31	31	35	13	41

S Survey sample; I Intervention sample

Appendix 4.11 Age-adjusted height, weight and body mass index of men and women in the survey and intervention groups

	Males		Females	
	S	I	S	I
Sample size	379	199	465	287
Height (cm)	176.7	175.5	163.6	162.4
Weight (kg)	76.7	76.7	62.8	63.1
BMI (kg/m^2)	24.6	24.9	23.4	24.0

S: survey sample; I intervention sample

Appendix 4.12 Proportions of the whole sample and age groups in the survey and intervention samples answering health belief questions strongly in the affirmative

	Males						Females					
	18-39 years		40-59 years		60+ years		18-39 years		40-59 years		60+ years	
	S	I	S	I	S	I	S	I	S	I	S	I
Sample size	176	67	142	71	76	62	216	98	152	97	106	93
Bad effect on health of (% of sample) [a]:												
Diet	42	76	44	77	67	77	51	90	51	94	66	90
Smoking	86	96	83	90	82	90	87	98	82	94	84	97
Pollution	66	67	70	77	82	77	80	73	76	87	80	85
Occupation	74	72	76	83	82	85	84	91	82	91	78	88
Alcohol	69	64	68	69	83	74	76	85	82	87	88	88
Weight	49	63	40	72	54	71	48	83	49	85	57	90
Lack of exercise	47	25	41	41	53	39	48	29	43	49	54	43
Diet strongly causative of (% of sample) [b]:												
Heart disease	57	84	47	92	37	82	61	94	49	93	35	95
Cholesterol	75	85	62	92	63	87	78	95	72	96	58	96
Overweight	77	84	70	89	66	90	89	97	84	97	75	99
Diabetes	28	45	27	46	16	60	33	52	26	72	29	71
Hypertension	45	64	37	72	45	74	46	83	41	85	40	86
Stroke	33	64	23	72	25	77	38	80	29	86	30	88

S: survey sample; I intervention sample
(a) The survey sample was allowed one strongest option out of three; the intervention sample was allowed two strongest options out of five.
(b) The survey sample was allowed two strongest options out of four; the intervention sample was allowed two strongest options out of five.

Smith, A.M., and Baghurst, K.I., (1992) Public health implications of dietary differences between social status and occupational category groups.
Journal of Epidemiology and Community Health, v. 46 (4), pp. 409-416.

NOTE:
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http://dx.doi.org/10.1136/jech.46.4.409

Smith, A.M., and Owen, N., (1992) Associations of social status and health-related beliefs with dietary fat and fiber densities.
Preventive Medicine, v. 21 (6), pp. 735-745, November 1992

NOTE: This publication is included in the print copy of the thesis held in the University of Adelaide Library.

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