Effects of Passive Exposure to Tobacco, Socioeconomic Status and a Family History of Essential Hypertension on Lipid Profiles in Children

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SUMMARY

There is abundant evidence that the atherosclerotic process begins in childhood. Dyslipidemia is a major risk factor for atherosclerosis in adults and children. In the present study, we measured serum lipoprotein concentrations in 194 healthy children aged between 4 to 14 years. Children were grouped according to the socioeconomic status of the families, family history of essential hypertension and passive tobacco exposure. The values of total cholesterol, low density lipoprotein cholesterol and the ratio of total cholesterol/high density lipoprotein cholesterol in the low socioeconomic group were found to be significantly higher than the values obtained for the middle-high socioeconomic group. The values of total cholesterol, low density lipoprotein cholesterol, the ratio of total cholesterol/high density lipoprotein cholesterol and low density lipoprotein cholesterol/high density lipoprotein cholesterol in the passive smoker group were found to be significantly higher than those of the non-smoker group. But, the socioeconomic level in the passive smoker group was found to be significantly lower than that of the nonsmoker group, and therefore, the impact of passive smoking on the serum lipids in children was related to socioeconomic status. A significant difference in terms of blood lipid fractions between the groups with and that without a family history of essential hypertension was not found.

These results suggest that passive smoking and lower socioeconomic status are important risk factors for cardiovascular heart disease, while a positive family history of essential hypertension is not an important risk factor. (Jpn Heart J 1996; 37: 917-923)

Key words: Child Lipoproteins Passive smoking Socioeconomic level Family history of essential hypertension

IT is well known that there is a strong relationship between coronary artery disease and some lipid fractions including total cholesterol (TC), triglycerides

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(TG), high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) concentrations. In addition, cigarette smoking is one of the cardiovascular risk factors as are obesity, hypertension, diabetes mellitus, etc.¹⁻⁶⁾ Although cigarette smoking is associated with changes in plasma lipid and lipoprotein levels, it is unknown whether or not passive smoking is associated with an alteration in lipid profile of children or not.⁵⁻⁷⁾ Its relationship to passive smoking as well as active smoking has implications for pediatric atherosclerosis prevention.^{8,9)} For this reason we aimed to investigate the relationship of passive smoking to lipid profile in healthy children.

In the last decade several intervention studies have shown that dietary modifications produce changes in blood lipid levels in children, it is also a well known fact that dietary components and blood lipids are associated with socioeconomic status.¹⁰⁻¹⁶⁾ The other purpose of this work was to study the relations between socioeconomic status and values for serum lipids in children.

There is a significant relationship between hypertension and blood lipid profile in adults.¹⁷⁻²⁰⁾ Results of previous studies^{21,22)} indicated significant associations between parental history of hypertension and childhood blood pressure levels. The relationship between family history of essential hypertension and serum lipid concentrations in children was also evaluated in the study.

MATERIALS AND METHODS

The experimental population consisted of 194 children, aged from 4 to 14 years. The children were examined by the same physician throughout the study. None of the children had any symptoms and signs of hypertension, hypercholesterolemia, abnormal blood pressure or obesity. They were not receiving any long-term medical treatment. Body weight, height, a family history of essential hypertension and passive exposure to tobacco were recorded. Parental education level was selected as the measure of socioeconomic status because it does not change.^{14,23)} Body mass index, weight/height², was used as an obesity index. After a 12 hour fast, blood samples were obtained for TC, HDL-C and TG. The sera were frozen at -20°C until analyzed. TC and TG were determined by enzymatic-calorimetric methods (Mitsubishi Z 818 autoanalyzer). HDL-C was measured after precipitation with magnesium-dextran sulphate. Low density lipoprotein cholesterol was calculated using the standard formula (Friedwald formula): $LDL-C = TC - HDL-C - TG/5$. Intraassay CV % values for lipid tests were less than 7.

Two-sample independent groups t test and chi-square test were used for statistical evaluation.

RESULTS

Baseline clinical characteristics and lipid values of groups appear in Tables I-IV.

No significant differences were found in terms of age, sex and the value of BMI between the middle-high socioeconomic level and the low socioeconomic level groups (Table I) or between the passive smoker group and the nonsmoker group (Table III). Also, there was no those significant difference in terms of these parameters between children with and those without a family history of essential

Table I. Baseline Clinical Characteristics and Lipid Values (Mean $\pm$ SD) of Children Grouped According to Socioeconomic Level

	Socioeconomic level		Significance
	Low (<i>n</i> = 111)	Middle-high (<i>n</i> = 83)	
Age (year)	9.3 $\pm$ 3.1	8.7 $\pm$ 3.2	NS
Sex (Female/Male)	53/58	35/48	NS
Passive smoker/Non smoker	76/35	39/44	<i>p</i> < 0.01
BMI (kg/m ²)	16.8 $\pm$ 2.4	17.0 $\pm$ 3.3	NS
Lipids			
TC (mmol/l)	3.90 $\pm$ 0.56	3.67 $\pm$ 0.55	<i>p</i> < 0.01
TG (mmol/l)	1.16 $\pm$ 0.36	1.06 $\pm$ 0.36	NS
HDL-C (mmol/l)	1.22 $\pm$ 0.1	1.22 $\pm$ 0.17	NS
LDL-C (mmol/l)	2.13 $\pm$ 0.55	1.96 $\pm$ 0.54	<i>p</i> < 0.05
TC/HDL-C	3.25 $\pm$ 0.63	3.05 $\pm$ 0.55	<i>p</i> < 0.05
LDL-C/HDL-C	1.79 $\pm$ 0.56	1.64 $\pm$ 0.51	NS

NS: Not significant

Table II. Lipid Parameters (Mean $\pm$ SD) in Children Grouped According to Smoking Exposure in the Low and Middle-high Socioeconomic Levels

	Socioeconomic level				Significance	
	Low		Middle-high			
	Passive smoker (<i>n</i> = 76)	Nonsmoker (<i>n</i> = 35)	Passive smoker (<i>n</i> = 39)	Nonsmoker (<i>n</i> = 44)	(1)	(2)
Age (year)	9.5 ± 3.0	9.1 ± 3.4	8.7 ± 3.0	8.7 ± 3.4	NS	NS
Sex (female/male)	35/41	18/17	17/22	18/26	NS	NS
BMI (kg/m ²)	16.6 ± 2.3	17.3 ± 2.6	17.2 ± 3.6	16.9 ± 3.2	NS	NS
TC (mmol/l)	3.95 ± 0.55	3.81 ± 0.60	3.74 ± 0.56	3.60 ± 0.54	NS	NS
TG (mmol/l)	1.16 ± 0.35	1.16 ± 0.38	1.03 ± 0.38	1.09 ± 0.34	NS	NS
HDL-C (mmol/l)	1.21 ± 0.17	1.26 ± 0.17	1.22 ± 0.14	1.22 ± 0.19	NS	NS
LDL-C (mmol/l)	2.21 ± 0.50	1.96 ± 0.63	2.06 ± 0.52	1.87 ± 0.55	<i>p</i> < 0.05	NS
TC/HDL-C	3.33 ± 0.61	3.08 ± 0.65	3.11 ± 0.55	2.99 ± 0.55	NS	NS
LDL-C/HDL-C	1.88 ± 0.53	1.59 ± 0.59	1.71 ± 0.49	1.57 ± 0.52	<i>p</i> < 0.05	NS

(1) Significance between passive smoker and nonsmoker groups in the low socioeconomic level. (2) Significance between passive smoker and nonsmoker groups in the middle-high socioeconomic level. NS: Not significant.

Table III. Baseline Clinical Characteristics and Lipid Values (Mean $\pm$ SD) of Children Grouped According to Smoking Exposure

	Groups		Significance
	Passive smoker (<i>n</i> = 115)	Nonsmoker (<i>n</i> = 79)	
Age (year)	9.2 $\pm$ 3.0	8.9 $\pm$ 3.4	NS
Sex (female/male)	52/63	36/43	NS
Socioeconomic level (Middle-high/low)	39/76	44/35	<i>p</i> < 0.01
BMI (kg/m ²)	16.8 $\pm$ 2.8	17.1 $\pm$ 2.9	NS
Lipids			
TC (mmol/l)	3.88 $\pm$ 0.56	3.69 $\pm$ 0.57	<i>p</i> < 0.05
TG (mmol/l)	1.12 $\pm$ 0.36	1.12 $\pm$ 0.36	NS
HDL-C (mmol/l)	1.21 $\pm$ 0.16	1.24 $\pm$ 0.18	NS
LDL-C (mmol/l)	2.16 $\pm$ 0.51	1.91 $\pm$ 0.59	<i>p</i> < 0.01
TC/HDL-C	3.26 $\pm$ 0.59	3.03 $\pm$ 0.59	<i>p</i> = 0.01
LDL-C/HDL-C	1.82 $\pm$ 0.52	1.58 $\pm$ 0.55	<i>p</i> < 0.01

NS: Not significant

Table IV. Baseline Clinical Characteristics and Lipid Values (Mean $\pm$ SD) of Children Grouped According to Family History of Essential Hypertension

	Family history of essential hypertension		Significance
	Present (<i>n</i> = 51)	Absent (<i>n</i> = 143)	
Age (year)	9.2 $\pm$ 3.3	9.0 $\pm$ 3.1	NS
Sex (female/male)	24/27	64/79	NS
BMI (kg/m ²)	17.2 $\pm$ 2.7	16.8 $\pm$ 2.9	NS
Passive smoker/nonsmoker	27/24	88/55	NS
Socioeconomic level (Middle-high/low)	22/29	61/82	NS
Lipids			
TC (mmol/l)	3.83 $\pm$ 0.55	3.79 $\pm$ 0.58	NS
TG (mmol/l)	1.13 $\pm$ 0.37	1.11 $\pm$ 0.36	NS
HDL-C (mmol/l)	1.22 $\pm$ 0.16	1.22 $\pm$ 0.17	NS
LDL-C (mmol/l)	2.09 $\pm$ 0.54	2.05 $\pm$ 0.56	NS
TC/HDL-C	3.19 $\pm$ 0.57	3.16 $\pm$ 0.61	NS
LDL-C/HDL-C	1.75 $\pm$ 0.53	1.72 $\pm$ 0.55	NS

NS: Not significant

hypertension (Table IV). The passive smoker/nonsmoker ratio in the low socioeconomic level group was significantly higher than that of the middle-high socioeconomic level group (Table I). Also, the socioeconomic level was found to be significantly lower in the passive smoker group than in that of the nonsmokers (Table III).

Mean ($\pm$ SD) values for fasting serum lipid fractions (TC, HDL-C, LDL-C, TG) and the ratios of TC/HDL-C and LDL-C/HDL-C in ten different subgroups appear in Tables I-IV. The values for TC, LDL-C, and TC/HDL-C ratio in the low socioeconomic level group were found to be significantly higher than the values obtained for the middle-high socioeconomic level group. Signifi-

cant differences were not found in HDL-C and TG concentrations between these two groups (Table I).

Mean $\pm$ SD values for fasting serum lipid fractions (TC, HDL-C, LDL-C and TG) and TC/HDL-C and LDL-C/HDL-C ratios in the middle-high socioeconomic level group and in the low socioeconomic level group according to smoking exposure are listed in Table II. No significant differences in blood lipid profiles were found between the passive smoker group with middle-high socioeconomic level and the nonsmoker group with middle-high socioeconomic level. The values for LDL-C and LDL-C/HDL-C ratio in the passive smoker group with low socioeconomic level were found to be significantly higher than the values obtained for the nonsmoker group with low socioeconomic level. No significant differences were observed in the TC, HDL-C and TG concentrations and TC/HDL-C ratio between these two groups (Table II).

The values of TC and LDL-C and the ratios of TC/HDL-C and LDL-C/HDL-C in the passive smoker group were found to be significantly higher than that of nonsmokers. No significant differences were observed in the HDL-C and TG concentrations between these two groups (Table III).

A significant difference was not found in the values of blood lipid fractions between the group with and that without a family history of essential hypertension (Table IV).

DISCUSSION

A relationship between socioeconomic factors and lipid profile in both adults and children has been demonstrated.^{24,26-28} We noted a more atherogenic lipid profile in children belonging to low socioeconomic status contrary to other studies.¹³⁻¹⁶ Environmental differences between populations as well as study design may influence the results of various studies. We also observed that hard margarine was consumed excessively by the children with low socioeconomic status. A higher incidence of smoking exposure in children with low socioeconomic status was also found in the study (Table I).

There are only a few studies^{22,25} which investigated the blood lipid profiles in children with and that without family history of essential hypertension. No significant differences in serum concentrations of TC, HDL-C, LDL-C and TG, and TC/HDL-C, LDL-C/HDL-C ratios between the children with and those without a family history of essential hypertension were found. These results are all consistent with prior investigations.^{22,25} It was concluded that family history of essential hypertension could not identify children with higher levels of atherogenic lipoprotein.

Many investigators have found that cigarette smoking is associated with an

elevated TC and ratio of TC/HDL-C, a lowered HDL-C, elevated LDL-C and LDL-C/HDL-C ratio.^{6-9,29-31)} In our study, it was found that passive exposure to tobacco smoke was associated with both a higher concentration of TC and LDL-C and a higher ratio of TC/HDL-C and LDL-C/HDL-C. These changes may be associated with the socioeconomic status of children because the socioeconomic level in the passive smoker group was found to be significantly lower than that of the nonsmoker group (Table III). The value of LDL-C and the ratio of LDL-C/HDL-C in the passive smoker group with low socioeconomic status were found to be significantly higher than that of the nonsmoker group with low socioeconomic status. No significant difference was found in terms of serum lipid and lipoprotein values between the passive smoker group with middle-high socioeconomic status and the nonsmoker group with middle-high socioeconomic status (Table II). Therefore, we concluded that the impact of smoking exposure on serum lipids in children was related to socioeconomic status.

The passive exposure of children, especially those with low socioeconomic status, to tobacco smoke may be associated with an increased risk of developing coronary heart disease in the future, and therefore these children should be followed-up for atherosclerosis prevention.

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