

Serum cholesterol and dietary fat of two populations of southern Chinese

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Children in Hong Kong (HK) are the second generation of Chinese migrants from Guangdong Province and are leading a more affluent lifestyle than those in Jiangmen (JM). The association between affluence and coronary risk was investigated by comparing the serum cholesterol and dietary fat intake of children in HK and JM. Fasting serum cholesterol was examined in 94 HK children and 99 JM children, all aged seven, using the same enzymatic method by the same observer. Duplicate meals were collected in two subsamples of 20 children, one each from HK and JM and analysed for their total fat intake and fatty acid profile, again by the same observer using gravimetric methodology and gas chromatography. The mean (SD) cholesterol of HK children was 4.59 (0.83) mmol/l, significantly higher than that of JM, 4.16 (0.61) mmol/l. The daily fat intake by the HK children was 48 g, 37% higher than that of JM at 35 g. PS ratio was 0.6 in HK and 0.8 in JM. C18-2/C14-0, the cholesterol-lowering ratio, was mostly below 10 in HK, whereas that of JM was between 10 and 40. Therefore, in order to lower the total serum cholesterol of Hong Kong children, dietary intervention to lessen total fat, in particular milk and animal fat, while moderately increasing fat consumption from vegetable sources would seem to be appropriate.

Introduction

Disease profiles in societies in transition are of global concern. Although Asian populations in general have a much lower prevalence of coronary heart disease (CHD) mortality, they have also experienced a change in the coronary risk associated with changes of lifestyle and dietary habit. In the 1970s, the lowest reported CHD death rate was in Japan. However, CHD prevalence and incidence rates tripled among Japanese within a generation of their being migrants to the west coast of United States and doubled in Japanese who migrated to Hawaii. This change was generally paralleled by changes in average levels of risk factors, including saturated fat in the diet and serum cholesterol level¹.

In the late 1940s, there was an influx of Southern Chinese in to Hong Kong. The second generation children of such migrants are now leading a much more affluent lifestyle than those in Guangdong province of mainland China. Jiangmen is a city in Guangdong Province and the degree of affluence would be similar to that of Hong Kong two decades ago. A comparison of the serum cholesterol and dietary fat of children in the two populations in Hong Kong and Jiangmen might be expected to reveal the relative risk of coronary heart disease.

Subjects and methods

Seven-year-old children were studied. In Hong Kong, the cohort of 94 children recruited in 1984 for the longitudinal study of growth and nutrition in infancy and childhood by the Department of Paediatrics, the Chinese University of Hong Kong, was studied. In Jiangmen, 99 children of the same age

were randomly selected from one primary school. They were all weighed and measured by standard methods. Fasting lipid profiles, including total serum cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), apolipoprotein A-1 (Apo A-1) and apolipoprotein B (Apo B) were all measured and the methods validated by external quality control².

In each of these two groups, 20 individuals were chosen at random. Their parents were asked to save duplicate food items on two consecutive week days for chemical analysis of dietary fat. Each food item collected was weighed. The food consumed in each day was then blended. A 10 g portion was used for total fat assessment using gravimetric methods while another 10 g portion was used for fatty acid analysis by gas chromatography.

Table 1. Lipid profile and body size of 7-year-old children: Hong Kong vs Jiangmen.

	Hong Kong n=94		Jiangmen n=99	
	Mean	(SD)	Mean	(SD)
Triglyceride, mmol/l	0.78	(0.45)	0.59	(0.22)
Cholesterol, mmol/l	4.56	(0.83)	4.16	(0.61)
HDL-C, mmol/l	1.60	(0.35)	1.49	(0.38)
LDL-C, mmol/l	2.63	(0.75)	2.40	(0.46)
VLDL-C, mmol/l	0.35	(0.21)	0.27	(0.10)
Apo A-1, mg/dl	149.87	(21.27)	126.54	(17.68)
Apo B, mg/dl	65.78	(13.27)	61.31	(10.17)
Weight, kg	21.8	(4.0)	21.7	(3.8)
Height, cm	120.1	(4.9)	119.9	(4.9)

Table 2. Dietary fat and fatty acids of children: Hong Kong vs Jiangmen.

	Hong Kong		Jiangmen		P
	Mean	(SD)	Mean	(SD)	
Total fat, g	47.55	(14.42)	34.67	(16.22)	0.0003
SFA, g	14.06	(5.27)	10.61	(5.06)	0.0037
MUFA, g	18.67	(6.54)	11.54	(7.71)	0.0001
PUFA, g	8.94	(3.04)	8.32	(4.05)	0.4432
PS ratio	0.69	(0.24)	0.81	(0.25)	<0.001
C8-0, g	0.22	(0.21)	0.23	(0.12)	0.8762
C10-0, g	0.28	(0.18)	0.12	(0.04)	0.0001
C12-0, g	0.76	(0.94)	0.26	(0.27)	0.0052
C14-0, g	1.00	(0.55)	0.36	(0.18)	0.0001
C16-0, g	9.27	(3.74)	7.51	(3.65)	0.0363
C18-0, g	2.09	(0.83)	2.15	(1.22)	0.7844
C12-1, g	0.03	(0.06)	0.1	(0)	0.0001
C14-1, g	0.11	(0.06)	0.1	(0)	0.3862
C16-1, g	1.64	(0.85)	0.83	(0.47)	0.0001
C18-1, g	16.48	(5.80)	10.39	(7.07)	0.0001
C20-1, g	0.25	(0.16)	0.45	(0.23)	0.0445
C22-1, g	0.05	(0.04)	1.69	(1.32)	0.0035
C18-2, g	7.94	(2.76)	6.56	(3.15)	0.0402
C18-3, g	0.57	(0.34)	1.17	(0.80)	0.0001
C20-4, g	0.10	(0.05)	0.80	(0.92)	0.0008
C20-5, g	0.06	(0.06)	0.12	(0.04)	0.0272
C22-6, g	0.35	(0.38)	0.28	(0.22)	0.5043
C18-2/C14-0	10.91	(7.68)	20.73	(9.09)	0.0001
C18-2/total fat	16.67	(4.02)	19.54	(5.47)	0.0192
Serum total cholesterol, mmol/l	5.18	(1.20)	3.89	(0.17)	<0.001

Results

While the body weight and height of the children in both populations were similar, the serum lipids showed a significant difference in all the parameters ($P < 0.05$) (see Table 1). The total serum cholesterol level of children in Hong Kong (HK) was 4.59 mmol/l (177 mg/dl) while that in Jiangmen (JM) was 4.16 mmol/l (161 mg/dl). The mean TC levels in the sub-sample population for the duplicate meal collection and fat analysis were 5.18 mmol/l and 3.89 mmol/l in HK and JM respectively. Dietary fat consumed by the HK children was 137 % of that consumed by JM children. The excess was mainly in the saturated and monounsaturated fat portions (see Table 2). While C16-0, C18-0 and C14-0 were the three main dietary saturated fatty acids in both populations, it is the consumption of C14-0 that differed most significantly.

For the monounsaturated fatty acids, C18-1 and C16-1 were the main portions that were consumed in significantly different amounts. The main polyunsaturated fatty acid in the diet was C18-2. While the P value of the difference between C18-2 intake in the two populations was only 0.04, when expressed as a ratio of C18-2/C14-0, known as the cholesterol-lowering ratio³, it increased to 0.0001 (Student's t -test). A scattergram clearly showed that the ratio in the HK group was mostly below 10, while that in JM between 10 and 40 (Fig. 1). A nonlinear relationship was observed between TC and C18-2/C14-0 which agrees with findings by Hayes and Khosla in 1992³. The sources of C14-0 in the HK group were cow's milk, beef and french fries (potato chips).

A comparison of the individual food items consumed at the three main meals and snacks showed that the dietary pattern in the two populations occurred mainly at breakfast. Milk and

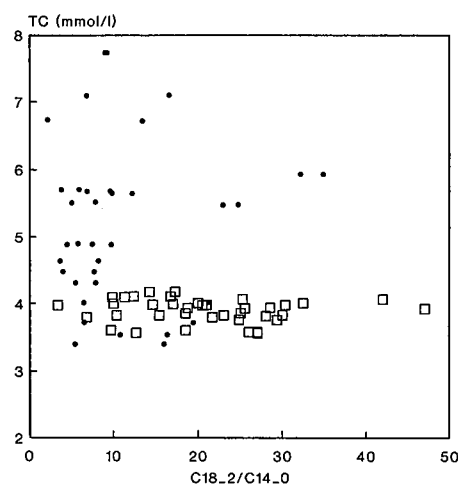


Figure 1. Scatter diagram of total serum cholesterol of the two sub-samples of 20 children each and the daily dietary C18-2/C14-0 ratio in their duplicate meals on two days: • Hong Kong; □ Jiangmen

eggs were more often consumed by the HK group. The main sources of carbohydrate in the HK group were wheat flour products, milk (lactose), process drinks (sucrose), whereas in that of the JM group, it was mainly products from rice flour followed by those from wheat flour (Fig. 2). Half of the HK group drank a glass of milk regularly at breakfast but none did so in JM. Fast food shops were present only in HK but not JM. Children in HK ate french fries occasionally for their main meals or snacks, and these were fried in a mixture of beef fat and vegetable oil.

Discussion

The two populations of Chinese children showed a definite difference in the risk of coronary heart disease as manifested by higher serum cholesterol levels (TC and LDL-C) and higher dietary fat intake in the Hong Kong group.

Food frequency, food record or food recall are the most frequently used methods in assessing nutrient intake, including fat. However, the amount of fat contained in each piece of meat can vary a lot. The Chinese way of cooking, such as stir fry vegetables or adding oil to the steamed fish, make the assessment of the actual amount of oil ingested very difficult. The method of chemical analysis on duplicate meals collected over two days is by far the most accurate way of assessing dietary fat. The advantage of increasing further the number of days of meal collection may be cancelled out by the decrease in co-operation from the parents.

The fatty acids contained in most foods are predominantly monounsaturated. It is therefore not surprising to find a higher intake of monounsaturated fat in the HK group. What is most interesting was the much higher C14-0 and lower C18-2 found in the HK group so that the C18-2/C14-0 ratio of the HK group was only half of that of JM.

Not all saturated fatty acids and polyunsaturated fatty acids play the same role in raising serum cholesterol levels⁴. C18-2 and C14-0 are the two key fatty acids that affect the plasma lipid profile. In the absence of dietary cholesterol and in subjects with normal LDL receptor activity, C14-0 is the only fatty acid that raises the plasma cholesterol, whereas C18-2 lowers it up to a certain threshold, as demonstrated in this study. As C14-0 is mainly present in milk and it is the HK and not the JM group that drank milk regularly, so the lower

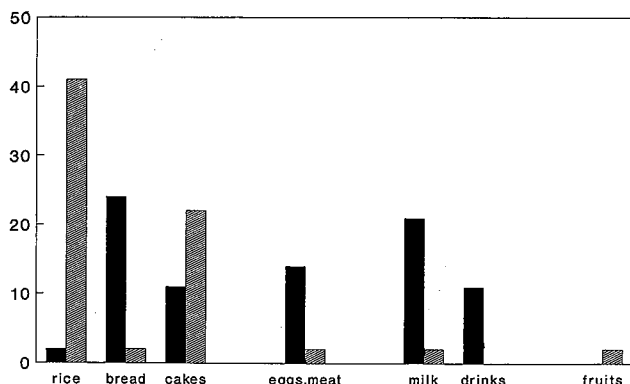


Figure 2. Number of individuals taking various food items at breakfast in the two study populations during a period of 40 school days: Hong Kong ■, Jiangmen ▨

ratio was observed in the HK group who had a higher serum TC. Fast food in HK played a role too. While vegetable oil has been the cooking oil for french fries in the major fast food shops in the United States of America and Australia, it is still beef fat in HK.

The implication of the study is that to reduce the high serum TC of HK children, it would be necessary to reduce the total dietary fat, in particular milk fat⁵, and to replace animal fat with vegetable fat (except coconut oil) which is richer in C18-2. It is also worth noting that the amount of total fat consumed by Hong Kong Chinese is much less than that reported for Australians (48 g vs 66 g), yet their serum TC was found to be higher (4.59 mmol vs 4.5 mmol/l)⁶, implying a possible genetic difference in the efficiency of handling dietary fat. Such genetic differences in handling nutrients by the body's metabolism has also been observed in calcium: Chinese children have an efficiency of calcium absorption double that of

Caucasians⁷. The traditional Chinese diet contained very little of dairy products and was low in fat, contributing 18 % of the total daily energy intake. To increase the dietary fat to the present 30 % of the total daily energy intake within two generations is a rapid nutritional transition. Prompt nutritional intervention to reduce dietary fat to 20–25 %, presumably by limiting milk and animal fat in the diet, is required to prevent the rapid emergence of atherosclerosis, the main aetiological factor in the major chronic diseases of affluence.

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Asia Pacific Journal of Clinical Nutrition 1994; 3: 127-130**南中國兩地中國兒童的血清膽固醇和膳食脂肪水平****摘要**

香港兒童多是由廣東省移居而來的華裔第二代，過著比廣東省江門市兒童更為富裕的生活方式。本文比較研究了香港和江門市兩地中國兒童的血清膽固醇和膳食脂肪水平，以了解社會富裕和冠心病危險性之間的關係，由同一組研究人員用統一的酶法測定 99 名江門市七歲兒童以及 94 名香港同齡兒童的空腹血清膽固醇水平，同時在江門市和香港兩地各選取 20 名兒童，用雙份法收集連續兩個周日的全部膳食，用稱重法和氣相層析法分析脂肪和脂肪酸含量。結果香港七歲兒童的血清膽固醇含量平均為 4.59 ± 0.83 mmol/l，顯著高於江門市同齡兒童 4.16 ± 0.61 mmol/l。香港兒童每日膳食中攝入脂肪為 48 克，比江門市兒童每日攝入量 35 克高 37%。香港兒童膳食中多不飽和與飽和脂肪的比例 (P/S) 為 0.6 而江門市兒童為 0.8，而且被認為對血清膽固醇有降低作用的亞油酸與荳蔻酸比例 (C18:2/C14:0) 在香港兒童膳食中的含量多為 10 以下，而江門市兒童則是 10 與 40 之間。因此要減低香港兒童的血清膽固醇，必需建議減食總脂肪，特別是奶油與動物性脂肪，而適量增加植物性脂肪是恰當的。