Celiac Disease Negatively Influences Lipid Profiles in Young Children With Type 1 Diabetes: Effect of the Gluten-Free Diet

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The association between low HDL cholesterol (HDL-C) concentrations and increased cardiovascular risk is well established. Low HDL-C levels were found in subjects with type 1 diabetes (T1D) who presented complications (1) and in untreated subjects with celiac disease (CD). The association between TID and CD might therefore enhance this lipid abnormality and accelerate the atherosclerotic process.

We collected data from 13 centers belonging to the Italian Society of Pediatric Endocrinology and Diabetology (ISPED) of a large number of children with both T1D and concurrent biopsy-proven CD, at the exact time point a gluten-free diet (GFD) was initiated and after 1 year of a GFD, verified by means of CD-related antibodies. A total of 201 children with T1D diagnosed at age of 5.8 ± 3.8 years and CD diagnosed at age of 7.5 ± 4.5 years were enrolled. We included only the cases in which CD diagnosis was made at least 3 months after that of T1D to avoid a potential influence of the metabolic derangement at diabetes onset. As a control group, we used a group of 224 patients with T1D only, matched by age, sex, diabetes duration, and HbA_{1c}.

Before GFD was initiated, HDL-C values were significantly lower in children with CD and T1D than in the control group, and the greatest decrease was found in younger children aged <6 years (Table 1). The subjects with HDL-C values lower than pediatric percentile cut points for sex and age were younger than those with normal values (6.2 ± 4.4 vs. 8.6 ± 4.3 years, $P < 0.0001$) and had lower HbA_{1c} (7.5 ± 0.8 vs. 8.0 ± 1.5%, $P < 0.005$).

After GFD, the mean values of HDL-C in the total study population significantly increased (60.9 ± 13.7 vs. 51.3 ± 13.6 mg/dL, $P < 0.0001$) and normalized. In children <6 years of age, the increase in HDL-C values was greater than in older children (28 vs. 13%) The percentage of subjects with HDL-C values lower than pediatric percentile cut points fell significantly ($P < 0.0001$) from 42 to 16%. Subjects with complete adherence to GFD showed the most significant improvement of HDL-C, and subjects with partial adherence showed a lower, but significant, improvement of HDL-C.

Our results confirm other data reported in the past few years (2–4) but showed a more evident reduction in HDL-C at diagnosis and a greater restore after GFD. This reduction of HDL-C has been interpreted as a proxy marker for intestinal inflammation or as a consequence of altered intestinal secretion of apolipoprotein AI (5), the major HDL structural protein. This occurs most considerably in the youngest children who probably have a more severe

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Table 1—HDL-C levels (mg/dL) in children with T1D alone and with T1D and CD before and after starting a GFD

	Patients with T1D and CD ($n = 201$)			
	Before GFD	*P*	After GFD	Patients with T1D only ($n = 224$)
All cases ($n = 201$)	51.3 ± 13.6*	<0.0001	60.9 ± 13.7	65.1 ± 30.8
Age <6 years ($n = 90$)	46.5 ± 13.6*†	<0.0001	59.2 ± 12.8	
Age >6 years ($n = 111$)	55.2 ± 12.3‡	<0.0001	62.4 ± 14.3	
Adherence to GFD diet				
Poor ($n = 33$)	51.8 ± 14.1§	NS	56.6 ± 13.5	
Partial ($n = 39$)	54.9 ± 12.0§	<0.05	64.2 ± 14.1	
Complete ($n = 129$)	50.1 ± 13.8*	<0.0001	61.1 ± 13.4	

Data are mean ± SD, unless stated otherwise. NS, not significant. *$P < 0.0001$, ‡$P < 0.001$, §$P < 0.05$ vs. control subjects. †$P < 0.0001$ vs. aged >6 years.

disease, as suggested by the presence of signs of malabsorption, e.g., lower HDL-C and HbA_{1c} levels.

An unfavorable lipid profile, i.e., low HDL-C values, characterizes children with T1D and untreated CD, especially the youngest. GFD is able to normalize HDL-C levels and the more marked beneficial effect of gluten withdrawal can be found in individuals who adhere to the GFD and in the youngest individuals. Therefore, a strict GFD is mandatory in these children, as they may be at increased risk of cardiovascular disease.

Duality of Interest. No potential conflicts of interest relevant to this article were reported.
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