

Food intakes of adult Melbourne Chinese

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Abstract: Food intake patterns of 545 adult Melbourne Chinese were studied in 1988 and 1989 using a 220-item food-frequency questionnaire appropriate for Chinese eating practices. Men and women were compared, adjusting for age, time in Australia and education. Men consumed more rice and alcoholic beverages as energy. In women, the energy intake was derived from foods of traditional Chinese types. There were two types of consumption patterns: in the first group were those who acculturated towards an Australian way of eating by replacing some traditional Chinese foods, such as rice, pork, leafy green and cruciferous vegetables, soups and tea, with 'new foods', such as wheat products, red meats and coffee; in the second were those who limited their intake to a handful of traditional Chinese foods as the major source of energy. The educated, the professional and those with an administrative profession, the Australian-born and those with a longer length of stay fitted into the first group, and were more acculturated towards Australia than those born in the People's Republic of China or Vietnam and who migrated at an older age. The first group may benefit from the best of both worlds, but may risk the diseases of an industrialised society. The second group may be trapped at a cultural crossroads and may be unable to make appropriate food choices. Public health efforts in Australia, where one in every five is overseas-born, should provide for nutrition and health education for new and aged migrants of non-European cultural backgrounds. (*Aust J Public Health* 1995; 19: 623-8)

FOOD habits are a complex behavioural expression, involving a progression of decision-making processes. Several models consider why population groups eat what they do.¹ In a sociocultural model, major determinants of food habits are the traditional food culture, food availability, and household economy.²⁻⁷ Migrant populations are particularly sensitive to these determinants because of an inevitable pressure to change after migration.^{9,8-13}

Adult Melbourne Chinese are predominantly overseas-born and have a cardiovascular risk profile comparable to all Australians.¹⁴ It was hypothesised that an increase in cardiovascular risk in Asian Australians after migration is attributable to changing life-style and dietary practices. In this paper, we report on food consumption patterns of adult Melbourne Chinese, with reference to sociodemographic factors.

Methods

A total of 545 subjects who participated in an assessment of food habits and cardiovascular risk in 1988-89 was studied. A sampling method was developed for the study and is reported elsewhere.¹⁵ Briefly, a set of Chinese surnames (in various dialects) was compiled by obtaining membership surname lists from several Chinese community organisations. A sampling list was compiled from the 1988 Melbourne telephone directory (White Pages) listings that matched the presumptive Chinese surnames. The study population was representative of the Melbourne Chinese at the time of survey.^{15,16} The sociodemographic characteristics of the study population are shown in Table 1.

The dietary intake was estimated using a 220-item food-frequency questionnaire. The questionnaire nominated a 'reference portion' using household measures such as Chinese rice bowl, glass, cup, and natural units (for example, one apple), and included foods and beverages commonly available from both the Chinese and non-Chinese market places. A 'reference portion weight' (in grams) was obtained for each food and beverage. The frequency of intake (never, or per day, week, month, and year interval) over the 12 months before the interview was obtained and converted into average 'daily intake frequency' (times per day). The daily intake in grams (g/d) was then estimated by multiplying the reference portion weight by the daily intake frequency. The method has been validated against urinary sodium, potassium and total nitrogen, with positive correlations between saturated fatty acids and plasma cholesterol and was therefore considered appropriate for use in the Chinese population.¹⁷

We classified foods into eight major groups: 1. cereals, 2. meats, 3. dairy products, 4. vegetables, 5. fruits, 6. beverages, 7. water and 8. other foods. Within each major group, there were subgroups that reflected either traditional Chinese food culture or foods of similar type. Cereals were subdivided into rice and wheat; meats into pork, poultry, red meats, fish, other seafood and eggs; vegetables into leafy greens, cruciferous type, legumes, dried and other vegetables; beverages into tea, coffee, nonalcoholic and alcoholic beverages. Water, an alternative to nonalcoholic beverages, was reported separately. The average daily intakes were expressed in grams of food per megajoule of total energy ingested per day. Means \pm standard deviations are presented where appropriate. Pearson's correlation analyses were

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Table 1: Sociodemographic characteristics of the study population (%)

	Men n=269	Women n=276
<i>Age in years</i>		
25 to 34	23.4	34.4
35 to 44	34.9	33.0
45 to 54	23.0	15.2
55 to 64	10.3	9.4
65 and over	8.2	8.0
Mean age \pm standard deviation	44.6 \pm 12.4	42.4 \pm 12.6
Mean years in Australia (\pm SD) ^{a,b}	12.1 \pm 9.0	8.8 \pm 5.8
<i>Country of birth</i>		
Australia	4.1	3.3
People's Republic of China	24.2	23.6
Hong Kong	11.2	13.4
Malaysia or Singapore	27.1	22.1
Vietnam	24.2	26.8
Others	9.3	10.9
<i>Education in years</i>		
0 to 6	12.3	28.7
7 to 9	22.3	17.8
10 to 12	20.1	27.9
13 and over	45.4	25.7
<i>Occupational status</i>		
Professional	28.6	24.3
Administrative, clerical and sales	24.2	18.9
Trades and services	43.9	33.0
Domestic duties	3.3	23.9
<i>Gross household income (\$ per year) ^c</i>		
\leq 12 000	8.6	14.0
12000 to 22000	20.7	24.5
22000 to 40000	35.7	35.9
> 40 000	35.0	25.6

Notes:

(a) Overseas-born only, 258 men and 267 women

(b) SD=standard deviation

(c) 266 men and 273 women

used to examine whether food intakes were associated with age, the length of stay in Australia (overseas-born only) or education level. Analyses of covariance were used to compare the average food intake between men and women; this took account of the confounding effects of age, the length of stay in Australia, and education level on intakes. Differences in food intakes by education level, occupational status and birthplace were tested for men and women separately. The least square means (adjusted means) and the standard errors of the means were obtained for each population subgroup. The adjusted mean \pm the standard error of the mean is presented where appropriate.

Results

Table 2 shows average daily intakes per megajoule of energy ingested, by sex.

Food intake and extraneous factors

Table 3 shows relationships of daily food intake with age, education level and the length of stay in Australia, for men and women. The intake of rice was negatively related to the length of stay and education level for men and women, independently of age. Intake of soups was positively related to age, and negatively related to education level for men and

Table 2: Average intake, in grams, per megajoule of energy ingested per day, by sex

	Men		Women	
	Mean	SD ^a	Mean	SD
<i>Cereals</i>				
Rice	57.8	28.8	56.3	28.1
Wheat	14.3	8.7	13.8	8.1
<i>Meats</i>				
Pork	6.1	4.8	6.1	4.3
Poultry	3.2	2.3	3.5	2.9
Red meat	4.3	3.4	4.2	3.5
Fish	2.2	1.6	2.8	2.2
Other seafood	2.4	2.0	2.5	2.1
Eggs	2.3	2.2	2.4	2.0
<i>Dairy products</i>	12.4	19.6	14.2	17.9
<i>Vegetables</i>				
Leafy greens	2.4	2.4	3.0	2.6
Cruciferous vegetables	1.9	1.7	2.3	1.9
Legumes	3.4	4.4	4.5	5.6
Dried vegetables	0.4	0.6	0.6	0.7
Other vegetables	15.1	9.4	16.9	10.2
<i>Fruit</i>				
Fresh fruit	29.3	22.9	33.4	21.5
Fruit juices	5.4	10.3	4.6	10.3
Processed fruit	1.5	4.0	1.2	2.1
<i>Beverages</i>				
Tea	43.0	44.3	35.6	42.8
Coffee	38.8	58.9	27.8	67.7
Nonalcoholic beverages	15.7	20.4	14.0	19.0
Alcoholic beverages	8.9	19.2	0.7	2.5
Water	47.2	58.7	67.6	61.9
<i>Other foods</i>				
Nuts and seeds	0.7	2.9	0.5	1.4
Sweets	3.2	3.4	3.7	3.3
Soups	9.6	9.7	13.1	11.4
Snacks and other foods	5.9	5.0	6.2	4.8
Total intake	337.5	98.4	341.5	105.8

Note: (a) SD=standard deviation

women. On the other hand, intakes of nonalcoholic beverages and fruit juices were negatively associated with age, and positively associated with education level (women only). There were negative relationships between the intake of leafy greens and education level for men and women. For women, the intake of red meats increased with education level and was negatively related to age. There was also a positive association between coffee consumption and the length of stay in Australia in women.

Sex

After adjustment for age, the length of stay in Australia and education level, it was found that men consumed more of cereals, beverages and water, and less vegetables, fruits, and other foods than women (Figure 1). The differences in cereal intake were attributable to rice intake (61.02 and 53.12 g/MJ per day for men and women), whereas differences in the intake of beverages were attributable to alcoholic beverages (8.75 and 0.88 g/MJ per day for men and women). Furthermore, women consumed more of fish (2.21 and 2.82 g/MJ per day for men and women), cruciferous vegetables (1.91 and 2.31 g/MJ per day for men and women), legumes (3.31 and 4.56 g/MJ per day for men and women), fresh fruits (28.86 and 33.87

Table 3: Relationships of food intake per megajoule of energy per day, by age, education, length of stay in Australia, and sex

	Men			Women		
	Age n=269	Stay ^a n=258	Education ^b n=269	Age n=276	Stay n=267	Education n=276
Cereals						
Rice	-0.03	-0.19†	-0.35§	0.08	-0.22‡	-0.43§
Wheat	0.03	0.11	0.13*	-0.07	0.05	0.24§
Meats						
Pork	-0.06	-0.02	0.01	-0.06	-0.05	0.13*
Poultry	0.05	-0.01	-0.16*	0.01	-0.05	0.04
Red meat	-0.08	0.02	0.14*	-0.16†	0.13*	0.23§
Fish	0.10	0.07	-0.07	0.17†	0.02	-0.11
Other seafood	0.10	0.04	-0.12	0.09	0.07	-0.17†
Eggs	0.02	0.02	0.01	-0.04	-0.08	0.00
Dairy products	0.04	0.08	0.12*	-0.03	0.06	0.10
Vegetables						
Leafy greens	0.15*	0.06	-0.24§	0.07	0.01	-0.20†
Cruciferous vegetables	0.25§	0.06	-0.05	0.04	-0.07	-0.01
Legumes	0.18†	-0.04	0.03	0.06	-0.04	0.01
Dried vegetables	0.09	-0.05	-0.05	0.12*	-0.04	-0.13*
Other vegetables	0.07	0.12*	0.10	0.01	0.04	0.01
Fruit						
Fresh fruit	0.06	0.04	0.06	0.08	0.10	-0.01
Fruit juices	-0.12*	0.05	0.24§	-0.06	0.14*	0.21‡
Processed fruit	-0.08	0.06	0.21‡	-0.11	0.12*	0.27§
Beverages						
Tea	0.16†	0.21‡	-0.02	-0.03	0.14*	0.02
Coffee	-0.01	0.13*	0.13*	0.02	0.25§	0.11
Nonalcoholic beverages	-0.26§	0.03	0.11	-0.21‡	0.05	0.16†
Alcoholic beverages	-0.04	0.06	0.05	-0.02	0.06	0.11
Other foods						
Nuts and seeds	0.10	0.07	0.0009	0.11	0.14*	0.07
Sweets	0.05	0.08	0.13*	-0.02	0.12	0.19†
Soups	0.21‡	-0.17†	-0.29§	0.22‡	-0.05	-0.28§
Snacks and other foods	-0.09	-0.04	0.25§	-0.02	0.12*	0.19†
Total intake	0.01	0.12	0.06	0.00	0.12*	0.06

Notes:
 (a) For overseas-born only.
 (b) Education levels: 2=0-6 years, 3=7-9 years, 4=10-12 years, 5=more than 13 years.
 *P<0.05, †P<0.01, ‡P<0.001, §P<0.0001

g/MJ per day for men and women), sweets (3.02 and 3.84 g/MJ per day for men and women), soups (10.09 and 12.59 g/MJ per day for men and women), and water (48.07 and 66.79 g/MJ per day for men and women).

Education level

Figure 2 shows average daily intake (g/MJ per day) of selected food groups for people of various education levels. For men, the intake of rice, leafy greens, and soups decreased with education level, while the intake of fruits and snacks increased with education level. Intakes of rice, leafy greens, and soups for women were negatively related to education level, similarly to men. The intake of wheat products was significantly higher among the educated women.

Occupational status

Differences in food intakes by occupational status were characterised by a significantly high intake of these foods among those who stayed at home (domestic duty occupation) after adjusting for age,

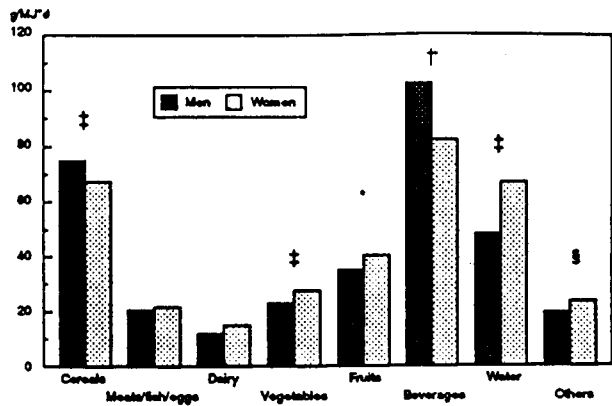


Figure 1: Average daily intakes (g/(MJ · d)) of selected food groups for men and women, adjusting for age, the length of stay in Australia, and education level. *P<0.05, †P<0.01, ‡P<0.001, §P<0.0001

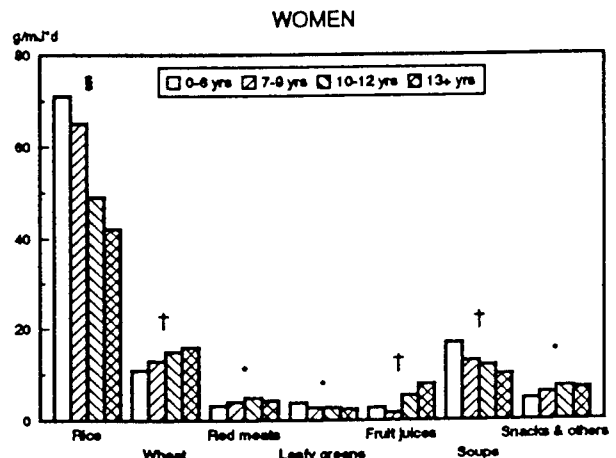
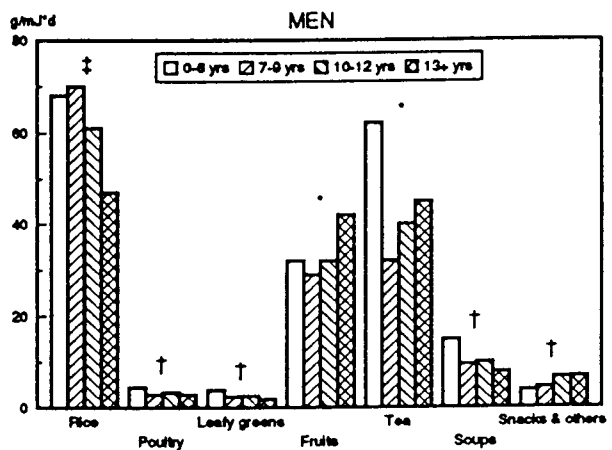


Figure 2: Average daily intakes (g/(MJ · d)) of selected food groups, by education level, for men and women, adjusting for age and the length of stay in Australia. *P<0.05, †P<0.01, ‡P<0.001, §P<0.0001

the length of stay in Australia, and education level (Figure 3).

Birthplace

In men, intakes of rice, red meats, leafy greens, soups, and snacks and other foods differed by birthplace, independently of age, the length of stay in

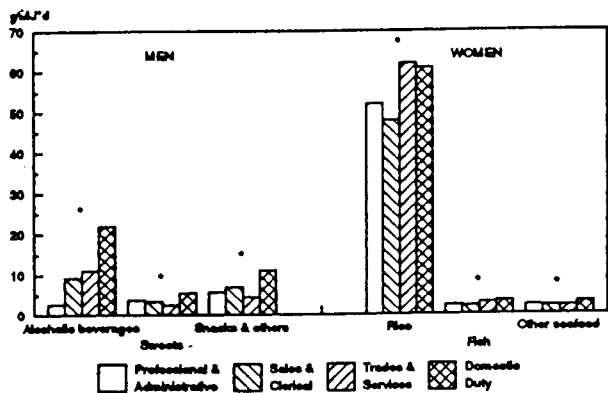


Figure 3: Average daily intakes (g/MJ · d) of selected food groups, by occupational status for men and women, adjusting for age, the length of stay in Australia, and education level. * $P < 0.05$, † $P < 0.01$, ‡ $P < 0.001$, § $P < 0.0001$

Australia, and education level (Figure 4). The differences were characterised by men born in Australia having a lower intake of rice and leafy greens, and a higher intake of red meats, and snacks and other. In women, the intake of rice was significantly higher in those born in Vietnam than that of their counterparts born in Australia, China, Hong Kong, Malaysia, or elsewhere. Women born in Vietnam also had a greater intake of legumes than women born in Hong Kong and Malaysia. Women born in Hong Kong had a greater intake of tea than the other overseas-born, but not the Australian-born women. Women born in Malaysia had the highest intake of total fruits.

Discussion

There are various food consumption patterns among adult Melbourne Chinese that could be characterised by sociodemographic factors.

There were sex differences in food consumption patterns; men on average consumed more energy-providing foods, such as rice and alcoholic beverages, than women. Women consumed more fish, cruciferous vegetables, legumes, fresh fruits, soups, sweets, and water, per megajoule of energy intake. This study suggests that dietary energy for women was derived from a wider variety of foods than for men. The diet was principally like that of traditional southern Chinese, using rice, pork, fish, leafy green and cruciferous vegetables, legumes, soups and tea.²⁰ However, the relative importance of these foods and the amounts consumed were less than for their counterparts in China;^{18,20} they had greater intakes of wheat products, dairy products, other vegetables, coffee and snack foods. This is apparent despite food consumption changing in China in the last 30 years.¹⁸

Compared to the 1983 Australian National dietary intakes,²² the general food consumption patterns in Melbourne Chinese were similar for men and women, in that both consumed more cereals and fresh fruit, and less vegetables, dairy products, and alcoholic beverages than the Australians generally (Figure 5). Vegetable and fresh fruit consumption were similar for Melbourne Chinese and Asian Australians. Compared to all Australians, Melbourne Chinese consumed less vegetables. This may be

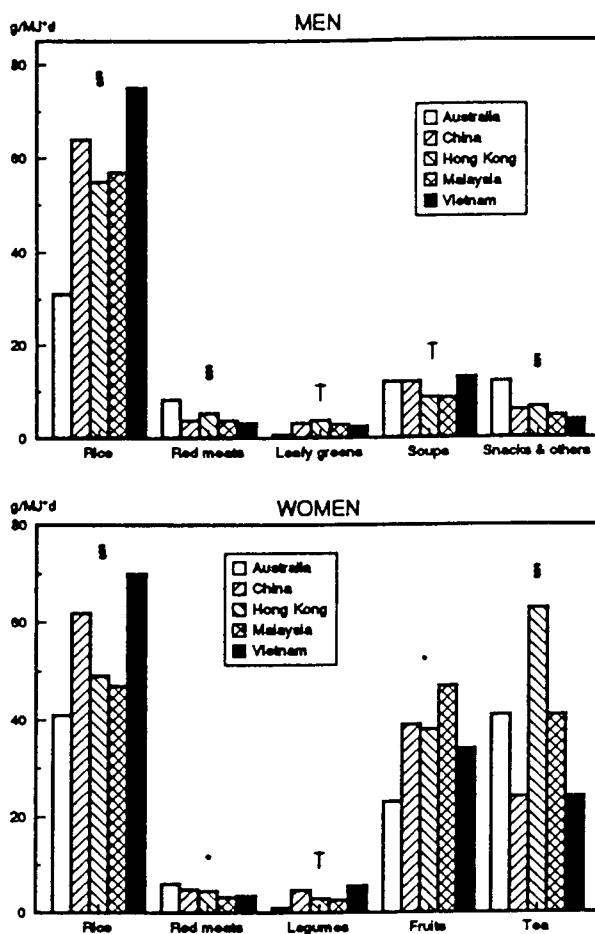


Figure 4: Average daily intakes (g/MJ · d) of selected food groups, by birthplace for men and women, adjusting for age, the length of stay in Australia, and education level. * $P < 0.05$, † $P < 0.01$, ‡ $P < 0.001$, § $P < 0.0001$

accounted for by the intake of potatoes, a main vegetable in the European Australian diet. Melbourne Chinese also consumed much less vegetables, particularly leafy green and cruciferous vegetables, and legumes, than did their counterparts in China.^{18,21} The low intake of alcoholic beverages in men and women was also consistent with household expenditure data which showed Asians spent the least amongst the Australians on alcoholic beverages.⁹ The intake of dairy products of Melbourne Chinese was considerably less than that of Asian Australians and Australians-at-large, but three- to fourfold higher than for their counterparts in southern and other parts of China (Hsu-Hage, unpublished data).^{18,21} The link between dairy product and calcium intakes in Western society,²³ however, does not hold in Chinese populations, for whom the principal food sources of calcium are leafy green and cruciferous vegetables (Hsu-Hage, unpublished data).

The older Chinese and those who travelled to Australia at an older age tended to retain their traditional food intake patterns, patterns characterised by high intakes of fruits and vegetables. Similar observations have been made of a group of female elderly Australians and American centenarians, who showed good compliance with the contemporary dietary guidelines.^{24,25} In adhering to the traditional

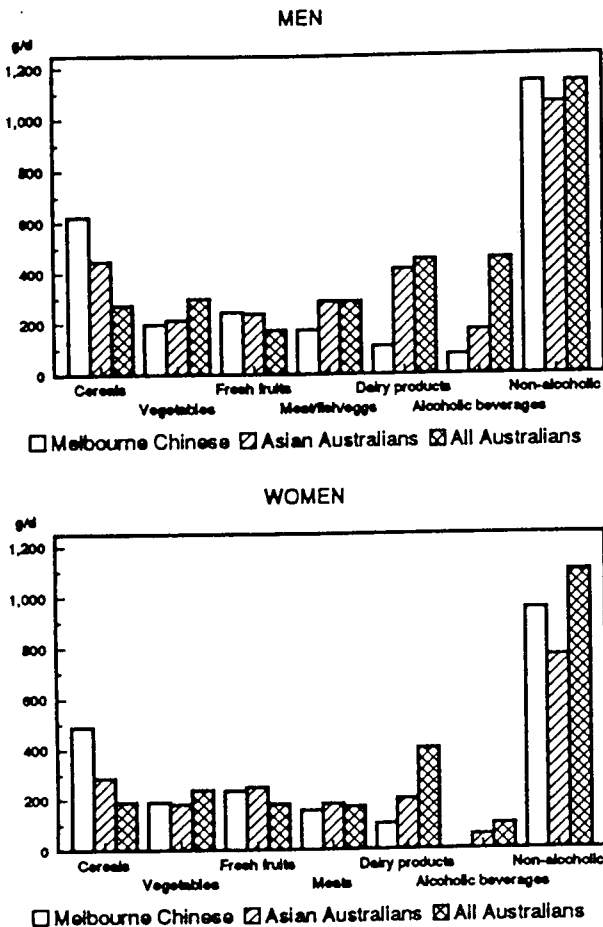


Figure 5: Average daily consumption (g) of selected major food groups in Melbourne Chinese, Asian Australians and all Australians, for men and women. * $P < 0.05$, † $P < 0.01$, ‡ $P < 0.001$, § $P < 0.0001$

food intake pattern, the aged were limited in food variety compared to the younger cohort, to the Australian-born and to those Chinese who arrived at Australia at a younger age.

Educational attainment and socioeconomic status play a significant role in the food consumption pattern of population groups.²⁶⁻³⁵ Educational attainment is best characterised by its influence on food acculturation, as evidenced by intake patterns of educated men and women moving away from traditional Chinese foods such as steamed rice, leafy green vegetables, Chinese tea (men only), and soups, and towards wheat products, red meats and snack foods (Table 3). Unlike observation made in Australian, American and European populations, the educated Melbourne Chinese consumed no more vegetables than the less educated; in fact, they consumed less leafy green vegetables. The preferred form of fruit was juice and processed fruit, not fresh fruit as found in other populations.^{19,29,36,37} A large percentage of educated Melbourne Chinese completed their formal education in Australia,¹⁴ and were, therefore, more fluent in the English language and more adaptable to Australian culture. They were also mostly professional or held administrative positions. Their choice of foods might, therefore, be influenced by the amount of time required in food preparation, and to a lesser extent, by finance. In a small study of household food purchases and dietary

habits in Singapore, it was reported that English-speaking households purchased more poultry, non-leafy green vegetables and fruits; the consumption data, however, were unavailable.³⁶ A similar pattern was observed amongst the educated Melbourne Chinese (Table 3). There are no reported data that systematically examine the food consumption patterns of Australians in a fashion that permits meaningful comparison or cross-referencing with our data.

Results from comparisons of food intake by birthplace show that Australian-born subjects (both sexes) and those born in Malaysia or Singapore consumed more Australian-type foods and less Chinese foods, independently of their education, which is predominantly tertiary in Australia. In contrast, those born in the People's Republic of China, who were the most aged subgroup, and those born in Vietnam, who were the newest migrants, showed little sign of food acculturation (Figure 4). No study has so far reported food consumption patterns of Chinese from different birthplaces living in the one city. Finally, we found a higher intake of alcohol, sweets, and snacks in the home-bound males (mostly retired). It is tempting to attribute this finding to being home-bound, but the numbers were small.

Comparisons with reported data require qualification because 1. different dietary methods have been used in studies carried out at different times (which reflects the cross-sectional nature of reported data), 2. the classification of Asian Australians includes Australians of middle-eastern and eastern-Mediterranean origin, and 3. differences in body size (as indicated by body weight) and energy requirements (which may be estimated by age, body weight and sex) between populations can affect food consumption. The observations we have made with reference to published work therefore need to take these qualifications into consideration.

Conclusion

In the last decade, Australian major public health concerns have been directed towards the reduction of so-called overnutrition for the prevention of cardiovascular and other degenerative diseases.^{24,39-41} Chinese Australians in Melbourne, however, might not have benefited directly from such a public health effort. We found that food intake patterns of adult Melbourne Chinese have undergone changes with acculturation towards Australian eating habits, notably amongst those who have been in Australia for an extended periods, and those who are highly educated or of high socioeconomic status. The aged and less educated, while tending to keep to traditional Chinese eating patterns, consumed a limited variety of foods for their energy source. The public health nutrition issues for Melbourne Chinese are twofold: 1. recognition of the inevitable changes in food habits which go beyond the traditional so that a wider food variety may be embraced, and 2. provision of public health education which links nutrition to health in such a way as to allow for a healthy food choice outside Chinese food culture. Melbourne Chinese, like south European and other migrants,^{8,9} have the opportunity to explore the best of two or more worlds and to achieve the best of health by

nutritional means. As the food intake pattern of Melbourne Chinese begins to show a similar pattern to the Australian norm (itself changing and, even, being Asianified), the contribution of various food sources to nutrient intake and health is more warranted.

Acknowledgments

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