

Fat intake in Hong Kong Chinese children¹⁻³

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ABSTRACT The people of Hong Kong are experiencing a transition in dietary practices and lifestyle that can be observed in the fat intakes of Hong Kong children as compared with those of their counterparts on mainland China. The studies described here include 1) a longitudinal and observational dietary survey beginning with a cohort of 174 newborns and concluding with 124 children at age 7 y; 2) a biochemical study of serum lipids in relation to dietary fat intake at age 7 y; 3) a chemical fatty acid analysis and comparison of duplicate meals collected from 20 Hong Kong and 20 mainland Chinese children at age 7 y; 4) a dietary assessment of 52 lactoovovegetarian children aged 4–14 y; and 5) a comparison of the growth of all subjects with US National Center for Health Statistics standards. About 30% of the total daily energy intake of Hong Kong Chinese children aged 1–7 y was contributed by fat—much more than that in the traditional Chinese diet. Growth of the children was not impaired, including that of children on the mainland and of those lactoovovegetarians in Hong Kong whose fat intakes were lower. Mean serum cholesterol of Hong Kong Chinese children at age 7 y was 4.59 mmol/L, significantly higher than that of their counterparts on the mainland, 4.16 mmol/L. Foods consumed in Hong Kong had a significantly lower ratio of 18:2 to 14:0. Nutritional deficiency was uncommon. Chinese children in Hong Kong had a dietary fat intake that was both quantitatively and qualitatively different from the traditional Chinese diet. *Am J Clin Nutr* 2000;72(suppl):1373S–8S.

KEY WORDS Fat, cholesterol, fatty acids, obesity, vegetarian children, energy intake, Asian diet, China, Hong Kong

INTRODUCTION

It was observed that dietary fat consumption in childhood can have a long-term effect on adult health, particularly the risk of coronary heart disease (CHD). Hence, recommendations to restrict dietary fat intake have been made; however, these recommendations vary between populations and there has been concern that excessive restriction could lead to growth failure and nutritional deficiency. Different populations have different eating habits and chronic adult diseases rates. The dietary fat intake of American children 6–11 y of age has decreased over the past 2 decades from 36.3% to 34.0% of total energy intake, and it has been targeted to decrease further to 30% (1).

The experience in Asia has been different. In Hong Kong, the age-standardized CHD rates from 1988 to 1992 remained at

≈58.3/100 000 in men and 32.0/100 000 in women, less than half those in the United States (2). The dietary fat intake with the traditional Chinese diet was low at 14%, but showed a rising trend in association with urbanization (3). Restriction of dietary fat has not been a concern until recently. The prevalence of childhood obesity in Hong Kong was first reported by the local growth survey in 1993: 10–13% of children aged 6–18 y had weights >120% of the Hong Kong median weight-for-height (4). This emergence of childhood obesity was considered to be related to changes in lifestyle. This article aims to examine the dietary fat intake of Chinese children, with special emphasis on those in Hong Kong.

CHANGES IN TOTAL DAILY FAT INTAKE FROM BIRTH TO 7 Y OF AGE

A cohort of healthy, full-term newborn babies ($n = 174$) was recruited in 1984 for a growth and nutrition study. Diet assessments were made at regular intervals by one of the research dietitians using a combination of dietary history, 24-h recall, and food-frequency questionnaire. Nutrient intakes were assessed by referring to appropriate food tables. The studied cohort was a stratified random sample. The dropout rate of 28% by age 7 y was mainly due to emigration or moving out of the area. Details of the survey and part of the results were reported elsewhere (5, 6). During infancy, formula feeding was the norm, and milk was continued as part of the diet for most of the subjects during childhood. By ages 5 and 7 y, 90% and 75% of children, respectively, were still consuming milk regularly. Rice-based weaning foods were introduced at ≈6 mo and served with fish, meat, eggs, vegetables, and fruit. By age 2 y, bread and rolls gradually became the main cereal for breakfast, often served with milk. Because the rice-based weaning diet contained much less fat than milk, the percentage of dietary fat contributing to the total daily energy intake fell rapidly during weaning from ≈50% at birth to ≈30% by age 1 y. Lean meat

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²Presented at the symposium Fat Intake During Childhood, held in Houston, June 8–9, 1998.

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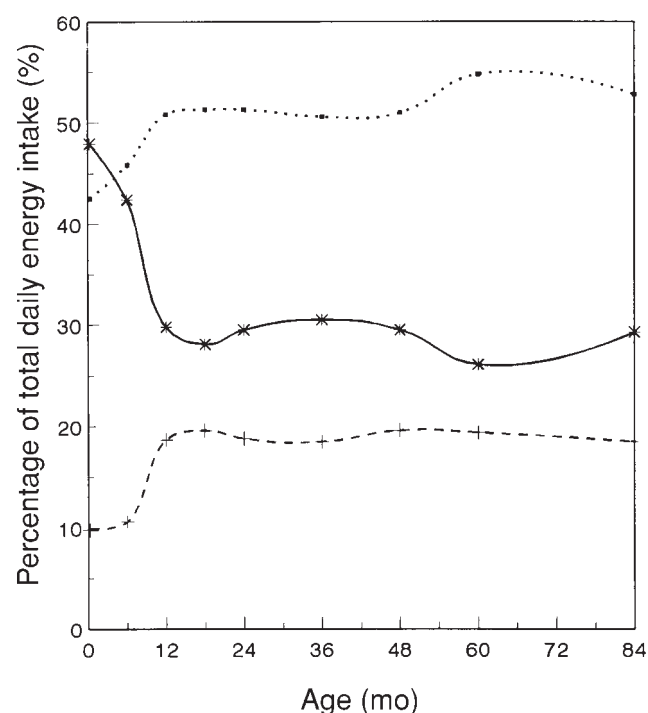


FIGURE 1. Percentages of total daily energy intake contributed by carbohydrate (.....), protein (-----), and fat (—) in Hong Kong Chinese children from birth to 7 y of age.

or fish was usually served with the weaning foods. Corn oil or peanut oil was mostly used for cooking and the amount was minimal, just enough to marinate the meat before cooking. Boiling and steaming were the usual cooking methods for preparing foods for infants and toddlers. Only when they became older did they begin to share the adult diet and to eat out away from home. By then, the amount of milk consumed also decreased. Therefore, dietary fat intake was maintained at $\approx 30\%$ of daily energy intake from age 1 to 7 y (**Figure 1**).

GROWTH OF CHILDREN FROM BIRTH TO AGE 7 Y

With 30% of energy intake as fat from age 1 y onward, none of the children studied had impaired growth at any time, and none weighed $<80\%$ of the Hong Kong median weight-for-height. In contrast, 4–8% were obese at ages 5 and 7 y, defined as weight $>120\%$ of the Hong Kong median weight-for-height, which is comparable with the prevalence of obesity in the population surveyed in 1993 (**Table 1**; 7). The mean weight and height of boys and girls at various intervals were comparable with the Hong Kong growth references (**Table 2**; 7, 8).

NUTRIENT INTAKE

The energy per unit mass decreased from birth to 6 mo and then increased to a peak at 15 mo before decreasing again ($\text{kJ} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$): for boys, 502 at day 7, 368 at 6 mo, 414 at 15 mo; for girls, 515 at day 7, 351 at 6 mo, 444 at 15 mo (**Table 3**). Protein intake ($\text{kg} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$) decreased from 3 g at birth to 2 g at 4 mo and then increased to a peak of 5 g at 15 mo before decreasing again (**Table 4**; 9). There was no evidence of iron deficiency

or vitamin D deficiency during the weaning period (10, 11). The possibility of zinc deficiency was excluded at age 5 y (12).

Nutrient intakes were examined in more detail at age 7 y; these were tested for correlation with the biochemical findings. Total energy intake was 7.0 ± 1.9 MJ/d and the total fat intake was 55.4 ± 20.8 g/d, contributing $29.3 \pm 5.6\%$ of total daily energy (**Table 5**; 13). Sources of total fat were meat (31%), cakes and bread (17%), milk (14%), eggs (10%), dim sum (6%), fast food (4%), fish (4%), and other sources (15%).

SERUM LIPID PROFILES OF 7-Y-OLD CHILDREN

Fasting blood concentrations of total serum cholesterol and triacylglycerol were measured in a cohort of 94 children at age 7 y by an enzymatic method with use of commercial reagents (Baker Instruments Corporation, Allentown, PA). HDL-cholesterol concentrations were measured after fractional precipitation with dextran sulfate–magnesium chloride, and apolipoproteins A-I and B were measured by rate immunonephelometry (Array Analyzer; Beckman Instruments, Fullerton, CA). Mean (\pm SD) serum cholesterol concentrations were 4.59 ± 0.91 mmol/L for boys and 4.58 ± 0.72 mmol/L for girls. LDL-cholesterol concentrations were 2.61 ± 0.82 mmol/L for boys and 2.65 ± 0.65 mmol/L for girls, higher than those of American children of the same age (14, 15). There was no significant difference between serum lipids of boys and girls. A total of 53% of the children had total cholesterol concentrations >4.4 mmol/L and 34% had LDL-cholesterol concentrations >2.86 mmol/L. A higher concentration of total cholesterol was associated with a lower intake of polyunsaturated fatty acid, a lower ratio of polyunsaturated to saturated fatty acids (P-S ratio), and a lower carbohydrate intake, all with $r = -0.2$ ($P < 0.05$). A higher LDL-cholesterol concentration was associated with a lower P-S ratio, whereas a lower HDL-cholesterol concentration was associated with a lower carbohydrate intake.

To investigate whether the relatively higher serum cholesterol concentration in Hong Kong children was genetic in origin, another Chinese population ($n = 99$) of the same age and ethnicity but residing in the city of Jiangmen on the mainland, was examined. This population's diet was much more traditional. Most children were breast-fed during infancy and milk products were not commonly consumed by toddlers and children. Rice was the main cereal. Bread was not a common food item, even for breakfast. Fast food, soft drinks, and snacks of high-fat content were not generally consumed. The total serum cholesterol concentration was 4.16 ± 0.61 mmol/L, triacylglycerol was 0.59 ± 0.22 mmol/L, and LDL cholesterol was 2.40 ± 0.46 mmol/L—all

TABLE 1

Percentage of cohort children with weight $>120\%$ of the Hong Kong median weight-for-height compared with the 1993 growth survey¹

Sex and age	Cohort	1993 Hong Kong reference
	% (n)	%
Boys		
5 y (n = 68)	2.9 (2)	4
7 y (n = 70)	7.1 (5)	7.6
Girls		
5 y (n = 63)	4.8 (3)	4.2
7 y (n = 55)	5.5 (3)	7.8

¹1993 Hong Kong reference values from reference 7.

TABLE 2

Weight and height of Hong Kong Chinese children <7 y of age¹

Sex and age (mo)	Weight			Height		
	Cohort	1993 Hong Kong reference	NCHS z score	Cohort	1993 Hong Kong reference	NCHS z score
		kg			cm	
Boys						
0.25 (n = 93)	3.3 ± 0.4	3.3 ± 0.4	-0.5 ± 0.8	50.0 ± 1.7	50.8 ± 1.8	-0.6 ± 0.8
2 (n = 86)	5.5 ± 0.5	5.6 ± 0.6	0.3 ± 0.6	57.6 ± 1.8	58.1 ± 1.9	-0.2 ± 0.7
4 (n = 83)	7.0 ± 0.7	7.0 ± 0.7	0.2 ± 0.7	63.1 ± 1.7	63.3 ± 2.1	-0.3 ± 0.7
6 (n = 81)	7.9 ± 0.8	7.9 ± 0.8	-0.0 ± 0.8	67.0 ± 1.9	67.3 ± 2.2	-0.3 ± 0.7
8 (n = 81)	8.4 ± 0.8	8.4 ± 0.8	-0.4 ± 0.9	70.1 ± 2.1	70.5 ± 2.3	-0.4 ± 0.8
10 (n = 79)	8.9 ± 0.9	8.9 ± 0.9	-0.7 ± 0.8	72.6 ± 2.2	72.9 ± 2.5	-0.4 ± 0.8
12 (n = 80)	9.3 ± 0.9	9.5 ± 0.8	-0.8 ± 0.9	74.9 ± 2.2	75.3 ± 2.6	-0.4 ± 0.8
15 (n = 79)	10.1 ± 0.9	—	-0.8 ± 0.8	78.2 ± 2.2	—	-0.4 ± 0.8
18 (n = 79)	10.6 ± 1.0	10.8 ± 1.2	-0.7 ± 0.8	80.9 ± 2.4	81.3 ± 3.1	-0.5 ± 0.8
21 (n = 77)	11.2 ± 1.0	—	-0.6 ± 0.8	83.6 ± 2.5	86.2 ± 3.2	-0.5 ± 0.8
24 (n = 78)	11.7 ± 1.1	12.1 ± 1.2	-0.6 ± 0.9	86.3 ± 2.6	—	-0.0 ± 0.8
27 (n = 73)	12.3 ± 1.1	—	-0.5 ± 0.9	88.7 ± 2.7	—	0.2 ± 0.8
30 (n = 74)	12.9 ± 1.2	—	-0.5 ± 0.8	90.7 ± 3.0	—	0.1 ± 0.8
33 (n = 74)	13.3 ± 1.2	—	-0.5 ± 0.8	92.8 ± 3.0	—	0.0 ± 0.8
36 (n = 74)	13.7 ± 1.2	14.0 ± 1.6	-0.6 ± 0.7	94.6 ± 3.0	95.3 ± 3.7	-0.1 ± 0.8
48 (n = 73)	15.6 ± 1.6	16.0 ± 2.3	-0.6 ± 0.9	101.3 ± 3.4	102.3 ± 4.2	-0.4 ± 0.8
60 (n = 68)	17.6 ± 2.3	20.2 ± 4.1	-0.3 ± 1.6	108.2 ± 4.0	108.2 ± 4.7	-0.2 ± 1.5
84 (n = 70)	22.4 ± 4.2	22.2 ± 4.4	-0.3 ± 1.3	120.3 ± 4.8	118.7 ± 5.5	-0.2 ± 0.9
Girls						
0.25 (n = 80)	3.1 ± 0.4	3.3 ± 0.4	-0.5 ± 0.8	49.1 ± 1.7	50.3 ± 1.8	-0.7 ± 0.8
2 (n = 78)	4.9 ± 0.5	5.1 ± 0.5	0.3 ± 0.8	56.2 ± 1.6	56.9 ± 1.9	-0.3 ± 0.7
4 (n = 76)	6.3 ± 0.6	6.3 ± 0.7	0.2 ± 0.8	61.5 ± 1.6	61.8 ± 2.1	-0.2 ± 0.6
6 (n = 76)	7.2 ± 0.8	7.2 ± 0.8	-1.0 ± 0.9	65.4 ± 1.8	65.8 ± 2.2	-0.2 ± 0.7
8 (n = 75)	7.8 ± 0.8	7.8 ± 0.8	-0.4 ± 0.9	68.5 ± 1.9	69.0 ± 2.4	-0.2 ± 0.7
10 (n = 75)	8.3 ± 0.9	8.5 ± 0.9	-0.7 ± 0.9	71.3 ± 2.0	71.5 ± 2.5	-0.2 ± 0.7
12 (n = 75)	8.7 ± 1.0	8.9 ± 0.9	-0.8 ± 0.9	73.8 ± 2.0	73.9 ± 2.7	-0.2 ± 0.7
15 (n = 74)	9.4 ± 1.0	—	-0.8 ± 0.9	77.2 ± 2.2	—	-0.2 ± 0.7
18 (n = 74)	10.1 ± 1.1	10.4 ± 1.2	-0.6 ± 0.9	80.3 ± 2.3	80.1 ± 3.1	-0.2 ± 0.8
21 (n = 69)	10.7 ± 1.2	—	-0.6 ± 1.0	82.9 ± 2.7	—	0.3 ± 0.8
24 (n = 68)	11.3 ± 1.2	11.5 ± 1.2	-0.5 ± 1.0	85.7 ± 2.8	85.0 ± 3.1	0.1 ± 0.8
27 (n = 61)	11.8 ± 1.4	—	-0.5 ± 1.0	88.2 ± 2.9	—	0.3 ± 0.9
30 (n = 61)	12.4 ± 1.4	—	-0.5 ± 1.0	90.1 ± 3.0	—	-0.2 ± 0.9
33 (n = 62)	12.8 ± 1.5	—	-0.6 ± 1.0	92.2 ± 3.2	—	0.1 ± 0.9
36 (n = 62)	13.3 ± 1.5	13.5 ± 1.4	-0.6 ± 1.0	94.1 ± 3.3	93.3 ± 3.5	0.2 ± 1.0
48 (n = 67)	15.1 ± 2.0	15.4 ± 2.2	-0.6 ± 1.0	101.0 ± 3.6	100.4 ± 4.0	-0.2 ± 0.9
60 (n = 63)	17.1 ± 2.6	17.3 ± 2.4	-0.4 ± 1.1	107.9 ± 4.3	106.9 ± 4.5	-0.1 ± 1.0
84 (n = 55)	21.1 ± 3.7	21.5 ± 3.4	-0.3 ± 1.1	119.8 ± 5.1	119.1 ± 5.5	-0.0 ± 0.9

¹ $\bar{x} \pm \text{SD}$. National Center for Health Statistics (NCHS) z scores from reference 8; 1993 Hong Kong reference values from reference 7.

cholesterol concentrations were significantly lower than those of the Hong Kong population despite similar body sizes (Table 6).

CHEMICAL ANALYSIS OF DIETARY FAT AND ITS RELATION TO SERUM LIPIDS

Estimation of dietary fat can be difficult, particularly in the Chinese diet. For instance, different pork parts with variable amounts of fat can be consumed at different meals and by different individuals sharing the same meal. Cooking oil use varies with different cooking methods and varies with the food mix in each dish. Therefore, chemical analysis of fat in duplicate meals is more accurate and also provides the content of various fatty acids, many of which are not available in food tables. However, the sample size is limited by the cost and tedious nature of the analytic method.

Of the Hong Kong cohort children and Jiangmen children who had fasting serum lipids measured, 20 children from each population were requested to bring in duplicate meals for 2 consecutive weekdays. Foods were analyzed by the same technician using the same methods. After blending, a 10-g portion was used for total fat estimation by the gravimetric method while another 10-g portion was used for fatty acid analysis by gas chromatography.

Dietary fat was significantly higher, 47.55 ± 14.42 g compared with 34.67 ± 16.22 g, and the P-S ratio was significantly lower, 0.69 ± 0.24 compared with 0.81 ± 0.25 , in the Hong Kong diet than in the Jiangmen diet. Likewise, the cholesterol-lowering ratio, ie, the ratio of 18:2 to 14:0 (16), was significantly lower in the former (Table 7). Because the Hong Kong population represented the second generation after migration from mainland China, the above results served as a reflection of both a qualitative and quantitative change in dietary fat.



TABLE 3
Daily energy intake of Hong Kong Chinese children from birth to 7 y of age

Age (mo)	Energy intake							
	Boys				Girls			
	$\bar{x} \pm \text{SD}$	10th	50th	90th	$\bar{x} \pm \text{SD}$	10th	50th	90th
<i>kJ·kg⁻¹·d⁻¹</i>								
0.25	502 ± 126	326	498	669	515 ± 105	364	506	669
2	452 ± 79	356	448	561	460 ± 88	356	452	586
4	368 ± 71	272	364	481	368 ± 75	280	372	469
6	368 ± 100	285	347	464	351 ± 71	272	347	431
8	368 ± 88	268	368	477	372 ± 79	276	368	477
10	381 ± 88	272	377	506	385 ± 84	293	368	502
12	410 ± 100	305	406	531	418 ± 109	314	389	582
15	414 ± 96	297	423	536	444 ± 117	318	418	586
18	397 ± 92	297	389	519	427 ± 142	289	397	586
21	381 ± 92	259	385	498	418 ± 130	285	397	561
24	385 ± 109	272	356	519	410 ± 134	293	393	527
30	351 ± 79	255	343	464	351 ± 96	243	335	456
36	335 ± 79	234	339	431	314 ± 96	213	301	423
48	305 ± 79	218	305	406	305 ± 75	205	301	402
60	360 ± 79	272	347	464	331 ± 75	243	326	414
84	343 ± 75	255	339	444	305 ± 92	205	289	410

FAT INTAKE IN CHINESE VEGETARIAN CHILDREN

A total of 53 Hong Kong lactoovovegetarian children aged 4–14 y with a mean age of 9.64 ± 2.56 y were studied for diet and nutrient intake. All of them showed normal growth, ie, within the normal range of the Hong Kong reference (Figure 2). Fat contributed 23.20 ± 5.59% of the total energy intake and the mean energy intake was 6.6 ± 2.2 MJ/d. The P-S ratio was 1.08 ± 0.38. Cholesterol intake was 154.87 ± 73.38 mg/d. The lower fat intake compared with that of omnivorous children was not associated with any evidence of growth failure or calcium deficiency. The daily calcium, iron, and vitamin C intakes were 527.93 ± 209.03 mg, 12.60 ± 6.46 mg, and 91.76 ± 57.21 mg, respectively. None had hemoglobin concen-

trations <110 g/L, and only 4% showed a rise in hemoglobin concentration >10 g/L after 3 mo of iron therapy. There was no evidence of vitamin B-12 deficiency. Such low incidence of nutritional deficiency associated with the 23% fat intake was reassuring.

SERUM FATTY ACIDS IN HONG KONG CHILDREN

The effect of dietary fat on growth is not just quantitative but is also qualitative. Apart from using duplicate meals to analyze fatty acids, serum fatty acids can also be analyzed. A pilot study

TABLE 4
Daily protein intake from birth to 7 y of age¹

Age (mo)	Total protein intake		Protein/unit body mass	
	Boys	Girls	Boys	Girls
	<i>g/d</i>		<i>g·kg⁻¹·d⁻¹</i>	
0.25	9.3 ± 2.7	9.3 ± 2.5	2.9 ± 0.8	3.0 ± 0.8
2	13.7 ± 2.7	12.7 ± 3.0	2.5 ± 0.5	2.6 ± 0.6
4	14.3 ± 2.9	13.0 ± 3.5	2.1 ± 0.4	2.1 ± 0.5
6	18.2 ± 7.4	16.0 ± 6.1	2.3 ± 0.9	2.2 ± 0.7
8	28.4 ± 11.0	25.2 ± 10.3	3.4 ± 1.3	3.2 ± 1.3
10	34.9 ± 11.1	33.6 ± 13.4	3.9 ± 1.3	4.1 ± 1.7
12	43.1 ± 15.4	41.1 ± 16.2	4.7 ± 1.8	4.7 ± 1.9
15	48.0 ± 13.3	47.4 ± 15.8	4.8 ± 1.4	5.1 ± 1.8
18	48.8 ± 13.9	51.2 ± 17.8	4.6 ± 1.4	5.1 ± 1.9
21	49.9 ± 14.5	49.5 ± 16.5	4.5 ± 1.4	4.7 ± 1.7
24	49.3 ± 17.6	48.9 ± 15.8	4.5 ± 1.5	4.6 ± 1.6
30	51.6 ± 15.7	51.2 ± 16.1	4.0 ± 1.2	4.2 ± 1.3
36	49.7 ± 14.8	46.8 ± 15.9	3.7 ± 1.1	3.6 ± 1.3
48	54.6 ± 19.2	55.5 ± 17.2	3.5 ± 1.2	3.7 ± 1.2
60	70.6 ± 18.7	66.1 ± 18.0	4.0 ± 1.1	3.9 ± 1.2
84	81.4 ± 22.7	72.1 ± 24.7	3.7 ± 1.0	3.5 ± 1.3

¹ $\bar{x} \pm \text{SD}$. Data from reference 9.

TABLE 5
Macronutrient intake of 7-y-old Hong Kong Chinese children¹

	Hong Kong children	US recommendation
Energy (MJ)	7.0 ± 1.9 ²	8.4 ³
(kJ/kg)	325.9 ± 85.7	292.9
Protein (g)	77.3 ± 24.0	28
(g/kg)	3.6 ± 1.2	1
(% of energy)	18.5 ± 3.3	15
Carbohydrate (g)	330 ± 62	—
(% of energy)	52.8 ± 7.6	55
Fat (g)	55.4 ± 20.8	—
(% of energy)	29.3 ± 5.6	30
(P:S)	0.46 ± 0.14	1
(M:S)	1.05 ± 0.14	—
Cholesterol (mg)	366 ± 167	300
(mg/kJ)	0.05 ± 0.02	0.02

¹US recommendation from reference 13. P:S, ratio of polyunsaturated to saturated fatty acids; M:S, ratio of monounsaturated to saturated fatty acids.

² $\bar{x} \pm \text{SD}$.

³ \bar{x} .

TABLE 6

Serum lipid profile and body size of 7-y-old Chinese children: Hong Kong compared with Jiangmen

	Hong Kong (n = 94)	Jiangmen (n = 99)
Triacylglycerol (mmol/L)	0.78 ± 0.45	0.59 ± 0.22 ²
Cholesterol (mmol/L)	4.59 ± 0.83	4.16 ± 0.61 ²
HDL cholesterol (mmol/L)	1.60 ± 0.35	1.49 ± 0.38 ²
LDL cholesterol (mmol/L)	2.63 ± 0.75	2.40 ± 0.46 ²
VLDL cholesterol (mmol/L)	0.35 ± 0.21	0.27 ± 0.10 ²
Apo A-I (g/L)	149.87 ± 21.27	126.54 ± 17.68 ²
Apo B (g/L)	65.78 ± 13.27	61.31 ± 10.17 ²
Weight (kg)	21.8 ± 4.0	21.7 ± 3.8
Height (cm)	120.1 ± 4.9	119.9 ± 4.9

¹ $\bar{x} \pm SD$. Apo, apolipoprotein.

²Significantly different from Hong Kong, $P < 0.05$.

was performed in 20 11-y-old children in Hong Kong to gather information on serum fatty acids. Overnight fasting venous blood samples were obtained. Serum was prepared and stored at -70°C before being thawed to room temperature for fatty acid assays. Total lipids were then extracted by using chloroform-methanol (2:1, by vol) and heptadecanoic acid was added as an internal standard to quantify the total fatty acids. The fatty acids from different lipids in serum were converted to their corresponding fatty acid methyl esters, which were then analyzed by gas-liquid chromatography using an SP-2560 flexible fused silica capillary column (Supelco, Bellefonte, PA). The individual fatty acid concentrations were expressed as a percentage of the total serum fatty acids (**Table 8**). There were no significant differences in findings between boys and girls. Serum cholesterol concentrations at age 11 y (4.20 ± 0.77 mmol/L) were lower than those at age 7 y (4.59 ± 0.91 mmol/L) for children belonging to the same cohort, probably because of the effect of sex hormones, which have a cholesterol-lowering effect. The serum fatty acid results remain to be compared with findings in other populations before further speculation about their significance can be made.

CONCLUSION

Available data on the dietary fat intake of a Hong Kong population of children showed the effect of urbanization and Westernization on the traditional Chinese diet. Fat intake in children had risen to 30% of energy, which was associated with a serum cholesterol concentration much higher than that of mainland Chinese. Diseases of affluence, such as childhood obesity, have

TABLE 7

Chemical analysis of dietary fat and fatty acids of Hong Kong and Jiangmen children¹

	Hong Kong (n = 20)	Jiangmen (n = 20)
Total fat (g/d)	47.55 ± 14.42	34.67 ± 16.22
P:S	0.69 ± 0.24	0.81 ± 0.25 ²
M:S	1.39 ± 0.44	1.11 ± 0.51 ²
18:2–14:0 ratio	10.91 ± 7.68	20.73 ± 9.09 ²

¹ $\bar{x} \pm SD$. P:S, ratio of polyunsaturated to saturated fatty acids; M:S, ratio of monounsaturated to saturated fatty acids.

²Significantly different from Hong Kong, $P < 0.05$.

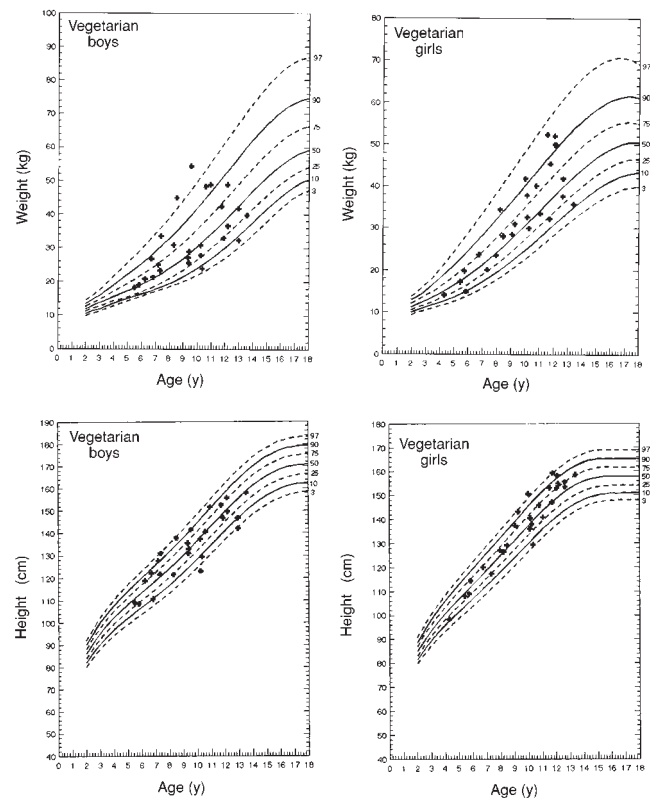


FIGURE 2. Growth of individual Chinese vegetarian boys ($n = 26$) and girls ($n = 27$) in weight and height plotted on the Hong Kong reference (7) with the 3rd, 10th, 25th, 75th, 90th, and 97th percentile curves marked.

already emerged in Hong Kong. With the present prevalence of adult obesity of 30–40% and diabetes mellitus of 10% (ED Janus, unpublished observations, 1997), we envisage that morbidity will be much higher when the generation of youths we studied becomes adults.


Although vegetarian children had a much lower percentage of dietary fat, a P:S ratio of 1, and a much lower total serum cholesterol concentration, they were not exempt from obesity. Therefore, not just a restriction of dietary fat, but an improvement in physical activity is important to promote better health in children. 

TABLE 8

Serum lipids and serum fatty acids in 20 Hong Kong Chinese children aged 11 y¹

	Total	Boys	Girls
Serum lipids (mmol/L)			
Triacylglycerol	0.90 ± 0.52	0.84 ± 0.62	0.96 ± 0.41
Total cholesterol	4.20 ± 0.77	4.25 ± 0.71	4.16 ± 0.85
HDL cholesterol	1.08 ± 0.41	1.18 ± 0.43	0.98 ± 0.38
LDL cholesterol	2.95 ± 0.60	2.91 ± 0.58	2.99 ± 0.64
Serum fatty acids (% of total fat)			
SFA	19.08 ± 1.82	19.52 ± 1.90	18.64 ± 1.68
MUFA	24.17 ± 3.20	23.68 ± 3.91	24.65 ± 0.62
PUFA	49.42 ± 4.13	49.45 ± 5.10	49.39 ± 3.05
n-3	6.05 ± 2.02	6.06 ± 1.80	6.04 ± 2.28
n-6	43.38 ± 3.59	43.39 ± 4.06	43.35 ± 3.21
trans	0.39 ± 0.24	0.39 ± 0.24	0.39 ± 0.25

¹SFA, saturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; n-3, n-3 PUFAs; n-6, n-6 PUFAs.



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