Bratisl Lek Listy 2009; 110 (4)
233 – 239

CLINICAL STUDY

Some cardiovascular risk factors in Gypsy children and adolescents from Central Slovakia

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Abstract: *Background:* Atherosclerosis could develope in the presence of CVD risk factors in early age.
Objective: To determine some risk factors of Cardiovascular Disease in Gypsy children and adolescents from Central Slovakia.
Participants: Study population (Gypsy/Caucasian ethnicities) consisted of 198 Gypsy children and adolescents (101 males and 97 females) aged 7–18 and 140 non-Gypsy children and adolescents (72 males and 68 females) from 3 Central Slovakia cities.
Methods: After 12 hours overnight fasting, venous blood samples were drawn in the morning. TC and TG were determined enzymatically. HDL-C after selective precipitation, lipoproteins containing apolipoprotein-B and LDL-C were calculated using Friedewald formula. Anthropometric measurements, including weight and height were used to calculate BMI, while waist and hip circumference for WHR. BP was also measured and used to classify hypertension.
Results: Gypsy population had statistically lower values of BMI, TC, LDL-C and HDL-C in comparison to the general population. BMI was positively correlated to systolic BP (0.476**) and TG (0.182*); BMI was negatively correlated to the HDL-C (-0.298**), this was especially significant for the males (-0.400**). The most frequent CVD risk factors were low HDL-C (29.9 %) and high WHR (29.3 %). The Gypsy children and adolescents showed presence of bad lifestyle related negative risk factors (e.g cigarette smoking, family history of CVD and lower socio-economic status).
Conclusion: The results of the study should lead to improvement in pediatric health treatment for Gypsy children to prevent risk factors leading to the early onset and further development of atherosclerosis *(Tab. 7, Ref. 30).*
Full Text (Free, PDF) *www.bmj.sk.*
Key words: cholesterol, obesity, children, adolescents, ethnicity, gypsy, atherosclerosis.

Abbreviations: CVD – cardiovascular disease; TC – total cholesterol; LDL-C – LDL-cholesterol; HDL-C – HDL-cholesterol; TG – triglycerides; BMI – body mass index; WHR – waist to hip ratio; BP – blood pressure.

It is necessary to examine the population at young age in regards to world-wide culminated distribution of modifiable cardiovascular disease (CVD) risk factors. Obesity, pathological levels of blood serum lipids and lipoproteins, and hypertension tend to develop multifactorial atherosclerosis. The Gypsy ethnic group is considered a "high-risk group". When comparing the epidemiologic aspect of CVD in Gypsy individuals to that in their non-Gypsy counterparts (1), the poorer health situation of Gypsy individuals and more health problems in older Gypsy adults are often caused by bad nutrition, dietary habits and life style (beside high prevalence of cigarette smoking at young age, absence of physical fitness (2). They can also be associated with low socio-economic status and poverty. Gypsy is a disadvantaged ethnic group exposed to a combination of harmful environmental factors, which can affect the health of children.

The public is not concerned enough about the health treatment of the Gypsy minority, although it has been predicted that their health status will become worse. The Gypsy population tends to have shorter life spans compared to the general population (62.4 to 69.9 in men and 72.1 to 77.7 years in women (3). The mortality rate of Gypsy inhabitants is four times higher than that in the remainder of the population. High incidence of morbidity in respect of non-communicable diseases has been presented by a study of Gypsy adults from Southern Slovakia, whose 30 % prevalence of diabetes mellitus II was compared to 10 % in the control group; the prevalence of obesity was 65 % to 30 %, hypercholesterolemia 69 % to 59 %, hypertriglyceridemia 66 % to 39 %, hypertension 49 % to 43 % and CVD 35 % to 26 % (4).

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Acknowledgment: The authors thank the director of Department of Clinical Biochemistry, F. D. Roosevelt Faculty Hospital in Banska Bystrica for ability of biochemical analyzes.

Research was taking part under financial support of projects UMB No. 984/2002, UMB No. 1251 a VEGA 1/2345/05 to study epidemiological examinations Gypsy population from Central Slovakia.

Tab. 1. Evaulation of blood pressure.

Values (mmHg)	Systolic	Diastolic
accetable	<115	<75
elevated	116–120	76–80
high	>120	>80

Heart diseases may become an increasingly important problem for Gypsy adults, but currently there is little information focused on the health status of children and adolescents. It may be a direct result of the influence of their completely different social and cultural environment (in comparison with their counterparts within the major Slovak population).

The aim of this study is to characterize the distribution and accumulation of CVD risk factors in Gypsy children and adolescents as to gender, age and ethnic differences as well as to provide more up-to-date information gained by analysis of anthropometric values such as Body mass index (BMI), Waist to hip ratio (WHR), Blood Pressure (BP) and blood serum levels of Total cholesterol (TC), LDL-cholesterol (LDL-C), HDL-cholesterol (HDL-C) and Triglycerides (TG), and the influence of lifestyle factors (family history of CVD, cigarette smoking, stress, physical fitness and socioeconomic status) that have not been previously investigated in Central Slovakia.

Methods

Examined population

The target population was represented by 198 Gypsy participants (including 101 males and 97 females). The control group was comprised of 140 non-Gypsy participants (including 72 males and 68 females) between the ages of 7 and 18.

Gypsy are an ethnic minority of northern Indian origin living in Slovakia (with unclear exact demographic size). It has been shown that there are up to 750,000 Gypsy living in Slovakia but the official census shows only 75,802 who identified themselves as being Gypsy in the 1991 census. As estimated, there are between 400.000 and 500.000 Gypsy people, i.e. 8.5 % of Slovakia's population. The Gypsy people have a high representation of children in their population (non-Gypsy Slovak inhabitants have an average of 151 children/1000 families as opposed to 420 children/ 1000 Gypsy families) (5).

Our multiethnic study selected a particular group of population to represent its population sample, namely that of Central Slovakia with adequate representation of the surrounding urban population (Žilina, Banská Bystrica, Rimavská Sobota). Provisions for age criteria of examined subjects were selected to fit two age categories: 7–11 years (children) and 12–18 years (adolescents). Randomly selected individuals were representatives of a healthy population (excluded from this report was everybody who had an illness that could influence the results – hypercholesterolemia, hypertriglyceridemia, diabetes, endocrine disorders and inadequate function of the kidneys).

Tab. 3. Acceptable, boundary and patological values of CVD risk factors.

Values	TC (mmol/L)	TG (mmol/L)	LDL-C (mmol/L)	HDL-C (mmol/L)
acceptable	≤4.4	>1	≤2.9	≥1.2
boundary	4.4–5	1.0–1.5	2.9–3.4	1.0–1.2
patological	≥5	≥1.5	≥3.4	≤1

The testing took place at the Pediatric Health Center during 2003–2006 where the participants provided blood samples and physical examinations.

Anthropometry

Measurements regularly used in pediatric practices (such as height, weight, waist and hip circumference) were obtained from each subject. BP was measured on the right arm in seated position by mercury sphygmomanometer with mmHg scale (Tab. 1).

BMI, used for the assessment of obesity prevalence (6), was calculated as contribution of weight and height in square meters ($kg.m^{-2}$) (Tab. 2).

WHR was derived from waist to hip circumference. Waist circumference was measured in the middle between the arch of the 10th rib and the top of crista iliaca 000.0 cm.

Information about related lifestyle factors (family history of CVD, cigarette smoking, stress, leisure-time physical activity and socioeconomic status) was obtained by a questionnaire. The collection of data about the nutrition of the Gypsy participants was marked by some communication problems (information seems to be intimate).

Blood sampling and lipid analysis

Blood was drawn between 800 am and 930 AM after a 12-hour overnight fasting. Samples were analyzed at a biochemical laboratory of Roosevelt's Hospital in Banská Bystrica. Blood serum levels TC, HDL-C and TG were determined enzymatically; the concentration of LDL-C was calculated by the Friedewald Formula: LDL-C = TC-(HDL-C + TG/2.2).

Tab. 2. Evaluation by body mass index.

Values ($kg.m^{-2}$)	Female 7–11 yrs	Male 7–11 yrs	Female 12–18 yrs	Male 12–18 yrs
acceptable	14.4–17.21–21.94	14.85–17.35–22.58	17.45–20.68–24.85	17.75–21.10–25.43
overweight	21.95–24.6	22.59–25.14	24.86–28.53	25.44–28.83
obesis	>24.6	>25.14	>28.53	>28.83

Tab. 4. The anthropometric and biochemical values by age, gender and ethnic differences in examined children and adolescents.

			BMI ($kg.m^{-2}$)	WHR	sBP (mmHg)	dBP (mmHg)	TC (mmol/l)	LDL-C (mmol/l)	HDL-C (mmol/l)	TG (mmol/l)
GYPSY(n=198)	MALES (n=101)	7-11-aged(n=40)	17.45±4.28	0.84±0.07	102,07±10,09	65,17±7,50	4.17±0.70	0.95±0.47	1.20±0.22	0.95±0.47
		12-18-aged(n=61)	19.65±3.54	0.85±0.06	113,05±12,46	72,97±8,92	3.74±0.69	0.90±0.47	1.13±0.27	0.90±0.47
		all	18.90±3.93	0.85±0.07	109,31±12,77	70,31±9,20	3.89±0.72	0.92±0.47	1.16±0.26	0.92±0.47
	FEMALES(n=97)	7-11-aged(n=36)	15.57±2.37	0.85±0.06	97,78±7,9	61,78±8,24	3.83±0.56	0.81±0.36	1.14±0.21	0.81±0.36
		12-18-aged(n=61)	18.70±3.48	0.81±0.08	110,32±10,34	70,53±9,21	3.80±0.60	1.05±0.59	1.16±0.27	1.05±0.59
		all	17.72±3.48	0.82±0.07	106,38±11,24	67,78±9,76	3.80±0.59	0.97±0.54	1.16±0.25	0.97±0.54
	ALL GYPSY		18.32±3.75	0.84±0.07	107,86±12,10	69,06±9,54	3.85±0.65	0.94±0.51	1.16±0.25	0.94±0.51
NON-GYPSY(n=140)	MALES(n=72)	7-11-aged(n=28)	17.47±3.54	0.81±0.04	102,14±9,27	66,25±9,29	4.13±0.68	0.78±0.28	1.27±0.29	0.78±0.28
		12-18-aged(n=39)	21.05±3.70	0.83±0.06	114,62±8,61	76,92±7,75	4.05±0.62	0.95±0.56	1.20±0.33	0.95±0.56
		all	19.55±4.03	0.82±0.05	109,40±10,78	72,46±9,90	4.08±0.64	0.88±0.47	1.22±0.31	0.88±0.47
	FEMALES(n=68)	7-11-aged(n=31)	18.05±3.24	0.81±0.04	99,07±11,52	61,15±9,23	4.25±0.62	1.05±0.64	1.24±0.32	1.05±0.64
		12-18-aged(n=37)	20.45±4.78	0.78±0.06	109,05±±8,48	72,16±5,95	3.82±0.73	1.08±0.53	1.12±0.21	1.08±0.53
		all	19.44±4.34	0.80±0.54	104,84±10,98	67,52±9,25	4.00±0.71	1.07±0.57	1.17±0.27	1.07±0.57
	ALL NON-GYPSY		19.50±4.16	0.81±0.54	107,18±11,08	70,05±9,87	4.05±0.67	0.97±0.53	1.20±0.29	0.97±0.53

mean±SD, sBP – systolic BP, dBP – diastolic BP

Tab. 5. Frequency tables of the examined CVD risk factors in Gypsy and non-Gypsy participants by Fisher test.

RF	% and number of all participants with high levels	% and number of Gypsy participants with high levels	% and number of non-Gypsy participants with high levels	P(Fisher Test)
BMI	8.5 % (26)	7.4 % (13)	9.9 % (13)	0.401
WHR	23.3 % (71)	29.3 %(51)	15.3 % (20)	0.004
TC	6.6 % (20)	4.0 % (7)	9.9 % (13)	0.059
LDL-C	3.6 % (11)	1.7 % (3)	6.1 % (8)	0.061
HDL-C	28.5 % (87)	29.9 % (52)	26.7 % (35)	0.700
TG	11.1 % (34)	9.8 % (17)	13.0 % (17)	0.463
sBP	7.9 % (24)	9.8 % (17)	5.3 % (7)	0.199
dBP	6.6 % (20)	6.3 % (11)	0.8 % (1)	1.

sBP – systolic BP, dBP – diastolic BP

Glucose levels were not analyzed.We compared and evaluated values that have been recommended by Czech Society for Atherosclerosis (7) (Tab. 3).

Statistical evaluation

Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine whether the outcome variables were normally distributed. Variables are reported as mean ± SD. As long as variables were normally distributed, we used t-test and ANOVA, whereas for variables that were not distributed normally, we used Mann–Whitney Test and Kruskal-Wallis Test and evaluated the variables distribution in ethnic-, gender- and age-related groups. A "p" value <0.05 was considered as significant. Spearman and Pearson correlation coefficients were computed to determine the bivariate relationship between all variables. The Fisher Exact Test was used to evaluate the relationship of CVD risk factors in Gypsy subjects and non-Gypsy participants. Lifestyle factors were given in freqency tables. Statistical analyses were performed by using the SPSS System software package.

Results

Subject sample characteristics and distribution RF

The values for CVD risk predictors in Gypsy (n=198) and non-Gypsy (n=140) participants, in ethnicity, gender and age related groups, are given in Table 4.

Tab. 6. Spearman and Pearson correlation coeficients of some variables in Gypsy and non-Gypsy, males and females, 7–11 years and 8–12 years.

	Gypsy		nonGypsy		Gypsy males		Gypsy females		Gypsy children		Gypsy adolescents	
	WHR	BMI	WHR	BMI	WHR	BMI	WHR	BMI	WHR	BMI	WHR	BMI
TC	-0.045	-0.045	0.056	-0.078	0.021	-0.147	-0.130	0.002	0.083	0.086	-0.116	-0.099
LDL-C	-0.123	0.028	0.053	-0.087	-0.101	-0.035	-0.151	0.067	0.018	0.161	0.237**	-0.207*
HDL-C	-0.142	-0.298**	-0.085	-0.330**	-0.127	-0.400**	-0.143	-0.230*	-0.109	-0.103	-0.171	-0.374**
TG	0.212**	0.182*	0.016	0.259**	0.235*	0.184	0.203	0.186	0.228	0.247	0.216	0.120
sBP	-0.102	0.476**	0.108	0.635**	0.008	0.527**	-0.243*	0.391**	-0.151	0.244	-0.022	0.355**
dBP	-0.126	0.392**	0.047	0.594**	0.034	0.448**	-0.336**	0.294**	-0.084	0.215	-0.065	0.231*

Statistical significance *<0.05 and *<0.01

All anthropometric and biochemical variables were classified in an acceptable range.

WHR in Gypsy population were calculated in range of 0.67–1.00 (in the control group 0.65–0.98), respectively. Lower BMI (10.6–32.5 kg/m^2) was found in Gypsy population in comparison to control group (11.8–39.64 kg/m^2). Among the overall Gypsy population tested, only 5.7 % showed to be overweight and 1.7 % of them were found to be obese (Tab. 5). Significant variables were found in values WHR (p=0.002) and BMI (p=0.013), the mean WHR was higher in the Gypsy population as opposed to that of the control population. In each gender group, a statistical significant variable was found in the values of WHR (p=0.022 in Gypsy individuals and p=0.028 in non-Gypsy individuals). There was a statistical significance of variables in BMI by gender (p=0.042) in Gypsy subjects. The mean WHR and BMI were higher in males than in females (the mean WHR in Gypsy males was the highest and the mean BMI in Gypsy females was the lowest in comparison to the other groups).

Slightly higher WHR was determined especially in the younger age group (7–11) in Gypsy and non-Gypsy girls. The mean BMI was lower in 7–11 year-old children of both ethnic groups than in those aged 12 to 18 yrs. BMI was at its maximum in adolescents of each gender. As a result of the study, significant variables were found in relation to BMI in adolescents of both ethnic groups. The statistical significance in BMI (p=0.000) was observed in both ethnic groups.

Significant variables were seen in the levels of TC (p=0.025) and LDL-C (p=0.003). Levels of TC were analyzed in range of 2.4–5.9 mmol/l in Gypsy participants (2.3–5.9 mmol/l in non-Gypsy), levels of LDL-C in range of 0.83–3.96 mmol/l in Gypsy participants (0.84–3.92 mmol/l in non-Gypsy). 4 % prevalence of hypercholesterolemia in Gypsy population was assessed (Tab. 5). Mean TC and LDL-C were completely lower in Gypsy population. Levels of TC and LDL-C in male participants were slightly higher as compared to female participants (except TC non-Gypsy girls aged 7–11 and Gypsy adolescents). Male adolescents had significant variations in levels of TC. Comparing the age groups 7 to 11 and 12 to 18, there were higher mean levels of TC and LDL-C in those at younger age. Mean levels of TC and LDL-C in the 12 to 18-year-old group tended to be lower than in the 7 to 11-year-old group. Significant variations in TC and LDL-C were noted in girls aged 7–11. An occurrence of significant variables levels of LDL-C were showed in ethnic (p=0.002) and adolescents group by age (p=0.002). Levels of HDL-C were analyzed in range of 0.43–1.88 mmol/l in Gypsy participants (0.65–2.40 mmol/l in non-Gypsy). Male participants had consistently higher levels of HDL-C as compared with female participants, except for Gypsy female adolescents. Throughout their early life, children had consistently higher mean levels of serum HDL-C. There was a trend to decreasing the mean HDL-C from ages 7–11 to ages 12–18, but without significant changes. Levels of TG were analyzed in range of 0.33–3.38 mmol/l in Gypsy group (range of control group was 0.28–3.61 mmol/l; the highest mean TG was found in female subjects of control group and significant difference of TG by gender was obtained only in the control group, p=0.015). 10 % Gypsy population showed hypertriglyceridemia to be prevalent (Tab. 5). An increase in mean TG was seen between adolescents groups (except for Gypsy males, whose levels of serum TG had slightly decreased). Blood pressure was measured in the range of 85–145/50–112 mmHg in the Gypsy population (75–130/40–100 mmHg in control group). The highest values of systolic BP were measured in Gypsy female adolescents. The diastolic BP was lower among Gypsy adolescents compared to adolescents of the control group. A significant difference in the diastolic BP in Gypsy participants by gender (p=0.033) and by ethnicity in adolescents (p=0.017) had been found. Similarly, significant variables of values of systolic and diastolic BP (p=0.000) had been found in all participants according to age. Systolic BP increased less with age when compared to diastolic BP.

Relation to body fatness and biochemical variables

The variables listed in Table 6 showed that WHR was slightly related to TG (WHR=0.212**) in Gypsy population. BMI was inversely related to TG, HDL-C, sBP and dBP (weaker than in nonGypsy).

When comparing the Gypsy population by gender, BMI was related to HDL-C, sBP and dBP; WHR to TG more significantly in males than in females. As expected, more significant associations between WHR and sBP, dBP were found in Gypsy females than Gypsy males.

The relation of WHR to LDL-C; BMI to LDL-C, HDL-C, sBP, dBP was slightly more significant in adolescent age group (no significant correlations were noted in children's age).

Tab. 7. Considering lifestyle factors by ethnic, gender and age aspect

Variable	Gypsy	nonGypsy	Gypsy males	Gypsy females	Gypsy children	Gypsy adolescents
Family history	n=173	n=131	n=87	n=86	n=57	n=116
yes	50%(87)	42.7%(56)	46.6%(41)	53.5%(46)	57.9%(33)	46.2%(54)
no	49.4%(86)	57.3%(75)	52.3%(46)	46.5%(40)	42.1%(24)	53%(62)
Cigarette smoking	n=174	n=131	n=88	n=86	n=57	n=117
yes	26.4%(46)	9.2%(12)	33%(29)	19.8%(17)	5.3%(3)	36.8%(43)
no	73.6%(128)	90.8%(119)	67%(59)	80.2%(69)	94.7%(54)	63.2%(74)
Stress at home	n=91	n=101	n=47	n=44	n=38	n=53
low	-	-	-	-	-	-
middle	20.1%(35)	4.6%(6)	15.9%(14)	24.4%(21)	24.6%(14)	17.9%(21)
high	32.2%(56)	72.5%(95)	37.5%(33)	26.7%(23)	42.1%(24)	27.4%(32)
Stress at school	n=91	n=101	n=47	n=44	n=38	n=53
low	0.6%(1)	-	1.1%(1)	-	1.8%(1)	-
middle	24.7%(43)	16%(21)	18.2%(16)	31.4%(27)	28.1%(16)	23.1%(27)
high	27%(47)	61.1%(80)	34.1%(30)	19.8%(17)	42.1%(24)	22.2%(26)
Leisure-time physical activity	n=82	n=31	n=40	n=42	n=19	n=63
yes	27%(47)	22.9%(30)	28.4%(25)	25.6%(22)	14%(8)	33.3%(39)
no	20.1%(35)	-	17%(15)	23.3%(20)	19.3%(11)	20.5%(24)
Socio-economic status	n=89	n=100	n=46	n=43	n=37	n=52
low	17.8%(31)	1.5%(2)	15.9%(14)	19.8%(17)	15.8%(9)	18.8%(22)
middle	20.1%(35)	6.9%(9)	18.2%(16)	22.1%(19)	31.6%(18)	14.5%(17)
high	13.2%(23)	67.9%(89)	18.2%(16)	8.1%(7)	17.5%(10)	11.1%(13)

Considering lifestyle factors

Gypsy population (in comparison with the control sample) showed more representation: family history of CVD (about a half of all Gypsy examined), cigarette smoking (about a fourth), both types of moderate stress (but high stress was more distributive in the control sample), low levels of physical activity and lower socioeconomic status (Tab. 7).

Discussion

This multiethnic cross-sectional study provides distribution, and correlates CVD risk factors in Gypsy children and adolescents from Central Slovakia.

The mean of lipid serum levels and antropological values were noted in an acceptable range. Gypsy participants had significantly lower BMI, TC, LDL-C and HDL-C than participants of the major population. BMI positively correlated with WHR, BP and TG and negatively with HDL-C, always significantly in boys. The most frequently CVD risk predictors were decreased HDL-C and high WHR, inversely associated with other modifiable factors (high incidence of CVD and cigarette smoking in family history; low physical fitness and socioeconomic status). Anthropometric indicators have different variables in different ethnic groups (Asians have higher levels of body adiposity compared to that of Caucasians and should have much higher values of BMI; BMI in Afro-Americans is overevaluated; similarly as WHR in Hispanics) (8).

Previous anthropological studies have shown lower values of weight and height in Gypsy children compared to control population (9, 10). Gypsy children were behind, as far as body height was concerned (values of BMI decreased to 12 years and body fat increased only slightly) (11). In Gypsy children from Eastern Slovakia, the values of BMI showed specific differences compared to the major population. The observed antropometric distribution in Gypsy subjects is consistent with previous data regarding Caucasian populations, including our own showed WHR values. A variability of ethnicity was demonstrated in higher mean determined values of WHR in Gypsy participants (as Hispanic versus Caucasian) and more atherogenic android type of body fat distribution with a proven tendency to persist into and throughout adulthood (which was provided in 36.4 % Gypsy women and 26.9 % Gypsy men, 12). Values of BMI tended to show gender differences slightly (higher in boys and girls) in a preliminary report (13). The current findings of higher BMI in Gypsy males from Central Slovakia in relation to published slightly elevated prevalence of obesity in Gypsy males from Eastern Slovakia (14). Serum levels of lipids at birth are similar in all populations. Environmental factors directly linked to their changes, to what is being seen on the ethnicity level – ethnic comparisons indicated higher serum levels of TC in American Caucasian and Afro-American children (Bogalusa review) (15). At the end of childhood, all children have similar concentrations of lipids due to their adaptation to universal life style (16).

Observed lower TC in Gypsy population from Central Slovakia when compared to major population is consistent with previous data. The current higher mean TC and LDL-C noted in younger age groups are increasing because of a growing presence of CVD risk factors due to their high prediction in Gypsy families. The ethnic contrasts in serum HDL-C levels that were observed in the present study are similar to those seen in other Gypsy studies (lower HDL-C in Gypsy children from Eastern Slovakia have been also noted (17); up to 55 % of Gypsy adults had low and only 5 % had optimal values of HDL-C (12). By influence of sex hormones accelerated by maturity, the concentrations of protective antiatherogenic HDL-C in girls should increase, the fact of which was reflected in Framingham study (18) and also in Gypsy girls. Analyzed higher mean TG levels in the Gypsy population from Eastern Slovakia compared to the major group (19) show contrary results (except for Gypsy boys aged 7–11), but similar to the Framingham study (20). Higher mean TG in Gypsy female adolescents compared to Gypsy males differ from that obtained from Gypsy adults (increased TG in men and higher prevalence of hypertriglyceridemia compared to women has already been described) (12). An increased prevalence of hypertension has been found as a result of previous pediatric ethnic studies (beside New York preschool Afro-American children with acceptable lipid profile compared to that of Caucasian and Hispanic children) (21). In the current study, the Gypsy ethnic group has higher mean values of systolic BP and lower mean values of diastolic BP compared to the major population. The statistical significance of BP values has also been similar to that of the recent review of the Gypsy children population. BP is in accordance with gender and ethnic differences, analyzed in Gypsy adults. Epidemiological researches have proven the variability in blood serum lipids, which is a result of WHR and BMI values. Also found was a positive association between WHR and TG in Gypsy adolescents corresponding with other studies (22, 23). The current study also indicates the previously reported associations between BMI, WHR and decreasing values of HDL-C in Gypsy adults. Serum levels of TC strongly correlated with LDL-C, and children with higher LDL-C levels showed higher HDL-C. Interestingly, no relation of TC to BMI and WHR was noted in Gypsy children and adolescents, the fact of which is in accord with a previous study of Gypsy adults.

As found in Gypsy adults (age 41.3), the described risk predictors (12) had originated in childhood, which was proven by the present study. The fact is that there are more non-Gypsy children and adolescents being without CVD risk factors than found in Gypsy children.

Higher predisposition to CVD of Gypsy young people (a half of examined participants noted an occurrence of CVD in their family history) was reflected by risk factors (low HDL-C and high TG). The Bogalusa Heart Study also showed a strong relationship between family history of CVD with obesity, hypertension and pathological serum lipids levels (24). The presence of risk factors and CVD in families is expected to increase in the Gypsy population.

Gypsy adolescents show high predisposition to cigarette smoking which has already been proven in adults (25). High consumption of cigarettes is one of the causes of early mortality in the Gypsy population (Ginter, 2002).

Regular aerobic exercise has beneficial effects on lipid profile and the prevention of atherosclerosis (26). Low physical fitness directly relates to the increased serum levels of TC, LDL-C, TG, decreased levels of HDL-C, increased BP and BMI in Quebec adolescents compared to that of their contemporaries with higher levels of physical fitness as this has been proven (27). Lower physical activity in Gypsy individuals, their adaption to sedentary lifestyle and rich caloric intake can negatively affect the serum lipid levels, BP and anthropometric indices.

Gypsy children and adolescents declared a lower socioeconomic status in their families. Gypsy poverty can negatively influence the development of CVD because of cheaper and unhealthy nutritional options.

It is recommended for children and adolescents to evaluate the risk factors of health problems leading to the onset of atherosclerosis at young age (early atherosclerotic lesions of autopsied Finish children and adolescents have had association with obesity (28); serum TC and LDL-C had significant relationship with increasing of intima-media thickness and reduction of dilatation brachial artery as the signs of early atherosclerosis in obese Chinese school children (29); in the PDAY study, the relationship of atherosclerotic lesions and lower HDL-C has been also noted (30), our results show this too.

The Gypsy population is living as a high-risk population discomposed regarding to the onset and development of CVD which should lead to the increase in effective health treatment in childhood and the carrying out of further intervention preventive programs, which are still more acute. They can reduce adult morbidity and mortality, which can affect the Slovak population considerably.

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Received November 5, 2008.
Accepted January 23, 2009.