Journal of Epidemiology and Community Health 1994;**48**:26–32

Demographic and dietary profiles of high and low fat consumers in Australia

Katrine I Baghurst, Peter A Baghurst, Sally J Record

Abstract

Study objective – **To determine the sociodemographic, attitudinal, and dietary correlates of high and low fat consumption in the community.**

Design – **The study was undertaken using a postal survey format. A questionnaire was sent for self completion to a randomised sample of the adult population of two Australian states.**

Participants – **Adult participants were selected randomly from the Electoral Rolls of the states of Victoria and South Australia. As voting at elections is compulsory in Australia, these rolls contain the names of all Australian citizens over the age of 18 years. Altogether 3209 respondents completed the survey giving a response rate of 67%.**

Main results – **Lower than average fat consumption was more common in women. Age was a significant factor only in men. Occupation was not related to lower than average fat consumption but manual work and low occupational prestige were linked to higher than average consumption in men. People with a history of conditions related to heart disease were more likely to be low consumers but medical history did not distinguish high from average consumers. Low fat consumption was linked to higher refined and natural sugar consumption and higher alcohol consumption, but protein and complex carbohydrate consumption did not vary with fat consumption. Low fat diets also had higher densities of fibre and most vitamins and minerals, the exceptions being retinol, zinc, and vitamin B12, nutrients generally linked to meat and dairy consumption. Of the latter, only the low zinc concentrations, which are already borderline in the community, pose a potential nutritional problem.**

Conclusions – **This study showed very strong links between dietary fat intake and the intake of nearly all other nutrients in the diet. The results highlight the need to consider relationships between nutrients not only for purposes of nutrition education but also in relation to nutritional epidemiology studies.**

(*J Epidemiol Community Health* 1994;48:26–32)

Commonwealth Scientific and Industrial Research Organisation, Division of Human Nutrition, PO Box 10041, Gouger Street, Adelaide SA 5000, Australia
K I Baghurst
P A Baghurst
S J Record

Correspondence to:
Dr K I Baghurst.

Accepted for publication June 1993

In the past two decades increasing concern and knowledge about the role of diet in the aetiology of chronic disease have led to the development of dietary guidelines by health authorities in most industrialised societies. These guidelines seek to optimise the community's nutrition profile and thus, it is hoped, reduce the incidence of chronic disease. Although each country has developed its own guidelines, there is an encouraging degree of commonality in the recommendations made.[1] Some countries may be more specific than others in setting definite targets for population intake and some differences occur in the importance placed on certain issues, but one underlying theme is the need for a reduction in fat intake. This has led, in many countries including Australia, to a profusion of information from the health sector, the media, and the food industry about the need to reduce dietary fat and ways in which to achieve this. In Australia, this has resulted in a reduction in fat intake in the community from around 39–40% of energy in the late 1970s[2] to an average intake of 33–34% in the early 1990s.[3]

Little is known, however, about the demographic or dietary characteristics of those who are currently consuming diets relatively low in fat nor whether these self selected diets are optimal with respect to nutrients other than fat. In addition, little is known about those who still consume high fat diets – what they eat, how they prepare it, and what their general dietary profile is. To this end, a random survey of adults from two states of Australia was undertaken in late 1990–91 to establish the demographic and dietary profile of low and high fat consumers.

Methods

SURVEY TECHNIQUE

In late 1990, a postal survey of a random sample of adults living in the adjoining states of Victoria and South Australia was undertaken. The sample was selected by random number generation from the electoral rolls of both states. As voting is compulsory in both state and federal elections in Australia, the rolls contain the names of all Australian citizens over the age of 18 years. The questionnaire was designed according to the principles of Dillman.[4] Two weeks after the initial posting, a reminder postcard was sent to those who had not replied, followed two weeks later by another letter and replacement questionnaire. Altogether 3209 people responded to the survey, 67% of eligible participants. The study was approved by the CSIRO Division of Human Nutrition, Human Ethics Committee, and conformed to the principles embodied in the Declaration of Helsinki.

THE DIETARY INSTRUMENT

The dietary instrument is a quantitative food frequency questionnaire based on the computerised dietary analysis system developed by Baghurst and Record[5] for the Australian population. Questions were included on the usual frequency and volume of intake for 180 food and drink items using a standard response format. In addition, there were quantitative and qualitative questions concerned with cooking and food preparation practices, particularly in relation to their effects on the intakes of salt, sugar, vitamins, and fat. For instance, the questions relating to fat intake concerned the use of different types of fats and oils in the cooking and serving of meats, vegetables, salads, and pasta; the type and extent of use of fat spreads on bread and crackers; the trimming of fat from meat; the use of low fat dairy products; and the usual method of cooking – for example, frying, grilling, or microwaving of meats. Several questions relating to the use of salt addressed the issue of how often and how much salt was added when cooking foods such as vegetables, pasta, or rice and the use of salt "at the table". Answers to all these questions were used in the computer analysis program to modify the nutrient intake figures obtained from the food frequency section. The amounts of fats, salt, sugars, or vitamins added or subtracted according to the stated food preparation techniques of respondents were derived initially from experimental testing with random population samples.

Average daily consumptions of particular foods were calculated from the stated usual portion size and how often each food was eaten. An alpha-numerical scale was used to describe frequency such that the number of times a day, week, or month that a food was consumed could be defined as 2D, or 4W, or 5M, etc. Using this information and the nutrient content of the food item per unit weight taken from food tables, an individual's intake of nutrients per day could be calculated with the FREQUAN dietary analysis program.[5] The Australian nutrient data base[6] was used as the main source of information on the nutrient composition of foods. Where this data base did not contain information on the food, or for nutrients not covered, equivalent data were used from the British *McCance and Widdowson's Food Tables*.[7] Those nutrients not available in the Australian tables include fibre, folate, and vitamins B6 and B12. The natural and refined sugars data base was derived as previously described[8] using, where necessary, information from manufacturers and a recipe approach for mixed dishes such as fruit pies or fruits canned in syrups.

This dietary analysis system has been used extensively with Australian population samples in both epidemiological and survey work.[2,3,9–15] It has been shown to have high repeatability and consistency with other dietary intake measurement techniques[16–18] and has shown good reliability when assessed against urinary protein and sodium measurements.[18] There has been much recent discussion in the published reports on the strengths and weaknesses of food frequency questionnaires.[19–22] The discussion about the accuracy and validity of the food frequency approach, whether it is valid only for group means or can characterise individuals' diets, is limited by the variable nature of the instruments and techniques that are included under the rubric of "food frequency". Most food frequency questionnaires have been developed for epidemiological studies in which the main interest is to compare one group of people with another – for example, in a case-control study. Instruments designed primarily for these purposes often have an attenuated listing of foods and the size of servings or individual portions assessment is limited. In addition, the effects of cooking method, or food preparation techniques such as trimming fat off meat, are not always addressed if, for that given population, they add little to the ability to discriminate between subgroups. The instrument described here was designed to assess, in as much detail as possible, the usual intake of individuals. The food listing is long, frequency categories are open-ended, portion sizes can be individualised, all relevant cooking and food preparation practices are taken into account in terms of their effect on nutrient availability and loss, there is provision for the individual to add to the food listing if they wish, and detailed data are collected on all food supplementation practices. As outlined above, the intakes thus measured have correlated well at the individual level with recorded intake data and with selected biomedical measures.

STATISTICAL ANALYSIS

The categorical demographic and attitudinal data were examined across selected quintiles of percentage fat intake using maximum likelihood χ^2 analysis with one degree of freedom (df). Comparisons were made between the lowest percentage fat intake quintile and the middle or average quintile, and of the highest percentage fat quintile and the average. These two separate analyses were carried out as it was felt that characteristics distinguishing low and average fat consumers might be different from those distinguishing high and average fat consumers and that a direct comparison of high and low consumers might mask these differences. The cut-off levels for these three quintiles were as follows: up to 29·7% energy as fat for the lowest quintile (low fat consumers), from 33·3–35·8% for the middle quintile (average consumer), and above 38·6% for the top quintile (high fat consumer). For the nutrient intake data, an initial graphic display of the data showed that relationships between the percentage of fat in the diet and the density of other nutrients was mostly linear in nature so the statistical significance of the linear relationships were assessed by a χ^2 test on one df for linear trend. The nutrient intake data has been displayed in tabular form in relation to the three quintiles of the percentage fat intake described above and in graphic form for selected nutrients.

*Table 1 Demographic and medical correlates of low and high fat consumption compared with average consumption**

Variable	Heterogeneity, χ^2 significance			
	Low fat consumers (compared with average)		High fat consumers (compared with average)	
	Men	Women	Men	Women
Demographic variables:				
Gender	More women§		NS	
Age	Older§	NS	NS	NS
Occupational prestige	NS	NS	Lower‡	NS
Manual/non-manual work	NS	NS	Manual§	NS
Medical background:				
Blood pressure	NS	Yes†	NS	NS
High blood cholesterol	Yes†	Yes§	NS	NS
Heart disease	Yes‡	Yes†	NS	NS
Diabetes*	NS	NS	NS	NS
Bowel complaints*	NS	NS	NS	NS
Malignant growth*	NS	NS	NS	NS
Other lifestyle factors:				
Ever regularly smoked	NS	No†	NS	NS
High exercise level	NS	Yes‡	No†	NS

Significance of χ^2 statistic † $p<0.05$; ‡ $p<0.01$; § $p<0.001$.
* For these conditions, lack of statistically significant differences could be due to relatively low numbers of subjects with these conditions in the sample.

Results

DEMOGRAPHIC, MEDICAL, AND ATTITUDINAL VARIABLES

An analysis of the demographic descriptors of fat consumption (see table 1) showed that fat consumption was relatively lower in women than men and in older (over 60) than younger men (under 30 years). There was no age-related trend in women. There was no significant link between high fat consumption and gender or age for either men or women but high fat consumption was more evident in men of low occupational status, and particularly those in manual occupations. Women who were low fat consumers were less likely to have been regular smokers and to have higher exercise levels but no effect was seen for these variables in men. High fat consumption was linked to lower exercise levels in men but not women, and there were no links with smoking status. In terms of medical background, low fat consumers, for both men and women, had a higher reported incidence of high blood cholesterol and heart disease and, in women only, of blood pressure. No differences were seen in medical history between average and high fat consumers.

*Table 2 Recent dietary changes and attitudinal correlates of low and high fat consumption compared with average consumption**

Variable	Heterogeneity, χ^2 significance			
	Low fat consumer (compared with average)		High fat consumer (compared with average)	
	Men	Women	Men	Women
Recent changes in diet (self report):				
Increased fibre	Yes*	Yes‡	No*	NS
Decreased fat	NS	Yes‡	No‡	NS
Decreased sugar	NS	Yes‡	NS	NS
Decreased salt	NS	Yes‡	No*	NS
Do the following have a major effect on health?				
Eating the wrong foods	Yes*	Yes†	NS	NS
Smoking	NS	NS	NS	NS
Pollution	NS	Yes‡	NS	NS
Excess body weight	NS	Yes*	NS	NS
Lack of exercise	NS	NS	NS	NS
Drinking alcohol	NS	Yes†	NS	NS
Having a dirty job	NS	NS	NS	NS
General living conditions	NS	NS	NS	NS
Your doctor	NS	NS	NS	NS
Family health history	NS	NS	NS	NS
Family problems	NS	NS	NS	NS
Money worries	NS	NS	NS	NS
Bad luck	NS	NS	Yes*	NS
Strong influences on personal eating patterns:				
Transport	NS	NS	NS	NS
Food availability	NS	NS	NS	Yes*
Nutritional value	Yes†	Yes‡	NS	NS

Significance of χ^2 statistic * $p<0.05$; † $p<0.01$; ‡ $p<0.001$.

Women consuming low fat diets reported more recent changes in their diets than average fat consumers, but in men this was restricted to dietary fibre (see table 2). Women who were high fat consumers were not significantly different from the average consumer in terms of self reported recent dietary change but men consuming high fat diets reported fewer changes than the average consumer for fibre, fat, or salt intake. Women eating lower fat diets were more likely to believe that the wrong foods, pollution, excess body weight, and drinking alcohol could have a major effect on health, but for men only the response "eating the wrong foods" was found to be significantly different from average. Factors such as smoking, exercise, general living conditions, the doctor, money, genetic background, and "luck" were not rated differently by low and average fat consumers. For men with high fat consumption, the rating of "luck" as a determinant of health was significantly higher than for the average male consumer. In terms of factors influencing personal eating patterns, significantly more men and women in the low fat consumption group reported that "nutritional value" was a major determinant of food choice for them but for high fat consuming women more reported an influence of food availability.

NUTRIENT INTAKES

In terms of dietary intake, those who had the lowest relative intake of fats had lower total energy intakes; lower cholesterol, retinol, vitamin B12, salt, and zinc intakes; but higher relative intakes of natural and refined sugars (the latter for men only), fibre, and alcohol. They also had higher relative intakes of beta-carotene, most of the B vitamins, folate, and vitamin C. There were no differences in the contribution of complex carbohydrate or protein to energy intake between those who consumed relatively high or low intakes of fat (see tables 3 and 4 and fig 1).

In terms of the foods eaten, fig 2 shows the percentage differences in consumption, corrected for total energy intake, between the high and low fat quintiles for a variety of foods. The extreme two quintiles only are shown here as the "average" figure lay almost equally between the two for these foods. The lower fat intake quintile had higher relative consumption of cereals, including breakfast cereals and rice but not breads. This group also had a higher consumption of fruit, soft drinks, and alcoholic beverages and, to a small extent, vegetables. As might be expected, high fat consumers ate relatively more cakes and buns, biscuits, eggs, carcass meats, dairy foods, processed meats, and take-away foods. The low fat quintile ate more of their bread as the wholegrain variety (χ^2, low *versus* high quintile, $p<0.01$), and more low-salt breads (χ^2, $p<0.05$). They rarely used butter (only 10% of butter users were in this group *versus* 29% in the highest fat percentage quintile;

Table 3 Macronutrient intakes in those people in the lowest, middle, and highest quintile of percentage energy from fat (low, average, and high consumers respectively)

	Mean nutrient intake							
	Men				Women			
	Lowest % fat quintile	*Average % fat quintile*	*Highest % fat quintile*	*Linear trend*	*Lowest % fat quintile*	*Average % fat quintile*	*Highest % fat quintile*	*Linear trend*
Energy (kj)	8465	9450	10158	‡	7011	7924	8710	‡
% energy from:								
Fat	25·6	34·6	41·4	‡	26·3	34·6	40·9	‡
Saturated fatty acids	10·1	14·4	17·5	‡	10·5	13·7	17·2	‡
Monounsaturated fatty acids	8·5	11·6	14·1	‡	8·2	11·2	13·5	‡
Polyunsaturated fatty acids	4·9	6·3	7·1	‡	5·6	6·9	7·2	‡
Protein	16·3	16·4	16·8	–	17·8	17·4	16·7	–
Total carbohydrate	50·0	44·0	38·7	†	51·1	44·3	39·7	‡
Complex carbohydrate	19·2	19·2	19·9	–	18·4	19·2	19·2	–
Simple sugars	30·6	24·7	18·7	‡	32·3	24·9	20·4	‡
Natural sugars	16·8	12·4	9·2	‡	22·8	14·7	11·1	‡
Added sugars	13·7	12·2	9·5	†	9·5	10·2	9·3	–
Alcohol	6·5	3·7	1·8	†	2·9	2·0	1·2	*
P:S ratio	0·52	0·48	0·44	†	0·57	0·55	0·46	†

Linear trend significance * $p<0·05$; † $p<0·01$; ‡ $p<0·001$.

$p<0·001$) and more often used reduced fat milks, fully skimmed milks or soya milks, or reduced fat cheeses (all $p<0·01$). The low fat group was less likely to fry meats ($p<0·05$). More of the low fat consumers claimed to be non-meat eaters and more of those who did eat meats claimed to be trimming the fat off meat ($p<0·05$).

Discussion

The data on demography and attitudes showed that the characteristics distinguishing low from average fat consumers were often different from those distinguishing high from average. For example, medical background, particularly heart disease related factors, distinguished low from average fat consumers but played no role in distinguishing high from average consumers. Similarly, in men, occupational status and the extent of manual labour distinguished high from average consumers but was not related to low fat intake status. In women, there were also several attitudinal and lifestyle differences between low fat consumers and average consumers that were not evident in a comparison of high fat consumers and average consumers. A clearer understanding of the motivation of the various sectors of the community in relation to fat consumption, or indeed consumption of other nutrients of concern, is obviously important in the design of nutrition intervention strategies and these data highlight the need to look at attitudes of people throughout the spectrum of food consumption habits not just those at the extremes.

Table 4 Cholesterol, fibre, vitamin, and mineral intakes and densities (intake per unit of energy intake) in those people from the lowest, middle, and highest quintile of percentage energy from fat

		Mean nutrient intake							
		Men				Women			
		Lowest % fat quintile	*Average % fat quintile*	*Highest % fat quintile*	*Linear trend*	*Lowest % fat quintile*	*Average % fat quintile*	*Highest % fat quintile*	*Linear trend*
Cholesterol	(mg)	215	219	367	‡	168	235	299	†
	(mg/MJ)	25	31	37	†	24	30	35	†
Fibre	(g)	26·2	22·9	21·8	†	28·8	23·9	21·4	‡
	(g/MJ)	3·3	2·5	2·2	†	4·2	3·1	2·5	‡
Sodium	(mg)	2274	2873	3502	‡	2100	2607	3095	†
	(mg/MJ)	271	306	345	‡	299	330	357	‡
Calcium	(mg)	961	1072	1103	–	1130	1059	1039	–
	(mg/MJ)	117	114	110	–	160	133	118	†
Zinc	(mg)	10·4	11·8	13·6	†	9·7	10·7	11·8	†
	(mg/MJ)	1·27	1·28	1·35	*	1·39	1·37	1·35	*
Iron	(mg)	13·4	13·7	14·2	*	12·5	12·6	12·4	–
	(mg/MJ)	1·6	1·4	1·3	†	1·8	1·5	1·4	†
Magnesium	(mg)	360	350	345	–	342	323	313	–
	(mg/MJ)	42	35	33	†	48	40	36	†
Retinol	(µg)	453	645	914	‡	237	390	475	†
	(µg/MJ)	55	71	94	‡	33	49	54	‡
Beta-carotene	(µg)	5265	4352	4114	†	6185	5150	4455	†
	(µg/MJ)	675	493	427	†	929	667	526	‡
Vitamin A	(µg)	1330	1371	1600	†	1268	1248	1217	–
	(µg/MJ)	167	154	165	–	188	160	142	†
Thiamin	(mg)	1·2	1·3	1·3	–	1·2	1·2	1·2	–
	(mg/MJ)	0·15	0·14	0·13	*	0·18	0·16	0·14	†
Riboflavin	(mg)	2·1	2·2	2·2	–	2·1	2·0	2·0	–
	(mg/MJ)	0·25	0·24	0·22	*	0·30	0·26	0·23	†
Niacin	(mg)	20·8	21·7	22·6	–	18·0	19·1	19·1	–
	(mg/MJ)	2·57	2·40	2·31	*	2·61	2·48	2·28	*
Vitamin C	(mg)	209	168	134	†	214	186	138	‡
	(mg/MJ)	26·7	18·4	13·6	‡	32·4	23·6	15·8	‡
Vitamin B6	(mg)	1·7	1·6	1·5	†	1·6	1·4	1·4	–
	(mg/MJ)	0·21	0·17	0·15	‡	0·23	0·19	0·16	†
Vitamin B12	(µg)	3·9	4·5	5·5	‡	2·8	3·3	3·7	‡
	(µg/MJ)	0·46	0·49	0·56	†	0·39	0·42	0·43	*
Folate	(µg)	256	224	218	†	250	221	201	†
	(µg/MJ)	32	25	22	‡	37	28	24	‡

Linear trend significance * $p<0·05$; † $p<0·01$; ‡ $p<0·001$.

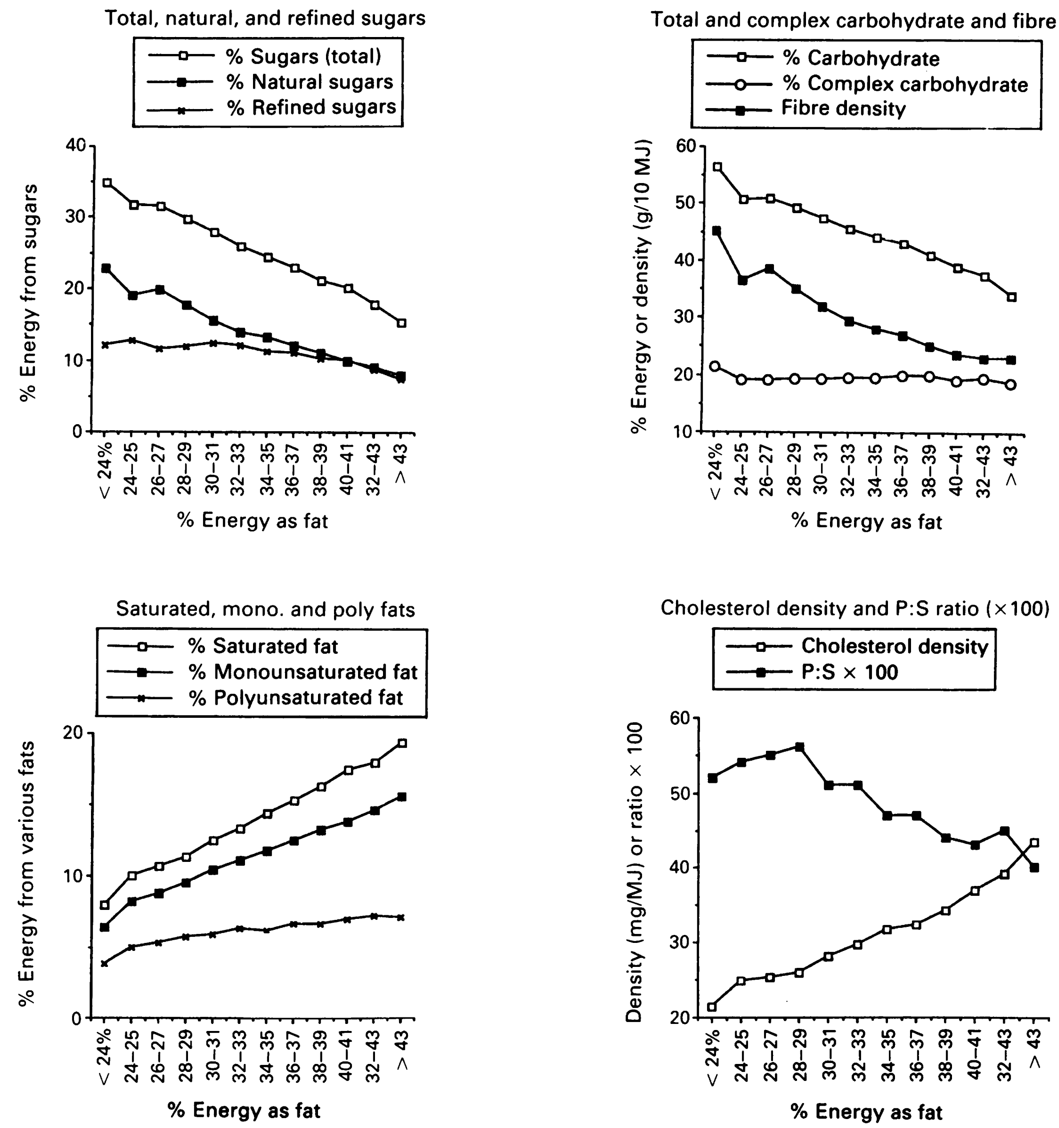

Figure 1 Interrelationships between fats and other dietary components in the population sample.

The data from these two surveys confirm the continuing downward trend in total fat consumption in the Australian population, previously indicated by both apparent consumption data[23] and by individual random population survey.[2,3,9–15] There are still several areas of concern, however, about the way in which the change is occurring. The data show that while the contribution of fat to energy intake is falling, there is still a wide range of fat intake in the community, with the lowest quintile of consumers eating, on average, only 25% of its energy as fat, while the upper quintile consumes on average over 40% of energy as fat. The nutrient data from the surveys also show that those who eat diets relatively low in fat are doing so by consuming relatively more simple sugars, both naturally derived and refined. While fibre intake is increased in those consuming lower fat diets, the contribution of co[illegible]arbohydrate to the diet is, if anything, lower and their retinol, zinc, and vitamin B12 intakes are also lower. For many subjects, the lower fat intakes were achieved by a major restriction in consumption of meats and dairy products leading to the observed lowering of zinc, B12, and retinol intakes. Lowering of retinol intake, however, was offset by an increase in betacarotene, and while B12 and, for men, calcium intakes were reduced in the low fat consumers, intakes were still adequate. Zinc intake, however, is borderline in the Australian population (recommended daily intake 12 mg) and this tendency for further decrease in low fat consumers is of concern.

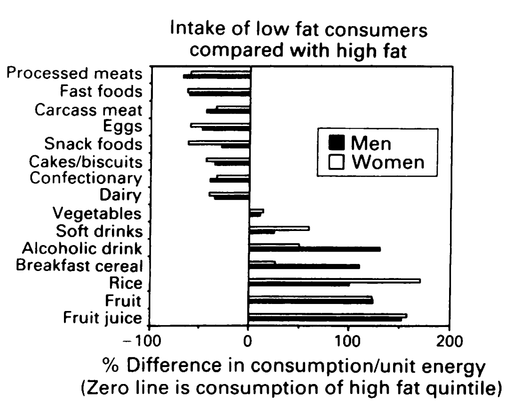

Figure 2 A comparison of the intakes of various food groups in high and low fat consumers.

It is also interesting to note that as all types of fat were reduced in the diets of those in the low fat quintile, the protein/sugar ratio, while improved a little from that of the high fat group, was still well below the target of 1:1. A higher alcohol intake also contributed to the lower percentage energy attributable to fat in the low consuming group. In some countries, energy derived from alcohol is excluded from calculations of dietary energy but in Australia it is traditionally included as it is felt that exclusion of alcohol is no more defensible in this context than exclusion of other nutrient-free energy sources such as soft or carbonated drinks or certain confectionaries.

Similar findings with respect to the fat/sugar interaction, and for some studies the fat/alcohol interaction, have been reported for two small scale surveys of some 68 men and women in Ireland[24] and 217 men and women from England,[25] and in two studies of large random population surveys of high added sugar consumers in the United States[26] and Australia,[15] indicating that the other fat/nutrient interactions seen in this study might be more widely applicable. In each of the studies listed above, and in the one reported here, the data were cross-sectional in nature but one other study of some 1000 adults taking part in a four year fitness intervention programme also showed that people who reduced their fat intake over the four year period did so partly by increasing their simple and refined sugar intake.[27] It has been suggested that the interrelationship between fat and sugars in the diet relates to variation in sensory preferences or to palatability considerations, or both,[25] but little work has been done to establish the underlying nature of this interaction.

Analysis of the food consumption patterns of the high, low, and average fat consumers showed that differences in fat intake were being achieved by a combination of differences in basic food choice between food groups, selection of lower fat alternatives within groups, and improvements in food preparation such as trimming of fat from meats.

Of all the dietary variables, dietary fat has received the most attention from government, health, and commercial sectors in the Australian community in the past decade and, indeed, in most developed countries. Progress is being made on the "fat" front at the population level in Australia, but the data from this study indicate a need to monitor the spectrum of unplanned dietary changes that might occur in response to nutrition intervention initiatives designed mainly to reduce fat intake. The data support the concept that for optimal effect, nutrition messages about specific nutrients should not be given in isolation but in the context of a general "healthy eating" message.

While the main purpose of this study was to further an understanding of the correlates of dietary fat intake and thus gain better insight into an area of community health concern, the strong nutrient intake correlations seen between dietary fat and nearly all other nutrients also highlights a potential problem for nutritional epidemiologists. As the nutrition educator may concentrate on one nutrient, with unforseen effects on others, so the epidemiologist might readily misinterpret nutritional data linking diet to disease outcome if the whole dietary picture is not takeninto consideration. Although corrections for dietary energy are used in many studies, interactions between nutrients, such as those shown in this study, are not always considered. The accuracy of estimation of intake of nutrients can vary noticeably across the nutrients due to variation in accuracy in assessment of their content in foods or in variation in accuracy of dietary intake measures for different nutrients. Multiple regression models are often used to try to determine the relative importance of different nutrients but this approach cannot always overcome the considerations outlined above where relative accuracy of measurement may come into play. In addition, many dietary instruments used in epidemiological work are designed only to assess a limited range of nutrients. If dietary fat were the nutrient of interest and if only a limited questionnaire was used, interpretation of results could be seriously flawed because of the strong interactions with a wide range of other nutrients.

Thus a sound knowledge of the interactions between nutrient variables in the diets of free living people is essential to people concerned with nutrition both in the community health and epidemiology disciplines.

1 National Research Council. Committee on Diet and Health, Food and Nutrition Board. *Diet and health. Implications for reducing chronic disease risk.* Washington DC: National Academy Press, 1989:675–90.

2 Baghurst KI, Record SJ. Intakes and sources in selected Australian subpopulations of dietary constituents implicated in the etiology of chronic disease. *Journal of Food and Nutrition* 1983;**40**:1–15.

3 Baghurst KI, Record SJ, Syrette JA, Baghurst PA. *The Victorian nutrition survey 1990.* Adelaide: Social Nutrition and Epidemiology Programme, CSIRO Division of Human Nutrition, 1991.

4 Dillman DA. *Mail and telephone surveys: the total design method.* New York: John Wiley, 1978.

5 Baghurst KI, Record SJ. A computerised dietary analysis system for use with diet diaries or food frequency questionnaires. *Community Health Stud* 1984;**8**(1):11–18.

6 Department of Community Services and Health. *Composition of Foods Australia.* Canberra: Australian Government Publishing Service, 1992.

7 Paul AA, Southgate DA. *The McCance and Widdowson food tables.* 4th rev ed. Amsterdam: Elsevier, 1978.

8 Baghurst KI, Record SJ, Syrette JA, Crawford DA, Baghurst PA. Intakes and sources of a range of dietary sugars in various Australian populations. *Med J Aust* 1989;**151**:512–18.

9 Baghurst KI, Record SJ, Syrette JA, Baghurst PA. *The South Australian dietary survey – 1988.* Adelaide: Social Nutrition and Epidemiology Programme, CSIRO Division of Human Nutrition, 1989.

10 Baghurst KI, Worsley A, Crawford DA, Baghurst PA, Record SJ, Syrette JA. *The Victorian Nutrition Survey 1985.* Adelaide: Social Nutrition and Epidemiology Programme, CSIRO Division of Human Nutrition, 1987.

11 Smith A, Baghurst KI. Public health implications of dietary differences between social status and occupational category groups. *J Epidemiol Community Health* 1992;**46**:409–16.

12 Baghurst KI, Dreosti IE, Syrette JA, Record SJ, Baghurst PA, Buckley RA. Zinc and magnesium status of Australian adults. *Nutr Res* 1991;**11**:22–32.

13 Rohan TE, McMichael AJ, Baghurst PA. A population-based case-control study of diet and breast cancer in Australia. *Am J Epidemiol* 1988;**128**:478–89.

14 Baghurst PA, McMichael AJ, Slavotinek AH, Baghurst KI, Boyle P, Walker A. A case-control study of diet and cancer of the pancreas. *Am J Epidemiol* 1991;**134**:167–79.

15 Baghurst KI, Baghurst PA, Record SJ. Demographic and nutritional profiles of people consuming varying levels of added sugars. *Nutr Res* 1992;**12**:1455–65.

16 Rohan TE, Record SJ, Cook MJ. Repeatability of estimates of nutrient and energy intake: the quantitative food frequency approach. *Nutr Res* 1987;**7**:125–37.

17 Rohan TE, Potter JD. Retrospective assessment of dietary intake. *Am J Epidemiol* 1984;**120**:876–87.

18 Baghurst KI, Baghurst PA. The measurement of usual

dietary intake in individuals and groups. *Transactions of the Menzies Foundation* 1981;**3**:139–60.
19 Sempos CT, Briefel RR, Flegal KM, Johnson C, Murphy RS, Wotecki C. Factors involved in selecting a dietary survey methodology for national nutritional surveys. *Australian Journal of Nutrition and Diet* 1992;**49**:96–101.
20 Baghurst KI. The food frequency technique and its relevance to population survey. *Australian Journal of Nutrition and Diet* 1992;**49**:101–3.
21 Sempos C. Invited commentary: some limitations of semiquantitative food frequency questionnaires. *Am J Epidemiol* 1992;**135**:1127–32.
22 Rimm EB, Giovannucci EL, Stampfer MJ, Colditz GA, Litin LB, Willett WC. Author's response to "Invited Commentary: Some limitations of semiquantitative food frequency questionnaires". *Am J Epidemiol* 1992;**135**:1133–6.
23 Australian Bureau of Statistics. *Apparent consumption of foodstuffs in Australia*. Canberra: Australian Bureau Statistics, 1992.
24 Gibney MJ, Maloney M, Shelley E. The Kilkenny health project: patterns of food intake in individuals consuming low-, moderate- and high-fat diets. *Proc Nutr Soc* 1987;**46**(1):A14.
25 McColl KA. The sugar-fat seesaw. *British Nutrition Foundation Bulletin* 1988;**13**(2):114–19.
26 Lewis CJ, Youngmee KP, Dexter PB, Tetley EA. Nutrient intakes and body weights of persons consuming high and moderate levels of added sugars. *J Am Diet Assoc* 1992;**92**(6):708–13.
27 Davies M, Baghurst KI. Dietary sugars and exchange between nutrients over four years. *J Dent Res* 1992;**72**:A611.