Acta Paediatrica Academiae Scientiarum Hungaricae, Vol. 22 (4), pp. 309–312 (1981)

Serum lipid and lipoprotein profile in children with malabsorption: an approach to the recognition of atherosclerosis risk factors*

by

Z. Szczepański, A. Malecka-Torbus, A. Obuchowicz, I. Swietochowska, R. Zaba, B. Wróbel-Lasok

First Paediatric Clinic, Silesian Academy of Medicine, Bytom, Poland

Received February 27, 1981

Serum lipoproteins, triglyceride, total cholesterol as well as HDL, LDL and VLDL-cholesterol were studied in 35 children, actually well nourished, who as infants suffered from malabsorption syndrome with severe malnutrition. If at the active stage of malabsorption some risk factors of atherosclerosis had been found, at the stage of realimentation no disturbances were encountered. The results did not significantly differ from those of the control group.

The risk of atherosclerosis is related to the serum total cholesterol. Initially, the studies were focussed almost exclusively on that parameter [4, 8, 11, 20]. Early in the course of these epidemiologic studies it was found that plasma cholesterol did not occur in a free state, but was carried by the lipoprotein fractions. Subsequently it was stated that a large amount of cholesterol in the low-density lipoprotein (LDL) fraction is atherogenic, whereas the cholesterol in the high-density lipoprotein (HDL) fraction is protective [1, 11, 15, 19]. Thus, a decrease in HDL cholesterol may be considered a risk factor of atherosclerosis [1, 6, 7, 14, 20].

There is considerable evidence to show that atherosclerosis originates in childhood. The paediatric component of the problem is the development of aortic fatty streaks in infancy [10, 20]. Two decades later some complication may precipitate the clinical manifestation in the form of e.g. ischaemic heart disease. Prevention of atherosclerosis might therefore begin in the paediatric age group [4, 6, 7] and this makes it necessary to identify the risk factors in children [19].

Hypercholesterolaemia of nutritional origin frequently coexists with obesity [2, 6, **21**], and in adults one of the therapeutical procedures is directed to induce weight loss. Previously we have observed some atherosclerosis risk factors in children with severe malnutrition; one of these

* This work was supported by the Polish Academy of Sciences.

factors was a significantly decreased serum HDL level not accompanied by an increase of the LDL fraction.

The aim of the present work was to study the lipid-lipoprotein composition in well-nourished children in a good state, who as infants had suffered from malabsorption syndrome with severe malnutrition.

Material and Methods

The material consisted of 35 children 3—5 years of age; of these 19 had coeliac disease and 16 had had secondary malabsorption syndrome. The diagnosis of coeliac disease was based on the ESPGAN criteria: villous atrophy at admission, clinical and histological improvement on a gluten-free diet and histological relapse after the reintroduction of gluten. At the time of the lipid examinations, all children were well-nourished and apparently healthy without any treatment except the gluten-free diet. The malabsorption syndrome was diagnosed on the basis of faecal fat and d-xylose absorption and other routine test. The control group consisted of 31 healthy children of the same age.

Serum HDL and LDL levels were estimated by the double immunodiffusion technique in agar gel [17]; results were expressed in dilution units. Serum total cholesterol was estimated by the method of Lieberman and Burghardt and the same method was applied for the measurement of HDL-cholesterol after precipitation of LDL and very low density (VLDL) cholesterol by means of heparin and manganese chloride [3]. Total trigliceride in serum was estimated enzymatically, using the Boehringer-kit. VLDL-cholesterol was calculated as a quotient of total triglyceride, and LDL-cholesterol from the Rifkind formula [2, 12].

Results

Results are given in Table I. It appears that there is no conclusive evidence of any risk factor. The alpha lipoprotein level was somewhat lower than in the control group, but the same was the case with the beta-lipoproteins while the value for HDL-cholesterol was like in the controls.

Discussion

The decreased level of beta-lipoprotein found by us corresponded to the lowered LDL-cholesterol. Kliorin

Table I

Serum lipoprotein fractions and lipoprotein cholesterol in well children who as infants had had malabsorption with considerable malnutrition

	No.	Immunochemically determined lipoproteins (dilution units)		Total cholesterol mg/dl	HDL-cholesterol mg/dl	VLDL-cholesterol mg/dl	LDL-cholesterol mg/dl
		alpha-Lpp	beta-Lpp				
Children with malabsorption	35	329.3±130.6	56.9±15.4	151.8±59.3	57.6±23.4	14.2±8.5	77.8±30.5
Control group	31	371.3±107.9	72.5±15.1	182.0±49.4	58.3±31.4	9.3±7.3	107.8±33.6

and Matvieev [12] in their control group (too small in number) showed values different from those generally considered normal; the HDL-cholesterol values were higher and those for LDL-cholesterol lower than those presented by others for the same age groups [7, 15] and as found by us in our control group. It is apparent from many studies that the extreme individual variability in lipoprotein levels makes it necessary to have large groups for detecting subtle differences [18].

Our previous studies in children with malabsorption syndrome at the active stage of the disease, showed a highly significantly lowered serum HDL level. Simultaneously, the LDL level too was significantly decreased as were also the total and LDL-cholesterol levels [5, 7]. Bearing this in mind it could hardly be believed that there are atherosclerosis risk factors in malabsorption syndrome, even if the HDL is diminished, because the deficiency may only play a limited role as an antiatherosclerotic agent in that stage when intensive realimentation takes place. Onitri and Boyo [16], Devi et al [5] and other authors [18] showed that in children with kwashiorkor some disturbance in lipoproteins must exist to explain the fatty liver. The cause of the observed changes in lipoproteins in the active stage of malabsorption is not clear. As one of the sources of apoprotein A and B formation are enterocytes, the decrease in HDL may perhaps be due to the damage of enterocytes in the case of villous atrophy. Another cause might be a protein leakage through the damaged intestinal mucosa. Thus the synthesis of alpha lipoprotein may be disturbed and the synthetized alpha lipoprotein may be lost in protein-losing enteropathy. Still, faecal analysis in our cases of enteropathy failed to show lipoproteins among the proteins lost. In children with malabsorption syndrome there is an evident decrease of the serum cholesterol concentration as compared with healthy children. It is believed that the malabsorption is the main cause of this. On the other hand, some disturbance in bile salt metabolism and their circulation such as a deconjugation of bile acids may also cause a loss of cholesterol [13].

It is generally accepted that a negative correlation exists between the HDL level and the incidence of ischaemic heart disease [11]. In cultured endothelial cells the addition of HDL inhibited the cellular injury elicited by LDL. In populations with a genetically determined high HDL level, atherosclerosis and ischaemic heart disease are infrequent [7].

According to the present study, in children with coeliac disease and secondary malabsorption syndrome at the stage of realimentation, the lipoproteins and the lipoprotein cholesterol fractions are not distinctly disturbed. It is concluded that the low HDL level had been transitory and had not persisted long enough to evoke changes in lipid-lipoprotein metabolism and to injure the endothelial cells by LDL-cholesterol.

References

1. Berg, K., Børresen, A.-L., Dahlen, G.: Serum high-density lipoprotein and atherosclerotic heart-disease. Lancet **1**, 343 (1979).
2. Boulton, T. J. C.: A coronary risk-factor profile of 4 year olds: blood pressure, serum lipids and skinfold thickness in normal children. Aust. Paediat. J. **13**, 271 (1977).
3. Burstein, M., Scholnick, H. R.: Lipoprotein-polyanion-metal interactions. Advanc. Lipid Res. **11**, 67 (1973).
4. Christensen, B., Glueck, C., Kwiterovich, P., Degroot, I., Chase, G., Heiss, G., Movery, R., Tamir, J., Rifkind, B.: Plasma cholesterol and triglyceride distributions in 13, 665 children and adolescents: prevalence study of the lipid research clinics program. Pediat. Res. **14**, 194 (1980).
5. Devi, S. C., Indiva, K., Chitra, D. R., Devi, S. M., Sagar, P.: Plasma lipids and lipoproteins in protein-calorie malnutrition. Acta paediat. scand. **65**, 161 (1976).
6. Epstein, F. H., Gutzwiller, F., Howald, H., Junod, B., Schweiza, W.: Prävention der Atherosclerose: Grundlagen heute. Schweiz. med. Wschr. **109**, 1171 (1979).
7. Glueck, C. J., Garside, P., Fallat, R. W., Sielski, J., Steiner, P. M.: Longevity syndromes: familial hypobeta and familial hyperalpha lipoproteinamia. J. Lab. clin. Med. **88**, 941 (1976).
8. Hennekens C. H., Jesse, M. J., Klein, B. E., Gourley, J. E., Blumenthal, S.: Cholesterol among children of men with myocardial infarction. Pediatrics **58**, 211 (1976).
9. Henriksen, T., Evensen, S. A., Carlander, B.: Injury to cultured endothelial cells induced by low density lipoproteins: protection by high density lipoproteins. Scand. J. clin. Lab. Invest. **39**, 368 (1979).
10. Holman, R. L.: Atherosclerosis — a pediatric nutrition problem? Amer. J. Clin. Nutr. **9**, 565 (1961).
11. Kannel, W., Castelli, W. P., Gordon, T.: Cholesterol in the prediction of atherosclerotic disease. Ann. intern. Med. **90**, 85 (1979).
12. Kliorin, A. I., Matvieev, I. I.: Detection of children with constitutionally determined hyperlipoproteinemia as a risk factor of early development of atherosclerosis. Pediatriya No **11**, 32 (1978).
13. Lutton, C.: The role of the digestive tract in cholesterol metabolism. Digestion **14**, 342 (1976).
14. Medalie, J. H., Kahn, H. A., Neufeld, H. N., Riss, E., Goldbourt, U.: Five year myocardial infarction incidence. II Association of single variables to age and birthplace. J. chron. Dis. **26**, 329 (1973).
15. Morrison, J. A., Larsen, R., Gladfelter, L., Boggs, D., Burton, K., Smith, C., Kelly, K., Mellies, M. J., Khoury, P., Glueck, C. J.: Interrelationships between nutrient intake and plasma lipids and lipoproteins in schoolchildren aged 6—19: the Princeton School District study. Pediatrics **65**, 727 (1980).
16. Onitri, A. C., Boyo, A. E.: Serum lipids and lipoproteins in children with kwashiorkor. Brit. med. J. **3**, 630 (1975).
17. Ouchterlony, O.: Diffusion in gel methods for immunological analysis. Progr. Allergy **6**, 30 (1962).
18. Srinivasan, S. R., Frerichs, R. R., Webber, L. S., Berenson, G. S.: Serum lipoprotein profile in children from a biracial community. Circulation **54**, 309 (1976).
19. Widhalm, K., Strobl, W.: HDL- and LDL-cholesterol in normal weight healthy children 13 years of age. Europ. J. Pediat. **132**, (1979).
20. Williams, P., Robinson, D. Bailey, A.: High-density lipoprotein and coronary risk factors in normal men. Lancet **1**, 72 (1979).
21. Wilson, D. E., Lees, R.S.: Metabolic relationships among the plasma lipoproteins. Reciprocal changes in the concentration of very low density lipoproteins in men. J. clin. Invest. **51**, 1051 (1972).

Doc. Dr. med. Z. Szczepański
ul. Gen. de Gaulle 69/5
41-800 Zabrze, Poland