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# Dietary intake and practices in the Hong Kong Chinese population

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**Abstract**

***Objectives*—To examine dietary intake and practices of the adult Hong Kong Chinese population to provide a basis for future public health recommendations with regard to prevention of certain chronic diseases such as cardiovascular disease, hypertension, and osteoporosis.**

***Participants*—Age and sex stratified random sample of the Hong Kong Chinese population aged 25 to 74 years (500 men, 510 women).**

***Method*—A food frequency method over a one week period was used for nutrient quantification, and a separate questionnaire was used for assessment of dietary habits. Information was obtained by interview.**

***Results*—Men had higher intakes of energy and higher nutrient density of vitamin D, monounsaturated fatty acids and cholesterol, but lower nutrient density of protein, many vitamins, calcium, iron, copper, and polyunsaturated fatty acids. There was an age related decrease in energy intake and other nutrients except for vitamin C, sodium, potassium, and percentage of total calorie from carbohydrate, which all increased with age. Approximately 50% of the population had a cholesterol intake of ⩽300 mg; 60% had a fat intake ⩽30% of total energy; and 85% had a percentage of energy from saturated fats ⩽10%; criteria considered desirable for cardiovascular health. Seventy eight per cent of the population had sodium intake values in the range shown to be associated with the age related rise in blood pressure with age. Mean calcium intake was lower than the FAO/WHO recommendations. The awareness of the value of wholemeal bread and polyunsaturated fat spreads was lower in this population compared with that in Australia. There was a marked difference in types of cooking oil compared with Singaporeans, the latter using more coconut/palm/mixed vegetable oils.**

***Conclusion*—Although the current intake pattern for cardiovascular health for fat, saturated fatty acid, and cholesterol fall within the recommended range for over 50% of the population, follow up surveys to monitor the pattern would be needed. Decreasing salt consumption, increasing calcium intake, and increasing the awareness of the health value of fibre may all be beneficial in the context of chronic disease prevention.**

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The top three causes of mortality in the Hong Kong Chinese population are cancer, ischaemic heart disease, and stroke.[1] Although there are no comprehensive data on the incidence or prevalence of chronic diseases, isolated studies have shown that between 1980–89, the number of hospital admissions for acute myocardial infarction and ischaemic heart disease rose despite a slow decline in ischaemic heart disease mortality[2]; the age truncated prevalence of diabetes mellitus for age 30–64 years has risen from 7.5%[3] to 8.7% over a period of five years (1990–1995) (E D Janus *et al*, 3rd International Diabetes Federation Western Pacific Regional Congress, Hong Kong, 1996); and the age specific hip fracture rates among subjects aged 70–79 years (as an indicator of osteoporosis) has increased from 224 in men and 173 per 100 000 in women in 1966, to 307 in men and 505 in women in 1989.[4] The role of dietary factors as risk factors for these chronic diseases have been described. These include the association between antioxidants and cancer and ischaemic heart disease[5–8]; dietary lipids and ischaemic heart disease[9]; intake of cations (sodium and potassium) and hypertension (ischaemic heart disease and stroke)[10 11]; calcium, sodium and protein intake and osteoporosis[4]; obesity and diabetes (with associated hypertension, ischaemic heart disease).[12] Therefore it would be of interest to report the dietary intake and practices of the Hong Kong Chinese population, to compare it with other populations where the pattern of chronic diseases may be different, and to form a basis for future public health recommendations with regard to prevention of these diseases. Currently dietary data are only confined to children[13] and the elderly,[14] and no information is available for the adult population as a whole. A survey of dietary intake and practices was carried out to investigate some of these issues.

## Methods

The dietary survey was conducted as part of a territory wide cardiovascular risk factor study in ethnic Chinese, from October 1995–May 1996. Subjects were contacted by random telephone survey, and invited to one of the hospitals for physical examination and blood tests. Dietary assessment was carried out consecutively on those who attended until more than 100 subjects in each 10 year age and sex groups from ⩽34 years to ⩾55 years were recruited. The response rate for telephone interview was approximately 80%, and of those approximately 40% attended for blood tests and anthropometric measurements. The attendees closely

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*Table 1 Twenty four hour nutrient density intake by age and sex in Hong Kong Chinese subjects. Data shown as mean (SD)*

| | *<35* | | *35–44* | | *45–54* | | *55+* | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *M (n=117)* | *F (n=121)* | *M (n=129)* | *F (n=134)* | *M (n=124)* | *F (n=127)* | *M (n=130)* | *F (n=128)* | *M (n=500)* | *F (n=510)* |
| Energy (MJ) | 10.8 (3.3)[c] | 7.9 (2.3)[c] | 10.4 (2.7)[c] | 7.7 (2.8)[c] | 10.2 (2.4)[c] | 7.8 (2.2)[c] | 9.2 (2.6) | 6.9 (1.9) | 10.1 (2.8)[z] | 7.6 (2.4) |
| Protein (G/MJ) | 11.1 (1.8)[c] | 11.7 (1.9)[c] | 11.0 (1.8)[c] | 11.3 (2.0)[c] | 11.2 (1.8)[c] | 11.4 (2.1)[c] | 10.6 (1.8) | 10.7 (1.9) | 11.0 (1.8)[x] | 11.3 (2.0) |
| Fat (G/MJ) | 7.9 (1.4)[c] | 8.3 (1.4)[bc] | 7.9 (1.5)[c] | 8.0 (1.3)[bc] | 7.7 (1.4)[c] | 7.5 (1.4)[c] | 7.1 (1.7) | 7.1 (1.4) | 7.6 (1.6) | 7.7 (1.4) |
| Carbohydrate (G/MJ) | 31.1 (4.2)[c] | 30.2 (4.4)[bc] | 31.4 (4.6)[c] | 31.3 (4.1)[c] | 31.6 (1.6)[c] | 32.3 (4.7)[c] | 33.9 (5.0) | 33.8 (4.3) | 32.0 (4.7) | 31.9 (4.6) |
| Vitamin A (ug/MJ)† | 111 (62)[bc] | 173 (91)[b] | 128 (76)[bc] | 186 (119) | 160 (93) | 210 (155) | 159 (113) | 194 (120) | 140 (91)[z] | 191 (124) |
| Thiamine (mg/MJ) | 0.11 (0.02) | 0.12 (0.03) | 0.11 (0.03) | 0.12 (0.03) | 0.12 (0.03) | 0.12 (0.03) | 0.11 (0.03) | 0.12 (0.03) | 0.11 (0.03)[z] | 0.12 (0.03) |
| Riboflavin (mg/MJ) | 0.12 (0.03) | 0.14 (0.04) | 0.12 (0.02) | 0.14 (0.04) | 0.12 (0.03)[c] | 0.13 (0.03) | 0.12 (0.03) | 0.13 (0.04) | 0.12 (0.03)[z] | 0.13 (0.03) |
| Niacin (mg/MJ)† | 2.0 (0.4) | 2.2 (0.5)[c] | 2.0 (0.5) | 2.1 (0.5) | 2.0 (0.5) | 2.1 (0.5) | 1.9 (0.5) | 2.0 (0.5) | 2.0 (0.5)[y] | 2.1 (0.5) |
| Vitamin C (mg/MJ) | 11.9 (6.2)[bc] | 20.6 (12.2)[abc] | 13.8 (8.0)[c] | 23.9 (14.0) | 15.3 (7.9)[c] | 24.1 (11.4) | 17.7 (10.5) | 24.7 (14.6) | 14.7 (8.6)[z] | 23.4 (13.2) |
| Vitamin D (ug/MJ) | 2.0 (1.7)[c] | 1.7 (1.7) | 1.9 (1.5)[c] | 1.8 (1.8) | 2.0 (2.3)[c] | 1.4 (1.3) | 1.4 (1.8) | 1.5 (2.0) | 1.8 (1.8) | 1.6 (1.7) |
| Vitamin E (mg/MJ)† | 1.0 (0.3) | 1.3 (0.5)[ab] | 1.0 (0.4) | 1.5 (0.6) | 1.2 (0.5) | 1.5 (0.5) | 1.3 (0.5) | 1.4 (0.5) | 1.1 (0.4)[z] | 1.4 (0.5) |
| Sodium (mg/MJ)* | 480 (684) | 504 (348)[bc] | 439 (322) | 592 (466)[b] | 515 (617) | 783 (876) | 608 (1408) | 681 (407) | 511 (863)[y] | 643 (573) |
| Potassium (mg/MJ)* | 312 (351) | 391 (247)[bc] | 309 (170) | 440 (240)[bc] | 362 (371) | 529 (372) | 479 (1608) | 524 (262) | 367 (862)[y] | 472 (291) |
| Calcium (mg/MJ) | 55 (15)[bc] | 71 (23)[bc] | 56 (17)[bc] | 77 (27) | 64 (20) | 78 (26) | 67 (26) | 78 (30) | 60 (21)[z] | 76 (27) |
| Iron (mg/MJ) | 1.6 (0.3)[bc] | 1.9 (0.5)[b] | 1.7 (0.4)[bc] | 2.0 (0.6) | 1.8 (0.4) | 2.0 (0.5) | 1.8 (0.5) | 2.0 (0.5) | 1.7 (0.4)[z] | 2.0 (0.5) |
| Zinc (mg/MJ) | 1.3 (0.3)[b] | 1.6 (2.9) | 1.4 (0.5) | 1.4 (0.5) | 1.5 (1.0) | 1.4 (0.7) | 1.4 (0.5) | 1.4 (0.6) | 1.4 (0.6) | 1.5 (1.5) |
| Copper (mg/MJ) | 1.3 (0.6) | 1.5 (0.7)[a] | 1.4 (0.6) | 1.8 (0.8)[c] | 1.3 (0.5) | 1.7 (0.7) | 1.4 (0.5) | 1.5 (0.7) | 1.4 (0.6)[z] | 1.7 (0.7) |
| SFA (G/MJ) | 2.3 (0.5)[bc] | 2.3 (0.5)[abc] | 2.2 (0.5)[c] | 2.1 (0.5)[bc] | 2.1 (0.5)[c] | 2.0 (0.5) | 1.9 (0.6) | 1.9 (0.5) | 2.1 (0.6) | 2.1 (0.5) |
| MUFA (G/MJ) | 2.9 (0.6)[c] | 2.9 (0.6)[abc] | 2.8 (0.7)[c] | 2.7 (0.6)[bc] | 2.7 (0.6)[c] | 2.5 (0.6) | 2.4 (0.7) | 2.4 (0.5) | 2.7 (0.7)[x] | 2.6 (0.6) |
| PUFA (G/MJ) | 1.7 (0.4) | 1.9 (0.4)[c] | 1.7 (0.4)[c] | 1.9 (0.4)[bc] | 1.7 (0.4)[c] | 1.8 (0.4)[c] | 1.6 (0.4) | 1.7 (0.4) | 1.7 (0.4)[z] | 1.8 (0.4) |
| Cholesterol (mg/MJ) | 41 (11)[c] | 41 (11)[abc] | 42 (13)[c] | 38 (13)[c] | 40 (13)[c] | 36 (13)[c] | 33 (13) | 33 (12) | 39 (13)[x] | 37 (13) |
| Protein (%/MJ) | 1.8 (0.5)[c] | 2.7 (0.9) | 1.9 (0.5)[c] | 2.7 (0.9) | 1.9 (0.5) | 2.6 (0.9) | 2.1 (0.7) | 2.8 (0.9) | 1.9 (0.5)[z] | 2.7 (0.9) |
| Fat (%/MJ) | 3.0 (0.9) | 4.2 (1.3) | 3.0 (0.8) | 4.3 (1.5)[b] | 3.0 (0.8) | 3.9 (1.4) | 3.1 (1.2) | 4.1 (1.2) | 3.0 (0.9)[z] | 4.1 (1.4) |
| Carbohydrate (%/MJ) | 5.2 (1.6)[c] | 7.0 (2.4)[c] | 5.4 (1.9)[c] | 7.6 (2.7)[c] | 5.5 (1.7)[c] | 7.6 (3.0)[c] | 6.7 (2.3) | 8.9 (3.0) | 5.7 (2.0)[z] | 7.8(2.9) |

SFA = Saturated fatty acid, MUFA = monounsaturated fatty acid, PUFA = polyunsaturated fatty acid. Between sex comparison, all subjects, one way ANOVA: p<0.05x, <0.01y, <0.001z. Within the same sex, comparison between different age groups by one way ANOVA: a, compared with 35–44 age group p<0.05, b, compared with 45–54 age group p<0.05, c, compared with 55+ age group p<0.05. *Estimation from urinary values. †Retinol, tocopherol, and niacin equivalents.

matched the overall Hong Kong population, as there was no difference in age distribution or socioeconomic characteristics between subjects attending for laboratory tests, those who participated in the telephone interview, and the population as a whole as described in the 1996 Hong Kong by census. The age distribution was also similar between the three geographical regions of Hong Kong. A detailed description of the sample for the territory wide cardiovascular risk factor study has been published elsewhere.[15] A subset of 1010 consecutive attendees had the dietary interview. No significant differences in physical or laboratory parameters were noted between subjects from the three geographical regions (Hong Kong Island, Kowloon, and New Territories) and between those who received the dietary assessment and those who did not. The overall cardiovascular risk factor study included 2900 attendees aged 25–74 years of whom 1010 underwent dietary assessment. The mean age of the study sample was 45.6 years (SD 11.7), range 24–74 years.

Dietary assessment was carried out using a food frequency questionnaire, the validity of which had been examined elsewhere.[16] This consists of items in the following seven categories; bread/pasta/rice (16 items); vegetables (63 items); fruits (26 items); meat (39 items)/fish (31 items)/eggs (5 items); beverages (37 items); dimsum/snacks (39 items); soups (10 items); and oil/salt/sauces. Items chosen were those most frequently consumed, based on previous local surveys where subjects described their dietary intake,[14 17] and were identical with some items of the questionnaire used in the Australian Chinese Dietary Survey.[18] Wherever possible, subjects were told before the visit that a survey on a week's diet would be carried out and were advised to make a brief record at home to help the interview. On the day of the interview, each subject was asked to complete the questionnaire—the food item, the size of each portion, the frequency of consumption on a daily and weekly basis. Portion size was explained to subjects using a catalogue of pictures of individual food portions developed by one of the authors (SSFL). Data were crossed checked by examining the dietary pattern (for example, if meals were missed) to see if it corresponded to the number of times staple foods such as rice or noodles were consumed over a one week period. The amount of cooking oil was estimated according to the method of preparing different foods: 0.2 tablespoon for steaming fish or stir frying half a portion of vegetables, and one tablespoon for stir frying one portion of vegetables or one portion of meat. The type of oil used was also recorded to allow estimation of the quantity of fat used in cooking. Quantification of nutrients was carried out using food tables for Hong Kong were compiled from McCance and Widdowson,[19] and two food tables used in China published by Zhongshan University (1991)[20] and the Insti-

*Table 2 Proportion of subjects in Hong Kong meeting recommendations for cardiovascular health[21]*

| | *Number (%)* | | |
|---|---|---|---|
| *24 hour nutrient intake* | *Men* | *Women* | *All* |
| Fat percentage ⩽30% | 294(59) | 304(60) | 598(59) |
| SFA as % of total energy ⩽10% | 419(84) | 439(86) | 858(85) |
| Cholesterol ⩽300 mg | 165(33) | 326(64) | 491(49) |
| Sodium ⩽2300 mg | 107(21) | 115(23) | 222(22) |

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tute of Health of the Chinese Medical Science Institute.[21]

Sodium and potassium intake were assessed from urinary output measurements, using estimates derived from spot urine sodium/creatinine and potassium/creatinine ratios. Although 24 hour urine collections were not available, the 24 hour output may be estimated from spot urine sodium/creatinine and potassium/creatinine ratios assuming a male to female ratio in 24 hour creatinine excretion of 4:3, a 24 hour urine volume of 1200 ml, and mean spot urine creatinine concentrations of 12 mmol/l in men and 9 mmol/l in women. The estimated 24 hour output of sodium and potassium was multiplied by 1.05 to allow for 5% faecal and skin loss.[22] Estimates from urinary excretion were used as the values calculated from food tables were much lower for both sodium and potassium.[16]

Dietary practice was assessed using a questionnaire from the Singapore dietary survey of 1993.[23] This consisted of information regarding place of taking meals, types of cooking oil used, types of fat spread on bread, avoidance of fat in meats or skin from poultry, types of milk used, frequency of consumption of eggs, and deep fried foods.

Differences in nutrient density (nutrient per mJ) with age and sex were tested for statistical significance using a one way analysis of variance. Nutrient density values are used because the absolute nutrient intake will be proportional to the total calorie intake, which varies with age and sex. Therefore nutrient density would be more appropriate in examining age and sex related differences in nutrient intake. The nutrient density follows a normal distribution. Duncan's test was used to test the difference between any two groups. No confounders were taken into account in the one way analysis of variance. Data from the Singaporean Food Consumption Study[23] and the Australian Food and Nutrition Survey 1993[24] were used for comparison. The $\chi^2$ test was used in comparing the dietary practices in Hong Kong Chinese with those from the Singapore and the Australian survey.

KEY POINTS

- Although dietary intake patterns are satisfactory with regard to cardiovascular health, there is room for improvement in chronic disease prevention by decreasing salt consumption, increasing calcium intake, and promoting the awareness of the health value of fibre.
- Comparisons of dietary practices and nutrient intake in Australians and Singaporeans may be useful in explaining the differences in ischaemic heart disease incidence between the different populations.

## Results

Table 1 shows the mean 24 hour nutrient intake by age and sex. Overall, men had higher intakes of energy, and higher nutrient density of vitamin D, monounsaturated fatty acids (MUFA) and cholesterol compared with women, while the nutrient density for protein, vitamins A, Bs, C, E, calcium, iron, copper, polyunsaturated fatty acids (PUFA) was lower. For both sexes, age related decrease in intake of energy, protein, the B vitamins, vitamin D, zinc, copper, the fatty acids, cholesterol and percentage of total calorie from fat was observed, while the intakes of vitamin C, sodium, potassium, and percentage of total calorie from carbohydrates increased with age. Alcohol intake was not included in this table because only 10% of the population consume alcohol regularly (5.1% on 1–3 days/week and 4.8%>4 days/week; 1.7% consume 100–200 g of ethanol per week; 1.7% above 200 g per week.

Table 2 shows the percentage of men and women meeting the criteria for lipid intake optimum for cardiovascular health.[25] These are: fat percentage $\leqslant 30\%$ of total calories;

*Table 3 Qualitative comparison of mean nutrient intake values with Singaporean Chinese and Australians*

| | *HK Chinese* | | *Singapore Chinese*[23] | | *Australians*[24] | |
|---|---|---|---|---|---|---|
| | *(n=500) M* | *(n=510) F* | *(n=214) M* | *(n=246) F* | *(n=736) M* | *(n=997) F* |
| Energy (kcal) | 2421 | 1813 | 2214 | 1726 | 2408 | 1922 |
| Protein (g) | 112 | 86 | 87 | 69 | 99 | 83 |
| Protein percentage | 18 | 19 | — | — | 17 | 18 |
| Carbohydrate (g) | 320 | 239 | 296 | 229 | 279 | 233 |
| Carbohydrate percentage | 54 | 53 | — | — | 45 | 47 |
| Fat | 78 | 59 | 74 | 59 | 94 | 71 |
| Fat percentage | 29 | 29 | — | — | 34 | 33 |
| Saturated fatty acid (g) | 22 | 16 | — | — | 38 | 29 |
| PUFA (g) | 17 | 14 | — | — | 16 | 12 |
| MUFA (g) | 28 | 20 | — | — | 32 | 25 |
| Cholesterol (mg) | 399 | 285 | 384 | 295 | 313 | 247 |
| Vitamin A (µg)† | 1399 | 1416 | 587 | 575 | 1752 | 1658 |
| Thiamine (mg) | 1.2 | 0.9 | — | — | 1.9 | 1.6 |
| Riboflavin (mg) | 1.2 | 1.0 | — | — | 2.4 | 2.2 |
| Niacin (mg)† | 20.2 | 15.9 | — | — | 43 | 37 |
| Vitamin C (mg) | 145 | 171 | — | — | 188 | 201 |
| Sodium (mg)* | 4841 | 4518 | 4032 | 3045 | 3144 | 2430 |
| Potassium (mg)* | 3428 | 3338 | — | — | 4117 | 3938 |
| Calcium (mg) | 605 | 570 | 546 | 437 | 1132 | 983 |
| Iron (mg) | 17 | 15 | 15 | 13 | 15 | 13 |
| Zinc (mg) | 14 | 11 | — | — | 13 | 11 |

*Values for HK Chinese estimated from urinary values; those for Singapore Chinese and Australians from dietary intake. †Retinol and niacin equivalents.

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saturated fatty acid ⩽10% of total energy; cholesterol ⩽300 mg. Overall, approximately 50% of the population had a cholesterol intake of ⩽300 mg, and 60% had a fat intake of ⩽30% of total energy, while the percentage of energy from saturated fats was ⩽10% in 85% of the subjects. However, 78% of the subjects had an estimated sodium intake >2300 mg, a value above which sodium has been shown to be significantly related to the slope of blood pressure increase with increasing age.[10] (The quantity of sodium and potassium intake per day estimated from the food frequency questionnaire was lower than values estimated from urine output. Mean (SD) values for sodium were 1260 (923) mg for men and 1084 (669) mg for women; values for potassium were 2619 (839) mg for men and 2202 (793) mg for women. The mean values for urinary sodium/creatinine were 14.3 (SD 22.4) mmol/mmol for men and 17.0 (SD 16.6) mmol/mmol for women; the values for potassium/creatinine were 5.5 (SD 11.7) mmol/mmol for men and 6.8 (SD 4.4) mmol/mmol for women).

Table 3 compares the mean intake values for Hong Kong Chinese, Singaporean Chinese, and Australians. Only nutrients with values provided for all three surveys are listed. No statistical analysis is performed as the SD values were not available from some of the other surveys. The fat percentage, saturated fatty acids, the B vitamins, vitamin C, calcium, and potassium appear to be lower in Chinese compared with Australians despite comparable energy intakes, while sodium intake appears to be higher.

Table 4 compares the dietary practices between Chinese, Singaporeans, and Australians. For the Singaporeans, findings refer to the whole Singaporean population and include Chinese, Malays, and Indians because the relation between dietary practices and the overall mortality from cardiovascular diseases in the Singaporean population compared with the Hong Kong population will be examined. Those practices showing statistically significant difference between the three groups are described below. Compared with Singaporeans, Hong Kong Chinese had more dietary restrictions, and used fast food outlets more. Consumption of wholemeal bread was most prevalent in Australians, followed by Hong

*Table 4 Comparison of dietary practices in Hong Kong, Singapore, and Australia*

| | *Per cent of subjects* | | | | | |
|---|---|---|---|---|---|---|
| | *1995 HK Chinese (n=1010)* | | *1993 Singaporeans (n=460)* | | *1993 Australians (n=1733)* | |
| | *M* | *F* | *M* | *F* | *M* | *F* |
| Dietary practices | | | | | | |
| Type of diet | | | | | | |
| No restriction | 72* | 54** | 74 | 68 | — | — |
| Low fat, sugar, red meat | 24 | 43 | 26 | 31 | — | — |
| Fat/cholesterol modified diet | 6 | 9 | 0 | 0.4 | — | — |
| Strict vegetarian | 0.6 | 0.8 | 0 | 0.4 | — | — |
| Eating at fast food restaurant | | | | | | |
| <1/wk | 60*** | 78* | 90 | 91 | — | — |
| 2—7 times/wk | 37 | 21 | 10 | 9 | — | — |
| >7 times/wk | 4 | 0.8 | 0.2 | 0 | — | — |
| Type of bread eaten | | | | | | |
| White | 55*** | 57*** | 78 | 73 | 35 | 25 |
| Wholemeal | 4 | 4 | 14 | 16 | 35 | 45 |
| Both | 36 | 33 | 3 | 9 | 25 | 22 |
| Do not eat bread | 5 | 6 | 6 | 3 | — | — |
| Choice of fat spread | | | | | | |
| Butter | 31*** | 18*** | 24 | 26 | 15 | 20 |
| Margarine | 31 | 41 | 38 | 51 | 60 | 55 |
| Do not use | 34 | 36 | 26 | 16 | 5 | 5 |
| Type of milk used | | | | | | |
| White/full cream | 30 | 22 | 25 | 30 | 62 | 50 |
| Low/non fat, skimmed | 18 | 40 | 14 | 22 | 35 | 50 |
| Sweetened condensed | 9 | 6 | 17 | 12 | — | — |
| Do not use milk | 44 | 34 | 40 | 35 | — | — |
| Intake of deep fried food per week | | | | | | |
| ⩽2 times | 64** | 72** | 49 | 57 | — | — |
| 3–5 times | 25 | 18 | 30 | 25 | — | — |
| >5 times | 4 | 2 | 19 | 14 | — | — |
| Not at all | 7 | 8 | 2 | 4 | — | — |
| Trimming of fat from meat | | | | | | |
| All of the fat | 19*** | 35*** | 35 | 55 | 8 | 3 |
| Some of the fat | 53 | 43 | 27 | 27 | 25 | 37 |
| None of the fat | 22 | 9 | 31 | 12 | 68 | 80 |
| Do not eat meat with visible fat | 6 | 12 | 6 | 5 | — | — |
| Trimming of skin from poultry | | | | | | |
| All of the skin | 14* | 32* | 30 | 50 | 27 | 45 |
| Some of the skin | 36 | 45 | 20 | 22 | 22 | 25 |
| None of the skin | 48 | 21 | 47 | 25 | 50 | 30 |
| Do not eat poultry | 1 | 1 | 4 | 3 | — | — |
| Type of cooking oil used | | | | | | |
| Polyunsaturated | 53*** | 61*** | 40 | 36 | — | — |
| Monounsaturated | 46 | 61 | 18 | 17 | — | — |
| Coconut/palm/mixed vegetable oil | 2 | 2 | 42 | 46 | — | — |
| Addition of salt/sauces at the table | | | | | | |
| Rarely or never | 33*** | 38*** | 71 | 67 | — | — |
| When food is not tasty enough | 62 | 56 | 26 | 31 | — | — |
| Before tasting | 5 | 6 | 3 | 2 | — | — |

$\chi^2$ Test in the same sex between Chinese and others: *p<0.05, **<0.01, ***<0.001.

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Kong Chinese, with Singaporeans having the lowest consumption. More Hong Kong Chinese and Singaporeans do not use fat spread on bread; but when this is used, the use of butter was greater in Hong Kong Chinese and Singaporeans compared with Australians. A high percentage of the Hong Kong Chinese and Singaporeans do not use milk. The habit of trimming fat from meat is higher in Hong Kong Chinese and Singaporeans compared with Australians. For cooking, Singaporeans use coconut/palm/mixed vegetable oil more than Hong Kong Chinese, while the latter used more monosaturated oils (mainly peanut oil). The habit of adding salt/sauces at the table was more prevalent in Hong Kong Chinese compared with Singaporeans.

## Discussion

The higher energy intake in men compared with women is to be expected, as part of the energy expenditure will be related to lean body mass, which will be higher in men. Men may also be more physically active. The reduction in energy intake with age is also compatible with the reduction in energy requirement with aging, as a consequence of reduction in basal metabolic rate because of the loss of fat-free mass and reduction in physical activity.[26] With reduction in energy intake, the intake of many micronutrients will be expected to decrease, hence the lower intake in women and with increasing age. There are some exceptions. Even though men have a higher energy intake, vitamin C intake was lower, and the total percentage calorie from protein was also lower. With increasing age, the energy intake and intake of many micronutrients are reduced. However, it has been noted that the age related reduction in energy requirement is not inevitable, wide variations occurring as a result of differences in physical activity and body composition.[26] Moreover, it is uncertain whether micronutrient intake may become inadequate, and it is possible that the nutrient density of micronutrients should be higher with increasing age.[27] In this population, vitamin C intake actually increases with age, together with sodium and potassium.

The urinary cation values are similar to those from previous surveys in the Hong Kong Chinese population[28] and to other Chinese populations in the Intersalt Study.[10] However, there may be day to day variations in cation excretion, so that urinary values will only be an approximate indication of intake. Moreover, as we were unable to collect 24 hour urine samples, the 24 hour cation output had to be estimated from random samples. Therefore the quantification of intake is an approximation only. Nevertheless, it would be expected to be more accurate compared with quantification from a food diary because it is difficult to quantify salt/sauce added to cooking or at the table. The comparatively high sodium intake in this population compared with Australian data in undesirable because of its contribution to the development of hypertension[10] and associated diseases (stroke, ischaemic heart disease). Thus only 22% of the subjects had an intake ≤2300 mg. In particular the increasing intake with age may also partly contribute to the increasing prevalence of hypertension with age in this population. The prevalence has been shown to vary from 17% in men and 5% in women in the working population,[28] to 48% in subjects aged 70 years and over.[29] The increasing salt intake may be partly because of the increasing taste threshold with age.[30] However, the effect of increased salt intake on blood pressure may be partly countered by the increase in potassium intake.

With regard to coronary heart disease, a large proportion of the population are taking a diet regarded as optimal for cardiovascular health. Indeed Hong Kong has one of the lowest age standardised death rates (per 100 000) for cardiovascular diseases in men and women aged 65 years and over,[31] being approximately half that for Singapore and a third of the rate for Australia. Worries about “Westernisation” of the diet appear not to be reflected in death rates for ischaemic heart disease, which are declining.[2] However, hospital admission from ischaemic heart disease is showing a rising trend. This may or may not be because of dietary factors, as it may be a result of hypertension and increasing prevalence of diabetes mellitus in the population. Indeed there seems to be a discrepancy between dietary lipid intake and serum lipid profile. Despite the “ideal” intake, the serum lipid profile is similar to those of some Western populations.[32] The low incidence of coronary heart disease despite a lipid profile similar to populations with much higher disease incidence suggests the presence of “protective” factors, which may be genetic or environmental (including dietary factors).

In relation to bone health, nutritional factors have been associated with increased bone loss with age—low calcium, high sodium, and protein intake.[4] The protein intake in this population is as high as that in Australia. At the same time the sodium intake is higher and the calcium intake is lower. A higher incidence of osteoporosis related fractures in the Chinese compared with Australians, based on nutritional considerations, might be expected. However, the incidence of hip fracture is not higher in Chinese compared with Australians,[4] and indeed is lower than some white populations (for example, Americans).[33] Polymorphism of the vitamin D receptor gene may account for this difference, perhaps by increasing fractional calcium absorption or retarding the rate of bone loss among certain ethnic groups who have a high prevalence of the “protective” genetype.[34] Nevertheless, nutritional factors (raising the calcium intake and reducing sodium intake), would help reduce the current incidence of osteoporosis. It has been shown in the local population that calcium supplementation together with increased physical activity increase bone mineral density in elderly women.[35]

Various studies suggest an association between anti-oxidant vitamins and cancer.[5–7] The role of nutrition in the aetiology of cancer in the Hong Kong population is uncertain. Lung

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cancer is a leading cause of cancer mortality for both men and women in this population despite a much lower smoking prevalence among women of 5%.[36] In epidemiological studies in the Hong Kong population, a diet with higher intakes of fresh fruits, vegetables, and fish seems to ameliorate the risk of lung cancer from environmental smoke or air pollutants.[37] Further studies to define the at risk level of antioxidant vitamin intake associated with cancer in this population would be of interest.

The rising prevalence of diabetes mellitus is of concern, and is probably related to overnutrition.[12] Currently, it is estimated that the prevalence of obesity as defined by a body mass index of >27 kg/m$^2$ is 10% in men and 14% in women (Ko, *et al* unpublished data). It is possible that the energy intake is in excess for the amount of physical activity performed in increasing numbers of the population.

The markedly lower milk consumption in Hong Kong Chinese compared with Australians may account for the lower nutrient density of the B vitamins. Neither Hong Kong Chinese nor Singaporeans seem to be as aware of the value of wholemeal bread (or increase fibre intake) as the Australians. There is also less tendency to favour margarine over butter in the Chinese Singaporeans. It is uncertain whether the much higher prevalence of use of coconut/palm/mixed vegetable oil in the Singaporeans compared with Hong Kong Chinese (who mainly used monosaturated oils), may in part account for the higher serum total and LDL-cholesterol concentrations and the higher coronary heart disease mortality in Singapore compared with Hong Kong.[38] For both men and women aged 65 years and over, the age standardised death rates for Singapore are approximately twice that for Hong Kong.[31] The higher death rates are mainly accounted for by the Indian and Malay population in Singapore, where the rates are up to fourfold higher compared with the Chinese population there.[39] The death rate for ethnic Chinese in Singapore[40] is also higher compared with Chinese in Hong Kong. The higher prevalences of use of coconut/palm/mixed vegetable oil is mainly accounted for by the Malay population (71%) followed by the Chinese (41%) and Indians (28%).[23]

Although this survey has many limitations in terms of sample size, sampling method, possibility of bias in informing subjects of a future dietary assessment, and estimation of sodium and potassium intake from urinary values, it gives a reasonable indication of population dietary intake in Hong Kong Chinese. However, strict comparisons with the Australian and Singapore surveys cannot be made because the survey sample characteristics and methods used for quantification were different. For example, three day weighed record was used for quantification in the Singapore survey. For the Hong Kong Chinese population, in terms of cardiovascular health, the current intake patterns for fat, saturated fatty acids, and cholesterol fall within the recommended range for over 50% of the population, although the salt intake is high. A follow up survey in future is required to see if the trend follows Western habits, and to monitor the intake of energy and prevalence of obesity. Increasing calcium intake should be beneficial for bone health, and the public should be made aware that certain leafy green vegetables are a good source of calcium comparable to milk,[41] in addition to soybean products. The beneficial effects of fibre could be better publicised, and salt consumption could be reduced. Apart from restraint of the use of added salt at the table, the salt content of various food should be displayed to permit the consumer to make an informed choice. More effective methods such as the food industry gradually reducing the salt content of manufactured foods, thus potentially influencing the mean blood pressure of the population, would have great public health implication in the prevention of chronic diseases.

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1 Chan M. *Annual Report 1994–95*. Hong Kong: Department of Health, 1995.
2 Yu TS, Wong SL, Lloyd OL, *et al*. Ischaemic heart disease: trends in mortality in Hong Kong, 1970–89. *J Epidemiol Community Health* 1995;**49**:16–21.
3 Cockram CS, Woo J, Lau E, *et al*. The prevalence of diabetes mellitus and impaired glucose tolerance among Hong Kong Chinese adults of working age. *Diabetes Res Clin Pract* 1993;**21**:67–73.
4 Lau E, Woo J. Osteoporosis in Asia—A modern epidemic. In: Draper HH, ed. *Advances in nutrition research.* New York: Plenum Press, 1994:101–18.
5 Ziegler RG. A review of epidemiological evidence that carotenoids reduce the risk of cancer. *J Nutr* 1989;**119**:116–22.
6 Beta Carotene Cancer Prevention Study Group. The effect of vitamin E and beta-carotene on the incidence of lung cancer and other cancer in male smokers. Alpha-Tocopherol. *N Engl J Med* 1994;**330**:1029–35.
7 Blot WJ, Li JY, Taylor PR, *et al*. Nutrition intervention trials in Linxian, China: supplementation with specific vitamin/mineral combinations, cancer incidence, and disease—specific mortality in the general population. *J Natl Cancer Inst* 1993;**85**:1483–92.
8 Jha P, Flather M, Lonn E, *et al*. The antioxidant vitamins and cardiovascular disease. A critical review of epidemiologic and clinical trial data. *Ann Intern Med* 1995;**123**:860–72.
9 Gurr MI. Dietary lipids and coronary heart disease: old evidence new perspective. *Prog Lipid Res* 1992;**31**:195–243.
10 INTERSALT Cooperative Research Group. INTERSALT: an international study of electrolyte excretion and blood pressure, results for 24 hour urinary sodium and potassium excretion. *BMJ* 1988;**297**:319–28.
11 Khaw KT, Barret-Conner E. Dietary potassium and stroke-associated mortality; a 12 year prospective population study. *N Engl J Med* 1987;**316**:235–40.
12 Chan JCN, Cheung JCK, Lau EMC, *et al*. The metabolic syndrome in Hong Kong Chinese. *Diabetes Care* 1996;**19**:953–9.
13 Leung SSF. Clinical nutrition in Hong Kong. *Asia Pac J Clin Nutr* 1993;**2**:151–3.
14 Ho SC, Donnan SPB, Sham A. Dietary intake among elderly Chinese in Hong Kong. *Journal of Human Nutrition and Dietetics* 1988;**1**:205–15.
15 Janus ED. *The Hong Cardiovascular risk factor prevalence study 1995–96.* Hong Kong: Prime Media, 1997.
16 Woo J, Leung SSF, Ho SC, *et al*. A food frequency questionnaire for use in the Chinese population in Hong Kong: description and examination of validity. *Nutr Res* 1997;**17**:1633–41.
17 Woo J. Health and nutritional status of elderly Chinese living in sheltered housing. [MD Thesis.] Cambridge: Cambridge University, 1988.
18 Hsu-Hage BH-H, Wahlqvist ML. A food frequency questionnaire for use in Chinese populations and its validation. *Asia Pac J Clin Nutr* 1992;**1**:211–23.
19 Holland B, Welch AA, Unwin ID, *et al*. *McCance and Widdowson's the composition of foods*. 5th ed. London: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Food, 1992.
20 Tsang YS, Yung SW. *Diet and ealth guide and composition of food in Southern China.* [In Chinese]. Zhongshan: Zhongshan University Press, 1991.
21 Institute of Health, Chinese Medical Science Institute. *Food composition tables*. [Chinese]. Beijing: Peoples Health Press, 1992.

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22 Schachter J, Marper PH, Radin ME, *et al*. Comparison of sodium and potassium intake with excretion. *Hypertension* 1980;**2**:695–9.
23 Food and Nutrition Department. *Food Consumption Study 1993*. Singapore: Ministry of Health, 1994.
24 Baghurst K, Record S, Syrette J, *et al*. *Food and Nutrition in Australia—does five years make a difference? Results from the CSIRO Australian Food and Nutrition Surveys 1988 and 1993*. Adelaide: CSIRO Division of Human Nutrition, 1996.
25 The International Lipid Information Bureau. *The ILIB lipid handbook: clinical guide, USA*. Houston: International Lipid Information Bureau, 1995.
26 Reilly JJ, Lord A, Bunker VW, *et al*. Energy balance in healthy elderly women. *Br J Nutr* 1993;**69**:21–7.
27 Whitehead RG. Lowered energy intake and dietary macronutrient balance: potential consequences for micronutrient status. *Nutr Rev* 1995;**53**:S2–8.
28 Woo J, Lau E, Chan A, Cockram CS, *et al*. Blood pressure and urinary cations in a Chinese population. *J Human Hypertens* 1992;**6**:299–304.
29 Woo J, Ho SSC, Yuen YK, *et al.* Prevalence and effectiveness of treatment of hypertension on cardiovascular morbidity and mortality in an elderly population aged 70 years and over. *Arch Gerontol Geriatr* 1997;**25**:159–65.
30 Walls AWG. The ageing mouth. In: Evans JG, Williams TF, eds. *Oxford texbook of geriatric medicine*. Oxford, Oxford University Press, 1992:181–2.
31 Beaglehole R, Bonita R. Cardiovascular disease in elderly people: epidemiology and prevention. *Cardiovascular Risk Factors* 1993;**3**:279–89.
32 Lau E, Woo J, Cockram CS, *et al*. Serum lipid profile and its association with some cardiovascular risk factors in an urban Chinese population. *Pathology* 1993;**25**:344–50.
33 Luz Villa M, Nelson L. Race, ethnicity and osteoporosis. In: Marcus R, Feldman P, Kelsy J, eds. *Osteoporosis*. San Diego: Academic Press, 1996.
34 Young RD, Lau EMC, Birjandi Z, *et al*. Interethnic differences in hip fracture rate and the vitamin D receptor polymorphism. *Lancet* 1996;**348**:688–9.
35 Lau E, Woo J, Leung PC, *et al*. The effect of calcium supplementation and exercise on bone density in elderly Chinese women. *Osteoporosis Int* 1992;**2**:168–73.
36 Department of Health. Public Health Report No 1. *A new approach to Public Health Report. Coronary Heart Disease and Lung Cancer*. Hong Kong Department of Health, 1994.
37 Koo LC, Ho JH. Diet as a confounder of the association between air pollution and female lung cancer: Hong Kong studies on exposures to environmental tobacco smoke, incense, and caking fumes as examples. *Lung Cancer* 1996; **14** (suppl 1):S47–61.
38 Hughes K, Yeo PPB, Lun KC, *et al*. Cardiovascular diseases in Chinese, Malays, and Indians in Singapore. II. Differences in risk factor levels. *J Epidemiol Community Health* 1990;**44**:29–35.
39 Hughes K, Teo PPB, Lun KC, *et al*. Ischaemic heart disease and its risk factors in Singapore in comparison with other countries. *Ann Acad Med Singapore* 1989;**18**:245–9.
40 Hughes K. Mortality from cardiovascular diseases in Chinese, Malays and Indians in Singapore, in comparison with England, Wales, USA and Japan. *Ann Acad Med Singapore* 1989;**18**:642–5.
41 Weaver CM, Heaney RP, Nickel KP, *et al*. Calcium bioavailability from high oxalate vegetables: Chinese vegetables, sweet potatoes and rhubarb. *J Food Sci* 1997;**67**:524–5.

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