

NON-ALCOHOLIC FATTY LIVER DISEASE IN CHILDREN WITH TYPE 1 DIABETES MELLITUS IN COMPARISON WITH OBESITY

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ABSTRACT

Recent studies show that non-alcoholic fatty liver disease and dyslipidemia can be more common in type 1 diabetes and obesity in pediatric population than previously thought. Moreover, non-alcoholic fatty liver disease and dyslipidemia seem to be closely associated with cardiovascular and metabolic risks.

Present work aimed to compare the dyslipidemia and non-alcoholic fatty liver disease in children and adolescents less than 18 years of age with type 1 diabetes mellitus with the children with obesity of the same age group.

For that reason 60 type 1 diabetic children were included in the investigation with mean age of 12.5 ± 1.4 , male/female ratio – 36/24, as well as 58 obese children without diabetes with mean age of 13 ± 1.5 , male/female ratio – 33/25. No significant connection has been found between quantitative dyslipidemia and non-alcoholic fatty liver disease in the group of type 1 diabetic patients ($p > 0.05$). In the group of patients with obesity and without diabetes 48.3% found to have non-alcoholic fatty liver disease and steatohepatosis by ultrasonography examination, and 60.7% from those also had dyslipidemia: either hypertriglyceridemia or high LDL. While comparing two groups by this parameter we found significant differences between them concerning non-alcoholic fatty liver disease and dyslipidemia ($p < 0.05$). Interestingly, dyslipidemia in the diabetic group showed no association with non-alcoholic fatty liver disease – 6.7% ($n=4$), unlike the obesity group, where 29.3% ($n=17$) of patients had dyslipidemia associated with non-alcoholic fatty liver disease ($p < 0.05$). Dyslipidemia was found not to be associated with non-alcoholic fatty liver disease in diabetic patients versus obese patients, in whom dyslipidemia is mostly associated with non-alcoholic fatty liver disease. Absolute values of body mass index do not correlate with the development of non-alcoholic fatty liver disease and dyslipidemia in both groups, as well as are not connected with HbA1c in diabetic group.

However, the precise consequences of these qualitative lipid changes and non-alcoholic fatty liver disease on the duration and complications of type 1 diabetes and obesity in children and adolescents, as well as on further cardiovascular complications should be profoundly evaluated.

KEYWORDS: non-alcoholic fatty liver disease, type 1 diabetes mellitus, obesity.

INTRODUCTION

Recently more and more investigations are dedicated to the development and clinical manifestation of non-alcoholic fatty liver disease, which is related not only to liver, but also to cardiovascular complications and mortality [Akin L et al., 2013;

Lu H et al., 2013; Zhang Q, Lu L, 2015]. Nowadays there is growing evidence that dyslipidemia and non-alcoholic fatty liver disease are multisystemic diseases, affecting other systems and regulatory pathways [Alkhoury N et al., 2014]. Furthermore, it is shown, that non-alcoholic fatty liver disease mostly coincides with diabetes mellitus, obesity, other metabolic disorders of liver, and etc. [Paschos P, Paletas K, 2009; Williams K et al., 2013; Llauradó G et al., 2015]. Moreover, diabetes mellitus seemed to be one of main disorders,

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which can worsen the metabolic aspects of non-alcoholic fatty liver disease and risk of later chronic cardiovascular and atherogenic complications [Monsour H et al., 2012; Ballestri S et al., 2014]. Many investigations are made to find out the connections between diabetes mellitus in adults and children [Targher G et al., 2010; Wang C et al., 2012; Bhatt H, Smith R, 2015], and obesity in adults and children, separately [White D et al., 2012]. However, there are only few works trying to compare diabetic [Regnell S, Lernmark A, 2011; Gaggini M et al., 2013] and obesity changes in liver, especially in children and adolescents. Nowadays, there is a growing evidence of increase in prevalence and incidence of obesity in children and adolescents [Raj M, Kumar R, 2010]. Thus, understanding and knowing the relationships between obesity, liver metabolism, dyslipidemias, diabetes and non-alcoholic fatty liver disease, will let the practitioner to examine those patients more profoundly and to evaluate further risks more adequately and carefully [Liu H, Lu H, 2014; Hazlehurst J et al., 2016].

Present work aimed to compare dyslipidemia and non-alcoholic fatty liver disease in children and adolescents less than 18 years of age with type 1 diabetes mellitus with the children with obesity of the same age group.

MATERIAL AND METHODS

Totally 60 type 1 diabetic children were included in the investigation with mean age of 12.5 ± 1.4 , male/female ratio – 36/24, as well as 58 obese children without diabetes with mean age of 13 ± 1.5 , male/female ratio – 33/25. Serum total cholesterol, triglyceride, low-density-lipoprotein, high-density-lipoprotein levels were measured, and ultrasonography examination was performed. In type 1 diabetic children HbA1c was checked to evaluate the glycemic control, and $<7.5\%$ was interpreted as compensated diabetes. In all patients body mass index was measured according to age and sex-related charts, and pubertal stage was evaluated according to Tanner scale, as well as ultrasonography examination of liver was performed [Wang C et al., 2012].

Statistical analysis was performed using Excel 2007 and SPSS 16.0 software packages. In all cases null hypothesis was rejected if $p < 0.05$.

RESULTS AND DISCUSSION

In 25% of children with type 1 diabetes non-alcoholic fatty liver disease or steatohepatosis was found by ultrasonography examination, only 6.6% from which developed hypertriglyceridemia, 20% – increased low-density-lipoprotein levels. No significant connection has been found between quantitative dyslipidemia and non-alcoholic fatty liver disease in the group of type 1 diabetic patients ($p > 0.05$). Interestingly, 30% diabetic patients found to have dyslipidemia, only 4 (22.2%) from which had dyslipidemia with non-alcoholic fatty liver disease. In diabetic group of patients there was no significant connection between dyslipidemia and non-alcoholic fatty liver disease and diabetes decompensation ($HbA1c > 8\%$) – 19.8% and 33.3%, respectively ($p > 0.05$).

In the group of patients with obesity and without diabetes 48.3% found to have non-alcoholic fatty liver disease and steatohepatosis by ultrasonography examination, and 60.7% from those had also dyslipidemia: either hypertriglyceridemia or high LDL (Fig. 1).

While comparing two groups by this parameter we found significant differences between them concerning non-alcoholic fatty liver disease and dyslipidemia ($p < 0.05$). Interestingly, dyslipidemia in the diabetic group showed no association with non-alcoholic fatty liver disease – 6.7% ($n=4$), unlike the obesity group, where 29.3% ($n=17$) of patients had dyslipidemia associated with non-alcoholic fatty liver disease ($p < 0.05$) (Fig. 2).



FIGURE 1. Non-alcoholic fatty liver disease prevalence in the groups of type 1 diabetes mellitus and obesity
Notes: Diabetic group with (red) and without (blue) non-alcoholic fatty liver disease. Obesity group with (purple) and without (green) non-alcoholic fatty liver disease

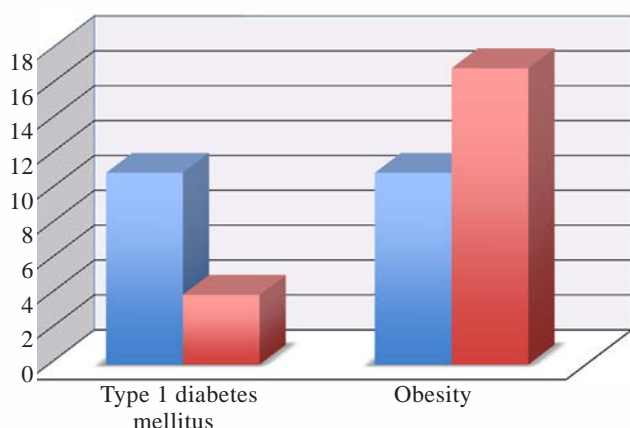


FIGURE 2. Comparison of non-alcoholic fatty liver disease and dyslipidemia in the groups of type 1 diabetes mellitus and obesity

Notes: Non-alcoholic fatty liver disease with (red column) and without (blue column) dyslipidemia

Figure 2 shows that in the obesity group dyslipidemia is mostly associated with non-alcoholic fatty liver disease, but in the diabetes group it shows no association. We assume, that dyslipidemia in the diabetic group is not connected only with the liver adiposity and non-alcoholic fatty liver disease, but mainly with the metabolic disorders that occur in diabetes, particularly in its decompensated duration.

No correlation between absolute values of body mass index and non-alcoholic fatty liver

disease and/or dyslipidemia was found in two study groups ($r < 0.02$).

CONCLUSION

Non-alcoholic fatty liver disease seems to be one of more spread accompanying disorder in diabetic and obese patients. But the mechanisms of its development differ in these two diseases. It is assumed that poor glycemic control probably has impact on the development of dyslipidemia and non-alcoholic fatty liver disease, but is not the only pathway. Some qualitative abnormalities of potentially atherogenic lipoproteins are found in diabetic children, as well as in obese children. Dyslipidemia was found not to be associated with non-alcoholic fatty liver disease in diabetic patients versus obese patients, in whom dyslipidemia is mostly associated with this disease. Absolute values of body mass index do not correlate with the development of non-alcoholic fatty liver disease and dyslipidemia in both groups, as well as are not connected with HbA1c in diabetic group.

However, the precise consequences of these qualitative lipid changes and non-alcoholic fatty liver disease on the duration and complications of type 1 diabetes and obesity in children and adolescents, as well as on further cardiovascular complications should be profoundly evaluated.

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