

# EVALUATION OF CARDIOVASCULAR RISK IN SCHOOL CHILDREN

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## ABSTRACT

Atherosclerosis is a pathological condition that begins in early childhood, but clinically the disease manifests in older age. The aim of work was to determine frequency of atherosclerosis risk factors in healthy school children. Cross-sectional study included 214 children in mean age 10,99±2,52 years, within range 7 to 15 years. Patients body mass index, blood pressure, lipid status, dietary habits, physical activity and sedentary habits have been evaluated. Cardiovascular risk factors are significantly present in children ( $P<0,05$ ) i.e. one cardiovascular risk factor is present in 47/214 (21,96%) children, two risk factors had 25/214 (11,68%) children, while 17/214 (7,94%) children had three or more cardiovascular risk factors. Obesity was present in 20/214 (9,34%) children, while overweight was present in 23/214 (10,83%) children. Hypertension was present in 10/214 (4,67%) children, and it was significantly present ( $p<0,05$ ) in obese and overweight children. Total cholesterol was increased in 171/214 (8,87%) children, LDL-cholesterol was increased in 11/214 (5,14%), increased triglycerides had 4/214 (1,86%) children, while decreased HDL-cholesterol was found in (3/214, 1,40%) children. Unhealthy dietary habits were present in 45/214 (21,02%) children, 42/214 (19,62%) children is physically inactive, while sedentary habits were shown in 39/214 (18,22%) children. Research shows that a large number within study group has one or more cardiovascular risk factors that can lead to premature atherosclerosis. Using massive screening of cardiovascular risk factors, along with adequate physical activity, healthy dietary habits, reduced sedentary habits, doctors and teacher's education, parents and children can reduce premature clinical sequels in atherosclerotic process.

KEY WORDS: cardiovascular risk, factors, evaluation, child

## INTRODUCTION

Cardiovascular diseases are one of leading public health problems and causes of death in all developed and in transition countries in the world. Arteriosclerosis plays a major role in the initiation and progression of cardiovascular disease. Arteriosclerosis is a complex process that emerges through interaction of structural and metabolism properties of the arterial wall, ingredients of blood and homodynamic forces. Many studies have shown that process of atherosclerosis begins in early childhood and that the same risk factors like those in adults, predispose the atherosclerosis phenomena in children (1,2). Intensity and progression of pathological variances on the blood vessels are related to body mass index, concentration of total and LDL-cholesterol, systolic blood pressure and smoking (3,4). Several cardiovascular risk factors (obesity, dyslipidemia, hypertension and physical inactivity) show retention tendency from child's age and adolescence to adult age, while affiliated risk factors significantly accelerate atherosclerosis process (3,4,5). Irreversible atherosclerosis changes only occur in mature age, therefore prevention of atherosclerosis in childhood is of exceptional significance. Therefore, it is necessary to think about coronary disease at child's age, while prevention of coronary disease at child's age needs to become public health priority (6). Insufficient access and attention to these issues in the every day's medical work with children, that may cause serious pathological consequences, have initiated the research, that aims to determine frequency of atherosclerosis risk factors in healthy school children.

## SUBJECTS AND METHODS

Cross-sectional study during the period from 20/03/2007 to 25/06/ 2008 have been conducted on 214 children. Children had regular physical status. Research was carried out in accordance to ethical standards of the 1975 Helsinki Convention. Research included: children physical examination, weight and height measurement, body mass index determination, blood pressure and lipid status, nutritional habits evaluation, children's physical activity and sedentary habits. Body weight was measured using portable digital scale (Seca 87, Hamburg, Germany) and body height was measured using portable stadiometer (Seca Leicester, Hamburg, Germany). Body mass index was determined by calculation (weight in kilo/height in m<sup>2</sup>) and values were compared with general adopted standards. Children with weight index over

95. percentile for age and sex were considered obese, and overweight children were with percentile between 85. and 95. for age and sex (7). Blood pressure of the examinees was determined in two occasions with calibrated aneroid sphygmomanometer (Erka Vario Desk model, Bad Tölz, Germany), auscultation method (Riva-Rocci-Kortkoff), with adequate cuff and in sedentary position. Blood pressure value (systolic, diastolic, both) that was equal or higher than 95. percentile for age, sex and height was defined as hypertension (8).

Pattern for lipid profile (3,5 cm<sup>3</sup> blood stored in Vacutainer) obtained from cubital vein puncture, after ten hours of starvation. Serum samples for lipid profile were analysed using enzyme method and on the (Dimension RXL max, Dade Behring, Deerfield, USA) analyser. Obtained values were compared to standard values of lipid status of children's age (9). High values of lipid status were defined as: total cholesterol  $\geq 5,16$  mmol/dm<sup>3</sup>, LDL-cholesterol  $\geq 3,36$  mmol/dm<sup>3</sup>, triglyceride  $\geq 1,47$  mmol/dm<sup>3</sup> and HDL-cholesterol  $< 0,91$  mmol/dm<sup>3</sup>. The survey questionnaire was used to assess the dietary habits, physical activity and sedentary habits. Insufficient consumption (rarely or once a day) of integral cereals, vegetables, fruits, fish and white meat was considered as improper nutrition. Physical activity less than 60 minutes (3 times a week) was characterized as improper physical activity. Watching TV, video games, or use of computer more than 2 hours per day was determined as exaggerated sedentary habits. Obtained data was entered in database and analysed by statistical program MedCalc, version 9.2.02, Mariakerke, Belgium. Importance of registered/non-registered certain variables were tested with statistical program Chi-square test and statistical significance was defined as  $p < 0,05$ .

## RESULTS

This study includes 214 children (112/214; 52,3% boys and 102/214; 47,7% girls), mean age  $10,99 \pm 2,52$  years, range 7 to 15 years of age. Frequency of cardiovascular risk factors in the examinees is shown the Figure 1. which explains: Body mass index over 95. percentile for age and sex had 20/214 (9,34%) children, and body mass index between 85. and 95. percentile for age and sex was a 23/214 (10,74%) children, hypertension had 10/214 (4,67%) children, 17/214 (10,74%) children had an increased cholesterol total, 11/214 (5,14%) children had an increased LDL-cholesterol, and increased triglyceride had 4/214 (1,86%) children and decreased HDL-cholesterol had 3/214 (1,40%) children.

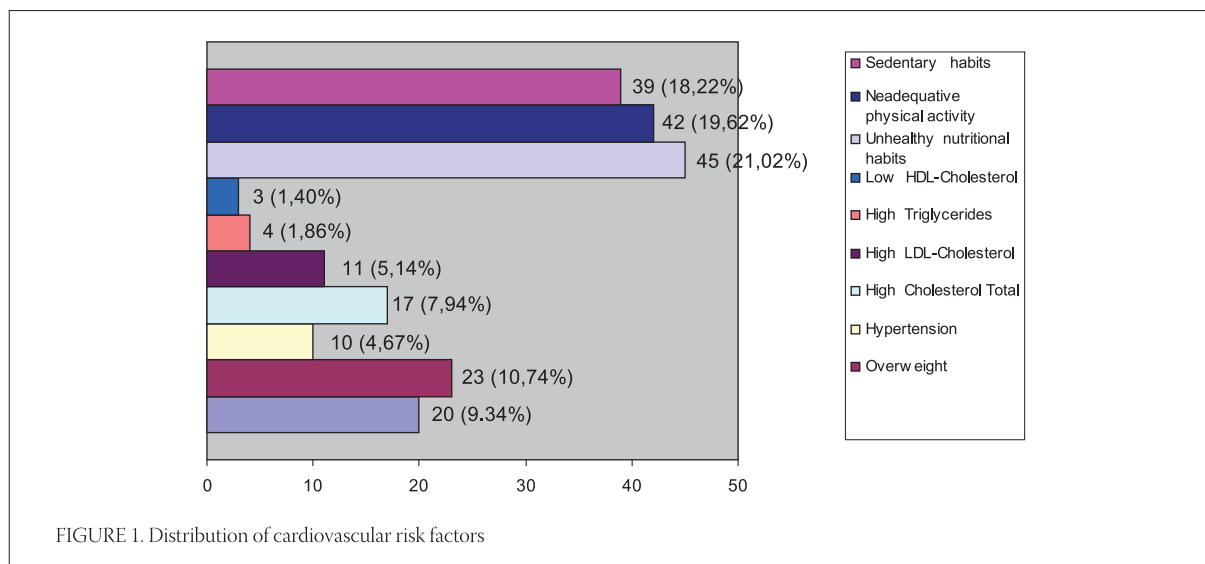


FIGURE 1. Distribution of cardiovascular risk factors

Figure 2. shows that unhealthy nutritional habits is present in 45/214 (21,02%) children, while 42/214 (19,62%) children have insufficient physical activity, and sedentary habits are showing in 39/214 (18,22%) children. Cardiovascular exertion is expressed in significant number of examinees ( $\chi^2=11,0$ ,  $P<0,05$ ). One cardiovascular risk factor had 47/214 (21,96%) examinees, two risk factors was expressed in 25/214 (11,68%) examinees and 17/214 (7,94%) examinees had three or more cardiovascular risk factor which is illustrated in Figure 2.

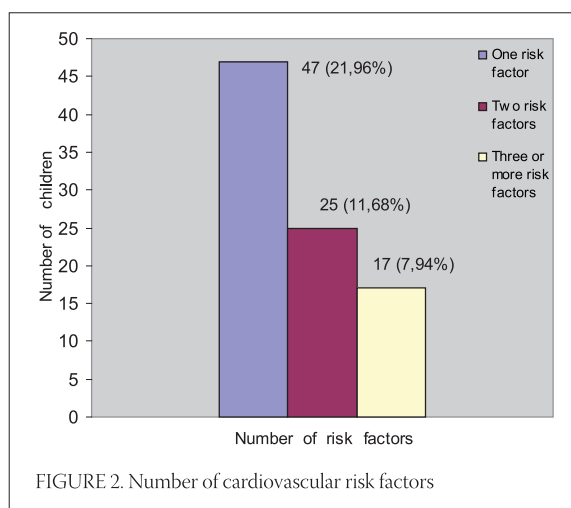


FIGURE 2. Number of cardiovascular risk factors

Atherogenic lipid profile (increased LDL-cholesterol, triglycerides and decreased HDL-cholesterol) is present in a significant number ( $P<0,05$ ) in obese children and overweight children (Table 1).

## DISCUSSION

Conducted research indicates that children with proper physical status also have a risk of cardiovascular disease as a result of present cardiovascular risk factors. We have found that significance number of ( $P<0,05$ ), 89/214 (41,56%) examinees have one or more cardiovascular risk factors. In accordance with Reed K.E. et al. 50% children have one or more cardiovascular risk factors (10). Modern style of life, practicing unhealthy nutrition, high caloric nutrition with fats, cholesterol, and refined sugars in interaction with insufficient physical activity and expressed sedentary habits has influence on obesity phenomena in children. This also shows in our examinees, i.e. obesity and overweight is shown significant number ( $P<0,05$ ) in children. Romaldini et al. (11) instigate that obesity and overweight was found in 25,7% children and adolescents. Study of Grünberg and Thetloff (12) points that 3-5% children are overweight. Disorder of lipopro-

Risk factor	Obesity (n=20)	Overweight (n=23)	Normal/ reduced weight (n=171)	Chi-square test, P value
Hypertension	7	2	1	$\chi^2= 29,70$ ; $P< 0,05$
Total Cholesterol	9	6	2	$\chi^2= 34,23$ ; $P< 0,05$
LDL-Cholesterol	6	4	1	$\chi^2= 26,93$ ; $P< 0,05$
Triglycerides	3	1	0	$\chi^2= 17,98$ ; $P< 0,05$
HDL-Cholesterol	2	1	0	$\chi^2= 12,48$ ; $P< 0,05$
Unhealthy food	16	15	14	$\chi^2= 0,11$ ; $P> 0,05$
Physical inactivity	18	14	10	$\chi^2= 1,91$ ; $P> 0,05$
Sedentary habits	15	12	12	$\chi^2= 0,87$ ; $P> 0,05$

TABLE 1. Representation of cardiovascular risk factors according to body weight

tein metabolism has the most important significance in the etiopathogenesis of atherosclerosis. In adults with coronary heart disease approximately 50% of patients have primary, hereditary, dyslipidemia. We have also found that in our examinees significant number ( $P < 0,05$ ) have dyslipidemia i.e. 37/214 (17,281%), children had dyslipidemia. Obese children and overweight children have altered lipid profiles in a significant number ( $P < 0,05$ ), with predominance frequency of total and LDL-cholesterol, and a number of these children have and increase triglyceride and decrease of HDL-cholesterol. Lipid profile disorder (increase in total and LDL-cholesterol) is determined in a number of children who do not have an increase body mass index. Enhanced physical inactivity and sedentary habits in our examinees and increased body mass index have a significant effect on occurrence of dyslipidemia. Altered lipid profile in children who do not have increased body mass index indicates that in our examinees hereditary dyslipidemia needs to be taken in consideration. Research of Romaldin et al. (11) indicates that 57,1% of examinees have an abnormal lipid values. Problem of dyslipidemia is indicated in a study of Salazar i.e. hypertriglyceridemia is present in 7,3% children and 29,1% adolescents, and decreased HDL-cholesterol at 8,2% children and 0,9% adolescents (15). Obesity, unhealthy nutrition and physical inactivity have an effect on the phenomena of primary hypertension in child's age (16). Hypertension is distributed in a significant number of children, ranging from 6% to 12% (12). Within the context of above mentioned, in our survey 11/236 (4,88%) of children ( $P < 0,05$ ) have a hypertension. American Pediatric Academy suggests

aimed lipid screening in cardiovascular risk assessment in children. It is necessary to do a lipid profile if: there is positive family anamnesis for early cardiovascular disease and dyslipidemia in parents and relatives, if family anamnesis for cardiovascular disease and dyslipidemia is unknown or incomplete or other cardiovascular risk factors exist (overweight, hypertension, diabetes mellitus, smoking, physical inactivity and low HDL-cholesterol (9). We think that instead of aimed lipid screening and other cardiovascular risk factors in identification of cardiovascular risk in children, major importance has a universal (mass) screening. By using mass screening of lipids and other cardiovascular risk factors it is possible to screen a significant number of healthy children with the aim of identifying cardiovascular risk, without considering data from family anamnesis, which are most often unknown, incomplete and vague. Derinoz et al. indicate unreliability of family anamnesis in evaluation of cardiovascular risk in children (17). In everyday's medical work with children, detection screening of cardiovascular risk factors is insufficiently conducted, so it is advised that every child or higher number of healthy children in early period of school make screening tests of cardiovascular risk factors (in order to determine body mass index, blood pressure, lipid profile, to estimate nutrition habits, physical activity and sedentary habits).

In regard to all mentioned, it is possible to identify children who have cardiovascular exertion and with using adequate prevention approach to it is possible to reduce or eliminate risk for cardiovascular disease at adult age in timely manner.

## CONCLUSION

On the basis of conducted research it can be concluded: (1) Screening of cardiovascular risk factors in healthy school children has an importance in determination of early cardiovascular risk; (2) Significant number of our examinees have one or more cardiovascular risk factors, stipulating early cardiovascular risk i.e. the significant number our examinees have obesity, hypertension, dyslipidemia, insufficient physical activity and expressed sedentary habits; (3) Successful prevention strategy of cardiovascular disease needs to be based on early mass detection of cardiovascular risk factors, suitable physical activity, healthy dietary habits, reduced sedentary habits and education of doctors, teachers, parents and children.

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