

The current dietary practice of Hong Kong adolescents

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In Hong Kong, blood lipid profiles of adults and children are comparable to the western industrialized nations. The age on-set of ischemic heart disease in Hong Kong is gradually declining to occur in younger adults. Dietary practices of adolescents influence food habits later in life. However, published data on current dietary intakes of Hong Kong adolescents are scanty. This paper reports a dietary survey of current food habits in 179 12-year-old adolescents using a food frequency questionnaire. The mean \pm SD intake of energy, protein, fat, carbohydrate, cholesterol, calcium, iron, vitamin C and fibre were 2164 \pm 766 kcal, 107 \pm 44 g, 71 \pm 33 g, 274 \pm 91 g, 481 \pm 246 mg, 643 \pm 252 mg, 16 \pm 6 mg, 78 \pm 41 mg and 3.5 \pm 2 g, respectively. The percentages of energy derived from protein, fat, carbohydrate, polyunsaturated fats, monounsaturated fats and saturated fats were 19.7%, 28.8%, 51.5%, 4.4%, 11.5% & 10.4%, respectively, whereas the P/S ratio was 0.43. Protein intake was 2.5 times higher than the FAO/WHO/UNU RDAs, animal protein was the predominant source of protein; meat was the principal source of fat intake (45%), over 61% of the individuals had saturated fat intake greater than 10% (% energy); mean cholesterol intake was 481 mg/d and 79% of the individuals had cholesterol intake above 300 mg/d. Low fibre intake was related to low intake of unrefined grains, vegetables and fruits. A high intake of animal products, cholesterol, a low P/S ratio and low consumption of unrefined grains, vegetables and fruits might be detrimental to a healthy heart. The increasing frequency of eating out at restaurants and fast-food outlets and relatively fewer meals being prepared and eaten at home is a growing concern for maintaining a healthy diet. Immediate action has to be taken to evaluate the current dietary practices of the population to establish appropriate healthy eating policy and guidelines in order to prevent the future risks of developing diet-related chronic diseases.

Introduction

Adolescence in the life cycle is characterized by rapid growth and maturation. At this stage of development, the majority of adolescents also actively engage in sports and recreational activities. Hence, sufficient energy and nutrient intake from balanced diets and healthy snacks are necessary for optimal growth. Hong Kong is similar to many recently developed affluent cities, imprudent diets rich in fats, particularly animal fats, sugars and salt are becoming more popular. Cumulative scientific data have demonstrated the roles of overweight and unbalanced diets in the development of chronic diseases of the affluent. The incidence of obesity among Hong Kong school children has risen to approximately 5%¹. Recent studies on blood lipid profiles in 7-year-old children¹ and in adults over 20 years of age² have shown that the patterns of serum cholesterol levels of the population are approaching those of western industrialized countries. However, published data on current dietary intakes and blood lipid profiles of Hong Kong adolescents are scanty. This

paper reports the dietary intakes of Hong Kong adolescents in the early 1990s and focuses on dietary fats, carbohydrate, protein and cholesterol. The results of the study may provide preliminary data for future larger scale dietary surveys in adolescents and to identify problem areas that might require nutritional education and intervention.

Subjects and methods

Sample population

179 first year students (92 boys and 87 girls) were recruited from a secondary school in Shatin New Town, the New Territories. All the subjects were Chinese with a mean age of 12 years. The school admits students from different socioeconomic classes and from different parts of Hong Kong.

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Dietary assessment

Food intake was evaluated by a self-administered quantitative food frequency questionnaire^{3,4}. The frequency questionnaire has been modified for use in Hong Kong Chinese populations. The questionnaire comprised 70 single items of food and drink as well as groups of food and drink sharing similar nutrient contents and characteristics. These foods and drinks are commonly consumed by people in Hong Kong. The dietary assessment aimed to assess the usual food intake of each individual in the preceding two months. The subject reported how frequent he/she consumed a particular food or drink item per month, per week or per day. The description of serving size was either in multiple or sub-multiple of the actual food item, eg two eggs, 1/4 of an apple or one chicken leg, etc., or in household measures, eg, three Chinese table-spoons, 1.5 teaspoons, one 250 ml glass or one 250 ml Chinese rice bowl, etc. The completed questionnaire was cross-checked by a research dietitian or a research nurse under supervision of the dietitian. Nutrient intake was calculated from a computerized food database with food items compiled from appropriate sources⁵⁻¹⁰, food manufacturers and food chemists.

Weight and height measurement

The weight of each subject (in short-sleeved cotton T-shirt and shorts) was measured on a Seca electronic balance corrected to nearest 0.1 kg. Height without shoes was measured using a wall-mounted stadiometer corrected to nearest 0.1 cm.

Results

The weight and height of 179 adolescents are shown in Table 1. There were no significant gender differences in weight and height ($P>0.05$).

Table 2 shows the intake of energy and nutrients of 179 Hong Kong adolescents. Boys had significantly higher dietary intakes than girls with respect to energy and nutrient intakes ($P<0.05$). The intake of energy was comparable to the FAO/WHO/UNU RDA (2400 kcal/d for boys and 2100 kcal/d for girls)¹¹. Percentage of energy derived from carbohydrate was approximately 51% which was comparable to the world-wide healthy-heart eating guidelines that percentage energy from carbohydrate intake to be above 50%¹²⁻¹⁴. 72% of total carbohydrate intake was derived from cereals such as rice, wheat noodles and bakery products. Mean total protein intake of adolescents was 107 ± 44 g/d which was approximately 2.5 times higher than those recommended by FAO/WHO/UNU (44 g/d for boys and 43 g/d for girls)¹¹. Such a high protein intake was due to the preference for animal products. Meat, fish, milk and milk products and eggs contributed 69% to the total protein intake, and 24% of protein intake was derived from cereals and bakery products, vegetables and fruits.

Fat intake and its sources

Mean percentage of energy derived from fat was $28.3 \pm 5.2\%$ which was not in excess of the recommendations in most developed countries to reduce blood cholesterol concentration¹²⁻¹⁴. Approximately 60% of the subjects had total fat intake (expressed as percentage of total energy intake) below 30%. Percentages of energy derived from polyunsaturated fatty acids, monounsaturated fatty acids and saturated fatty acids were $4.4 \pm 0.96\%$, $11.5 \pm 2.3\%$ and $10.4 \pm 2.1\%$,

Table 1. Mean (SD) weight and height of 179 Hong Kong Adolescents*.

	Boys+Girls (n=197)	Boys (n=92)	Girls (n=87)
Weight (kg)	41.6 (7.9)	40.6 (8.5)	42.6 (7.1)
Height (cm)	152 (7.3)	152 (8.3)	153 (6.0)

*Group gender difference by Student's *t*-test, $P>0.05$.

Table 2. Mean (SD) dietary energy and nutrient intake of 179 Hong Kong adolescents.

	Boys+Girls (n=179)	Boys (n=92)	Girls (n=87)
Energy (kcal)	2164 (766)	*2466 (816)	1845 (557)
Protein (g)	107 (44)	*123 (49)	90 (31)
Fat (g)	71 (33)	*82 (37)	60 (24)
Carbohydrate (g)	274 (91)	*309 (92)	236 (72)
SFA (g)	25.7 (11.7)	*29.3 (12.9)	21.8 (8.7)
MUFA (g)	28.4 (13.9)	*32.7 (15.6)	23.9 (10.1)
PUFA (g)	10.8 (5.4)	*12.5 (6.3)	9.0 (3.4)
Cholesterol (mg)	481 (246)	*569 (285)	388 (150)
% Protein energy	19.7 (3.1)	19.8 (3.1)	19.6 (3.2)
% Fat energy	28.3 (5.2)	28.9 (5.4)	28.7 (4.9)
% Carbohydrate energy	51.4 (7.0)	51.2 (7.0)	51.6 (6.9)
P/S Ratio	0.43 (0.11)	0.44 (0.12)	0.43 (0.10)
% PUFA energy	4.4 (0.96)	4.41 (1.02)	4.37 (0.90)
% MUFA energy	11.5 (2.3)	11.5 (2.4)	11.4 (2.3)
% SFA energy	10.4 (2.1)	10.4 (2.1)	10.4 (2.0)
Thiamin (mg)	1.25 (0.51)	*1.38 (0.53)	1.10 (0.45)
Riboflavin (mg)	1.42 (0.54)	*1.61 (0.57)	1.21 (0.42)
Niacin (mg)	20.0 (8.8)	*22.9 (9.8)	16.9 (6.3)
Vitamin C (mg)	77.7 (41.3)	*84.4 (40.3)	70.6 (40.8)
Calcium (mg)	643 (252)	*722 (257)	560 (220)
Iron (mg)	16.4 (6.15)	*18.8 (6.5)	13.9 (4.7)
Zinc (mg)	9.0 (7.5)	*11.1 (8.5)	6.7 (5.4)
Fibre (g)	3.5 (2.0)	*4.0 (2.2)	3.0 (1.8)

* Group gender difference by Student's *t*-test $P<0.05$.

PUFA = polyunsaturated fatty acids. MUFA = monounsaturated fatty acids. SFA = saturated fatty acids. P/S ratio = the ratio of PUFA to SFA.

respectively. Mean P/S ratio was 0.43 ± 0.11 . Meat provided 45% of mean total fat intake, milk and milk products provided 11%. Approximately 28% of dietary fat was derived from bakery products, instant wheat noodles and eggs. Various types of meat burgers and french fries from fast-food shops contributed to 7% of total fat intake.

Saturated fat intake and its sources

Mean saturated fat intake expressed as a percentage of energy intake was $10.4 \pm 2.1\%$. 38.5% of the subjects received $\leq 10\%$ of their energy from saturated fat. 61.5% of adolescents had saturated fat intake above 10% (range: 10.1%–15.9%). Meat was the principal source of saturated fat intake (45%) for all subjects. Milk and milk products, bakery products and fast-food items (meat burgers and french fries) contributed 18%, 15% and 7% respectively, to the total saturated fat intake in this age group.

Cholesterol intake and its sources

Mean total cholesterol intake of adolescents was 481 ± 246 mg/d. Only approximately 21% of the subjects had cholesterol intake below 300 mg/d as recommended by international committees¹²⁻¹⁴. 79% of individuals had total cholesterol intake between 301 and 1500 mg/d. Meat (41%) and eggs (34%) were the two major sources of cholesterol

among the subjects; while fish and shellfish, bakery products and milk and milk products each contributed 11%, 6% and 5% respectively, to the total cholesterol intake.

Vitamins, minerals and dietary fibre intakes

Mean intakes of thiamin, riboflavin, niacin, vitamin C, iron and zinc were comparable to the US recommendations¹⁵. Mean calcium intake was 643 ± 252 mg/d. The major dietary sources of calcium were milk (28%), dark green leafy vegetables (22%) and cereals (17%). Dietary fibre intake was only 3.5 ± 2.0 g which was due to the preference of refined carbohydrate to unrefined carbohydrate as well as lower consumption of vegetables and fruits.

Discussion

The results of the pilot study reveals that the mean dietary intakes of selected nutrients in the study group were adequate when compared to the RDAs. Furthermore, the results of the survey reflects the affluence of dietary practices among Hong Kong adolescents: protein intake was 2.5 times higher than the RDAs, animal protein was the predominant source of protein; meat was the principal source of fat intake (45%), over 61% of the individuals had saturated fat intake expressed as percentage of energy intake greater than 10%; mean cholesterol intake was 481 mg/d and 79% of the individuals had daily cholesterol intake above 300 mg/d.

There appears to have been some under-estimation of fat intake because cooking oils were not included in the questionnaire. In fact, retrospective dietary assessment has a limited ability to estimate accurately the amount of oil added in cooking, the amount of oil absorbed by the food and the amount left in the serving container. In the present study, however, most of the listed items were either ready-to-eat or cooked, and there was the appropriate food item with corresponding cooking method (including cooking oil) in the food composition database for nutrient calculation. Therefore, under-estimation of fat intake from cooking oil should be minimal.

Despite the fact that mean total fat intake only accounted for less than 30% of total energy intake, and saturated fat intake was less than 10% of total energy intake, however, a majority of the adolescents had a high dietary cholesterol intake and a low P/S ratio. A recent survey¹ in 125 7-year-old Hong Kong children found that though the mean fat intake and saturated fat intake of these children were respectively 29.3% and 10.7% of total energy consumption, the mean serum cholesterol concentration was as high as 4.59 mmol/l which was comparable to the counterparts in western European countries¹³. There are two observations in common in both the previous study and the current study: subjects in both studies had high dietary cholesterol intakes (366 ± 167 mg/d in 7-year-old children vs 481 ± 246 mg/d in adolescents) and low P/S ratios (0.46 in 7-year-old children vs 0.43 in adolescents). In the children's study it seems that even if the percentage of energy derived from fat, protein, carbohydrate and saturated fat compared favourably with healthy eating recommendations in the western developed nations, the concentration of serum cholesterol was still elevated. Furthermore, a high intake of cholesterol, a low P/S ratio and low consumption of unrefined complex carbohydrate, vegetables and fruits might also contribute to an unhealthy diet that would predispose to elevated blood cholesterol. There-

fore, given that the dietary intakes of adolescents in the present study are similar to the children's study, the serum level of cholesterol of adolescents may also be at risk.

In Hong Kong, cardiovascular diseases counted as the second major killer disease¹⁶. The age onset of coronary heart diseases appears to be declining to younger age group according to most local cardiologists. A recent study of 700 Hong Kong adults aged over 20 years² revealed the serum lipids profile of the study population was similar to the Caucasian populations of industrialized countries. The mean serum cholesterol concentration was 5.47 mmol/l, which is higher than the USA figure of 5.3 mmol/l. 25% of the sample population had serum cholesterol level 6.2 mmol/l. Furthermore, the current serum cholesterol level of Hong Kong adults was higher than the value estimated in 1950s (3–4 mmol/l).

As Hong Kong is becoming more prosperous, people can afford to eat more animal products and dine out more frequently. Nowadays people are particularly fond of gathering around the dining table in a restaurant for a family gathering, a birthday party, a reunion with a friend, or a business function, etc. In addition, there is a rapid change in family structure in that more wives and mothers join the work force than did decades ago. After a busy day's work, people would prefer to eat out in restaurants in order to save time and effort in buying and cooking food at home. Unfortunately, most restaurant foods are rich in fats, cholesterol and salt. As a result, the numbers of meals prepared and eaten at home are getting less, the traditional home-based eating habits have gradually changed. More families eat their meals at restaurants, especially during weekends. Consequently, increased preference to animal products and frequent visits to restaurants where foods are high in fats, particularly animal fats and cholesterol, might partially explain for the rise in serum cholesterol concentrations of Hong Kong people.

Such a trend, shifting from home-based eating habits to restaurant foods, also has an impact on the food habits of adolescents and children in the family. Consumption of franchised fast-food, either for meals or a snack is becoming popular as evident in an increasing number of multinational fast-food chain restaurants open on virtually every street corner of Hong Kong. The reason that fast-food establishments increasingly gain popularity among local young people may be that the food they sell symbolizes western culture; these foods are familiar because they are often advertised in the mass media. Food and drinks from these outlets are also inexpensive and can be eaten quickly if one is in a hurry. The interiors of the restaurants look free, youthful and attractive, which is somewhat different to the conventional Chinese or western restaurants. There are also plenty of young people buying from or eating in these places. From a healthy point of view, fast-foods tend to be condensed in energy, fats (especially saturated fats) and sodium; these foods also contain little or no vegetables and fruits, which are in fact good sources of vitamins A, C, folic acid β -carotene and dietary fibre. If such a deviance from normal home-based eating habits persists, it may hamper the long-term health and nutritional status of adolescents.

Preliminary dietary surveys have shown that the general public are following imprudent dietary patterns. In order to lower the prevalence of elevated serum cholesterol in Hong Kong, thereby contributing to a reduction in the risk of developing diet-related chronic diseases, namely, cardiovascular

diseases, diabetes, hypertension, etc., the general public has to modify its current dietary practices and develop more healthy eating habits. More local studies have to be undertaken to study food beliefs, eating behaviours, nutritional status and demographic data of the population in order to provide adequate scientific information for formulating appropriate healthy eating guidelines and for developing nutritional education programs for the needs of different spectrums of the community.

Dietary calcium is important for bone mineralization in children and adolescents. Although mean calcium intake of the adolescents in the present study achieved only about half of the US RDA¹⁵, an optimal level of calcium intake for adolescents has not been derived. It is still controversial as to whether or not populations whose traditional diets consist of little animal milk need to increase their calcium intake¹⁷⁻²³ as recommended recently by some western industrialized countries¹⁵⁻²⁴. Our research group has recently studied calcium absorption in Chinese children¹⁹ with habitually low (300 mg/d) and high (800 mg/d) calcium intakes. We found that the low calcium children had significantly higher true fractional calcium absorption (63%) than their high calcium intake counterparts (55%) ($P=0.016$). The percentage of calcium absorption was even higher than the Caucasian children (35-40%)^{25,26}. The higher efficiency calcium absorption may be due to nutritional adaptation and ethnic difference. Results of our study of the influence of calcium supplementation on rates of fractional calcium absorption²⁰ supported the hypothesis that nutritional adaptation operates in children in response to different calcium intakes which enhances calcium requirements for Chinese children may be lower than for those for their Caucasian counterparts. Furthermore, there is no evidence to indicate that such a level of calcium intake is reported in the present study, which in fact reached the WHO recommended safe intake of calcium²⁷ is inadequate for bone mineralization in adolescents or insufficient for achieving future peak bone mass. The results from our recent calcium supplementation trials in 270 Chinese children conducted over 18 months¹⁸ have found that by giving 300 mg/d elemental calcium to the supplemented group, there were extra increases of 3.14% and 4.61%, respectively in bone mass for the mid-forearm and the lumbar spine. Such magnitudes of gains in bone mass were comparable to those studies in Caucasian children²⁸ and adolescents²⁹ using two-to three-fold higher daily doses of supplemental calcium.

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香港青少年飲食的現狀

摘要

作者比較了西方工業國家和香港成人和兒童的血脂含量。香港成人患缺血性心臟病的年齡已續步下降，青少年的飲食將影響今後的食物習慣。但目前香港青少年飲食的數據發表不多。該文用食物次數問卷 (FFQ) 調查了 179 位 12 歲青少年的飲食，結果發現能量、蛋白質、脂肪、碳水化合物、膽固醇、鈣、鐵、維生素 C 和食物纖維素的平均數±標準差分別為 2164±766 仟卡、107±44 克、71±33 克、274±91 克、481±246 毫克、643±252 毫克、16±6 毫克、78±41 毫克和 3.5±2 克。蛋白質、脂肪、碳水化合物、多不飽和脂肪、單不飽和脂肪和飽和脂肪分別佔總能量 19.7%、28.8%、51.5%、4.4%、11.5% 和 10.4%，而 P/S 比值為 0.43，蛋白質進食比 (RDAS) 大 2.5 倍，主要是動物蛋白，肉類是主要的脂肪來源 (佔 45%)，超過 61% 的人進食飽和脂肪佔總能量 10% 以上，每日平均進食膽固醇為 481 毫克，79% 的人每日膽固醇進食超過 300 毫克。低纖維與進食粗穀類食品、蔬菜和水果不足有關。進食過多的動物食品、膽固醇、P/S 比值低和進食粗穀類食品、蔬菜和水果不足似不利於健康的心臟。多在餐館和快餐店進食，少在家裡進食對維持健康膳食引起關注。一個評估目前青少年飲食的緊急措施已經進行，目的在建立適當的健康飲食政策和指導，以預防與食物有關的慢性疾病。

