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Prevention of adult cardiovascular disease in obese children

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An investigation was carried out to establish the risk factors of cardiovascular disease among obese children. Among 173 obese children 38% were endangered in respect of cardiovascular disease. The frequency of hyperlipoproteinaemia was near to 20%. It is considered necessary to separate these children from the group of obese children and to treat them according to the outlined aspects.

Nowadays, the aetiology of cardiovascular diseases, in other words, the risk factors which could lead to such disorders, are mostly known. And still we have to face difficulties when planning examination programmes in order to throw light on the risk factors in childhood.

Large screening programmes are known which take into consideration the whole child population, especially as regards lipid parameters. Others again propose only the screening of the risk-population, e.g. of children of parents recovered from juvenile heart infarction, considering that metabolic disturbances of lipoprotein are hereditary and even the way of life within one and the same family is alike [1].

Among the risk factors the importance of obesity is widely known. The decrease of physical working capacity goes together with obesity. The relationship between the latter and the high density lipoprotein-cholesterol level (HDL-C), which is a protective agent for the vessel walls, is also known. It seemed thus obvious to regard as a risk population the obese children free from endocrine changes and to start among them an investigation.

Materials and Methods

From our out-patients we have selected 173 obese children, 90 girls and 83 boys without any disturbance of endocrine origin. Their mean age was 12.6 ± 1.93 years. In all children we measured on the right side of their body 5 skinfolds (biceps, triceps, subscapular, suprailiac, calf) with Holtain caliper and estimated the per cent of body fat according to Parizkova and Roth [10]. On the basis of anthropometrical data the body fat per cent of all boys was over 25% while that of the girls was over 30%.

A detailed family history was taken and after 12 hours fasting native and heparinized red blood cell samples were obtained from the children. Cholesterol and HDL-C were determined enzymatically, triglyceride according to Laurell, lipoid by agargel electrophoresis according to Noble. From the above data the frequency of hyperlipoproteinaemia was established.

After 5 minutes in lying position, blood pressure was repeatedly measured on all extremities.

The data obtained were elaborated and scored according to the system of Nora [9] as modified by us.

Questions concerning family history

1. Has a first-degree relative (parent or sibling) had a heart attack or coronary disease and/or a stroke with onset before age 45?
2. Has a first-degree relative had a heart attack, coronary disease and/or a stroke with onset before age 65?
3. Has a second-degree relative had a heart attack, coronary disease and/or a stroke with onset before age 65?
4. Does the child or a first-degree relative have juvenile onset diabetes?

Questions concerning lipid and lipoproteinaemias

5. Has the cholesterol level repeatedly been higher than 5.17 mmol/l?
6. Has the serum cholesterol level been repeatedly higher than 5.70 mmol/l?
7. Has the triglyceride level been repeatedly higher than 1.95 mmol/l?
8. Has the HDL-C level repeatedly been lower than 0.77 mmol/l?

Questions concerning blood pressure, weight, smoking, physical working capacity

9. Has the blood pressure repeatedly been higher than 140/90 mmHg?
10. Is the body fat per cent in boys higher than 25%, in girls higher than 30%?
11. Does the child perform vigorous exercise daily?
12. Does the child smoke?

Counting of risk indexes

	Score
Family history (the single maximum score is 3)	
Coronary disease in first-degree relative before age 45	3
Coronary disease in first-degree relative before age 65	2.5
Coronary disease in second-degree relative before age 65	1
Stroke in first-degree relative before age 45	1
Stroke in second-degree relative before age 65	0.5
Lipids, lipoproteins (add value to a maximum score of 2)	
Cholesterol higher than 5.70 mmol/l	
HDL-C under 0.77 mmol/l	2
Cholesterol higher than 5.17 mmol/l	1
HDL-C under 0.77 mmol/l (normal HDL-C, no point)	1
Triglyceride level higher than 1.95 mmol/l	0.5
Blood pressure, weight, smoking, physical exercise (add to all values)	
Smoking regularly	1.5
Juvenile diabetes in patient or first-degree relative	1
Lack of regular physical activity	0.5
Blood pressure higher than 140/90 mm Hg	1
Body fat per cent over 25% or 30% respectively	0.5

Results

We have processed the data of 173 out-patients according to the above aspects. Detailed results are given in Table I. On the basis of the family history (cardiac infarction, stroke) 7.5% of obese children obtained scores. If juvenile diabetes was included 17.9% of the children had a positive family history.

Considering the serum lipids and lipoprotein parameters, we have met

Table I

Frequency of risk factors in obese children (n: 173)

	No. of cases	Per cent
Family history		
Early onset coronary disease in first-degree relatives	3	2
Stroke in first-degree relatives	5	3
Coronary disease in first-degree relatives before age 65	—	—
Coronary disease and stroke in second-degree relatives before age 65	5	3
Diabetes (juvenile onset) in first-degree relatives	18	10
Hyperlipoproteinaemia (Fredrickson)		
Type II/a	16	9
Type II/b	6	3
Type IV	14	8
Regular smoking	6	3
High blood pressure — 140/90 mmHg	56	32
Lack of physical activity	147	85
High body fat per cent	173	100

Frederickson types II/a (9.2%), II/b (3.4%) and IV (8%). These data indicated scores for approximately 20% of the obese patients. In another study the frequency of hyperlipoproteinaemia was 9% among patients with normal weight.

Finally, blood pressure of 32.4% of the patients was repeatedly higher than 140/90 mm Hg; 3% were smoking regularly and 85% did not participate in any kind of sport apart from school gymnastics. All the patients were obese and, thus, were automatically given scores.

Risk scores and increased risks have been calculated according to Nora [9] as follows.

Risk score	*Increased risk*
3	2×
3.5	3×
4	5×
4.5	6×
5	15×
5.5	not calculable by present methods

TABLE II

Development of risk scores in obese children (n: 173)

Score	No. of cases	Per cent
1–2.5 without risk	106	61
3	33	19
3.5	16	9
4	7	4
4.5	7	4
5	3	2
5.5	1	0.5
Total endangered	67	38

On the basis of their scores, the 173 obese patients could be divided into six groups (see Table II).

DISCUSSION

Berwick et al. [3] mention among the possibilities of screening and prevention in childhood, the following procedures.

1. Universal screening examination in 10-year-old children by determination of serum cholesterol level twice in all children or twice only in those where the first value has been found elevated.

2. Target screening in all children on the basis of questionnaires. With a positive family history (coronary disease) the serum cholesterol level should be estimated.

3. Triggered screening: serum cholesterol estimation in children whose parents have recovered from cardiac infarction.

4. Population-wide campaign, in the first place through mass media, in order to give dietary and living habit instructions.

5. School education for children aged 10 through 15, to offer, in the first place, dietary regulations.

Universal screenning, though in this field experiences already exists, is expensive, especially if not only the serum cholesterol but the level of the important HDL-C is also planned [2, 3, 4].

Our questionnaire differs from that recommended by Nora [9] in the following. We have put the age of juve-

nile cardiac infarction to an earlier age, 45 years, in accordance with literary data [1]. The lowest limit of serum cholesterol has been set at 5.17 mmol/l, on the basis of some statistics for populations outside Hungary [5, 7]. Recent data have shown the protective role of HDL-C; it was, therefore, considered important to determine it among the lipoprotein parameters. Instead of body weight, it seemed more correct to determine body fat per cent by the skinfold method; the data for boys (25%) and girls (30%) are the conventional limits of "obesity" [11]. Typifying of behaviour seems to be difficult in practice and therefore it was left out from our questionnaire.

In the case of targeted screening, namely, if we would have examined the patients only on the basis of the positive family history, the lipoid metabolism would have been examined in not more than 31 cases. At the same time, among the 31 obese children we found a hyperlipoproteinaemia in 26 cases and these patients, of course, fall into high point and high risk groups.

Among the children, 32% had a blood pressure higher than 140/90 mm Hg, in 8 cases with changes in the ocular fundus. At the same time, in most children a loss of weight led to a normalization of blood pressure. Also, 85% of these children did not pursue any sport associated with serious physical exertion.

Screening of obese children belongs to the possibilities of targeted screening because it can be solved either by simple inspection by the school physician with weighing and height measuring, but also with anthropometrical methods (Kaup index, skinfold). According to our results, the questionnaire system, together with blood pressure, lipid and lipoprotein estimations was able to indicate a high proportion (39%) of endangered children with a high frequency of hyperlipoproteinaemia among them.

At the same time, in order to get correct results, some criteria in our questionnaire were stricter than those of Nora, as already mentioned.

It is obvious that screening is of importance only if we can do something in the interest of these children. Glueck [6] summarized the tasks to be done as follows. With the restriction of administering saturated fats and cholesterol, the total cholesterol level can be reduced. The diet, based on the reduction of all calories and carbohydrates generally normalizes the concentration of serum triglycerides. The reduction of body weight, according to the Muscatine study [8], where half of the children with hypertension were obese, is associated with a decrease of blood pressure.

We have to add that the effect of physical activity, increased in the interest of weight loss, improves the HDL-C level of these children [6]. Finally, the discontinuation of smoking assists profitably the above-mentioned tasks.

Screening and proper management of children is probably the only means to prevent vascular diseases which manifest themselves in adult age. We

have presented one variation of the many screening programmes, the screening of obese children. It was not our aim to develop a disease consciousness in either the children or their parents; we only wish to emphasize the possibilities of prevention of serious cardiovascular disease.

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