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A Study on the Serum Lipids of Children in Okinawa

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Introduction

It has been recently revealed that atherosclerosis originates in childhood. "Atherosclerosis in childhood" is now advocated placing a stress on its prophylaxis from childhood[1]. Hyperlipidemia has to be found in childhood. We have to take countermeasures or prophylaxis from childhood. As hyperlipidemia is one of the risk factors of atherosclerosis. Children have different serum lipid contents according to age sex, race and eating habits. Recently they started determination of normal levels of serum lipid in Japanese children. We joined to a group that made a health survey on children living Yonashiro Village, Henza Island, Okinawa in November 1981. In the health survey, serum cholesterol and triglyceride (abbreviate them to TC and TG) were measured to compair their contents by sex and age. Their correlation with obesity was also analyzed. The results were discussed in this paper with detailed examination of past data.

Subjects and methods

The number of subjects were 242 normal children (age 6-14), 130 males and 112 females living in Henza Island which is located at 5km from Katsuren pennisula of the main island of Okinawa. The island has a population of about 2,000 living on fishing. Their livelihood changed since construction of road bridging from main island.

We explained the purpose of survery in advance to parents and children. Blood sampling and anthropometry (height and weight) were made before breakfast.

TC and TG were determined by enzyme methods using an automatic analyzer.

Results

1) Anthropometric data by age and sex (Table 1)

Comparison was made between the data obtained in Henza Island in April 1981 and those of the school Health Statistics issued by Ministry of Education in 1981. The height and weight of both male and female children in Henza Island were found to be smaller than average of Japan. Differences of 3.2- 8.8 cm for boys and 1.0 - 6.1 cm for girls in the mean height were found. Only the height of the boy at age 13 was 1.6 cm higher than the Japanese average.

Table 1 Mean and standard deviation of height and weight by age and sex

Age group (years)	Boy								Girl							
	Height (cm)				Weight (kg)				Height (cm)				Weight (kg)			
	Mean		Standard deviation		Mean		Standard deviation		Mean		Standard deviation		Mean		Standard deviation	
	Japan	Henza	Japan	Henza	Japan	Henza	Japan	Henza	Japan	Henza	Japan	Henza	Japan	Henza	Japan	Henza
6	115.9	112.7	4.87	6.40	20.9	19.7	3.19	2.87	115.1	114.1	4.76	5.03	20.4	20.6	3.35	2.08
7	121.4	116.3	5.02	3.42	23.2	20.8	3.67	1.66	120.8	117.9	5.01	5.73	22.8	22.4	3.76	3.44
8	126.8	122.6	5.29	5.51	25.9	26.4	4.44	6.23	126.1	122.0	5.31	4.73	25.4	24.6	4.21	7.75
9	132.1	127.1	5.52	3.01	29.0	27.3	5.32	3.06	131.9	130.3	5.84	5.01	28.5	27.4	5.05	2.88
10	137.2	133.5	5.90	5.47	32.3	30.4	6.30	4.37	138.2	133.4	6.60	9.39	32.4	31.6	6.22	8.13
11	147.8	139.0	6.71	7.67	35.9	34.1	7.20	6.33	145.0	142.4	6.76	4.85	37.3	35.2	7.38	6.31
12	149.8	145.7	7.73	7.86	41.2	38.5	8.30	6.26	150.5	144.4	6.08	7.29	42.4	37.5	7.68	7.41
13	157.3	158.9	7.95	3.46	46.8	46.8	9.03	5.07	154.2	152.5	5.43	6.20	46.6	45.9	7.35	8.34
14	163.2	156.8	7.06	8.55	52.8	46.5	9.04	7.90	156.0	152.2	5.10	4.79	49.6	48.5	7.12	7.90

Table 2 Prevalence of obesity child by ages 6 - 14 years

Age group(years)		6	7	8	9	10	11	12	13	14	6-14 years
Boy	Japan	2.70	3.75	4.65	5.81	7.14	7.32	6.88	6.34	6.03	
	Henza	13.3	0.0	20.8	20.0	7.1	0.0	5.3	6.7	8.3	10.8
Girl	Japan	2.97	3.58	5.17	5.57	6.21	7.27	7.13	6.42	5.71	
	Henza	6.7	10.0	7.1	0.0	17.6	0.0	0.0	9.1	30.0	8.9
Total	Japan	2.81	3.41	4.90	5.69	6.69	7.29	7.00	6.38	5.87	
	Henza	9.4	5.3	16.2	10.7	12.9	0.0	3.2	7.7	18.2	9.9

2) Obesity (Table 2)

Students classified as obese children with index of +20 or more were 10.8% of boys and 8.9% of girls.

High rate of obesity was found at the age 8 , 9 and 14 which showed 16.2%, 10.7% and 18.2%, respectively. Obesity index were scored highly for girls except for 6, 8, 9 and 12.

3) TC (Table 3)

As shown in Table 3, TC tend to be low in both male and female junior high school students. While mean values (mg/dl) 179 ± 32 for boys and 189 ± 44 for girls of primary school, no significant difference was found between the primary and junior high school students. Girls except for age 6, 7 and 11 showed higher values than boys. No difference was found between boys and girls of primary school, but significantiy higher values were found in girls than those in boys in junior high school ($p < 0.001$).

Table 3 Mean and standard deviation(SD) for serum lipids by age and sex

Age (years)	Boy			Girl		
	No.	TC Mean ± SD	TG Mean ± SD	No.	TC Mean ± SD	TG Mean ± SD
6	15	198 ± 48	56 ± 14	15	177 ± 26	64 ± 16
7	9	189 ± 31	67 ± 23	10	177 ± 20	69 ± 20
8	23	179 ± 29	81 ± 59	14	193 ± 42	63 ± 29
9	13	157 ± 21	66 ± 27	15	207 ± 67	89 ± 32
10	14	176 ± 19	73 ± 41	17	199 ± 44	90 ± 27
11	10	184 ± 29	72 ± 10	9	180 ± 47	86 ± 18
12	19	176 ± 31	63 ± 30	12	189 ± 18	56 ± 13
13	15	159 ± 21	55 ± 17	10	184 ± 27	73 ± 25
14	12	153 ± 21	46 ± 11	10	189 ± 27	77 ± 42
6 −11	84	179 ± 32	70 ± 38	80	189 ± 44	77 ± 27
12 −14	46	165 ± 27	56 ± 23	32	187 ± 24	68 ± 29
6 −14	130	174 ± 31	65 ± 34	112	188 ± 39	74 ± 28

TC: Serum cholesterol

TG: Serum triglyceride

4) TG (Table 3)

Table 3 shows TG values by age. Mean values (mg/dl) were 70 ± 38 for boys and 77 ± 27 for girls in primary school. In junior high school the mean values were 56 ± 23 for boys and 68 ± 29 for girls both of which were significantly lower values than primary school ($p < 0.05$). In TG values by sex, girls except for age 8 and 12 showed higher values than those of boys. Difference

by sex was prominent in junior high school students, and significantly higher values were found in girls than those in boys ($p < 0.05$)

5) Obesity and TC, TG values (Table 4)

Students were classified by the degree of obesity index to 4 groups, which were consist of slender type, standard type, slightly obese type and obese type as shown in Table 4. Both TC and TG showed higher values in the obese type than those in the standard type. Obese boys showed TC values of 182 ± 33.4 which were higher than 172.3 ± 27.4 for standard boys. Both obese boys and girls also showed rather high TC contents than standard cases.

TG values were significantly higher in obese boys and girls than standard cases ($p < 0.01$, $p < 0.05$).

Table 4 The obesity index and serum lipids

	obesity index group	~−10	−9 ~+9	+10~+19	+20 ~
Boy	No	12	95	9	14
	TC	164.0 ±26.3	172.3 ±27.4	188.6 ±53.6	182.0 ±33.4
	TG	68.3 ±32.9	60.0 ±20.1	72.0 ±31.0	86.4 ±68.4 *
Girl	No	18	68	14	10
	TC	168.5 ±28.6	190.0 ± 42.1	187.4 ±36.1	208.6 ± 40.2
	TG	72.7 ±24.6	72.8 ± 28.7	73.9 ±20.7	93.6 ± 28.8**

*p <0.01 **p<0.05

Obese did not show positive correlation with TC, TG value in boys regarding correlation coefficient. in contrast girls showed significant conelation with TC and TG values. ($p < 0.05$, Table 5)

Table 5 Correlation coefficient between obesity index and serum lipids

		Correlation coeffcient
Boy(130)	TC - obesity	0.02
	TG - obesity	0.16
Girl(112)	TC - obesity	0.23*
	TG - obesity	0.25*

*p < 0.05

Discussion

Atherosclerosis, one of the major geriatric diseases, originates in childhood. Prophylactic meaures should be taken from childhood. Several reports on serum lipids in childhood have already been published in Japan.

Matsuzaki[2], Hayashi[3], and Hamada[4] reported serum lipids level of Japanese children. According to their report Japanese children showed same serum lipids level as the children in the U. S..

Matsuzaki[2] also reported that Japanese adult age group of 20-30 showed lower TC levels than those in the same age group in U.S.. He stated the importance of prophylactic measures against atherosclerosis that should be started from adolescence.

According to the report by Hayashi et al[3], mean TC values for primary school students in Tokyo were 160.7 mg/dl for boys, and 163.2 mg/dl for girls, and those for junior high school students 150.9 mg/dl for boys and 159.4 mg/dl for girls.

Hamada et al[4] reported that mean TC values for primary sdhool students in Miyazaki City were 165 mg/dl for boys and 169 mg/dl for girls. Both primary school and junior high school students in Henza Island showed high TC levels compaired with the result in Tokyo and Miyazaki district.

In comparison with the report by Frerichs et al[5] in 1976 and the survery results on American children by Morrison et al[6] in 1977, TC values of both boys and girls in Henza Island were higher. Research Group of primary prophylaxis for Atherosclerosis of Health & Welfare Ministry definds the case over 200 mg/dl of TC values as children's hypercholesterolemia. As shown in Table 6, hypercholesterolemia defined above was found especialy in primary school students (age 6-11) at the level of 23.2% and 17.9% for junior high school students. In primary school Hamada[4] found about 8.7% hypercholesterolemia for boys and 1.5% for girls in Miyazaki, Hayashi[3] found 2-8% for boys and 5.9% for girls in Tokyo district.

Table 6 Prevalence of hypercholesterolemia

(%)

Age group(years)	Boy	Girl	Total
6-11	15(17.9)	23(28.8)	38(23.2)
12-14	4(8.7)	10(31.3)	14(17.9)
6-14	19(14.6)	33(21.5)	52(21.5)

The couse of discrepancy in incidence rate of hypercholesterolemia between Henza and Miyazaki or Tokyo district might be ascribed to the enviromental factors including food and diet.

TG values are considerd to be important in relation to coronary artery diseases. Hamada[4] reported higher TG values in boys than in girls. TG values at 70 ± 38 mg/dl for primary school boys in Henza Island were significantly higher than those at 60 ± 24 mg/dl for primary school boys in Miyazaki City. There was no almost difference between 74 ± 32 mg/dl for girls in Miyazaki

City and 77 ± 27mg/dl for girls in Henza Island. Both boys and girls in junior high school in Henza showed a tendency of low levels of TG in compaired to Miyazaki. This might be caused by enviromental and hereditary factors.

Obesity dose not have direct relation with TC and TG. Lipid metabolism are supposed to influence TC and TG value. Nomber of obese children is lately increasing in Japan. Size of children in Henza Island is slightly smaller than the Japanese average[7]. According to the statistics published by Education Ministry[8] rates of obese children in primary and junior high schools were 3-7% (6-14 years old) while the rates were 10.8% for boys and 8.9% for girls in Henza Island.

In the present survey we can summarize the cause of high incidence of obese children in Henza Island as follows:

1 Enviromental facter
2 Food and diet which will increase amount of TG and TC

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