

Algorithm-based cholesterol monitoring in diabetic children related to non-diabetic peers

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Introduction

Lipoproteins of juvenile patients with type 1 diabetes depend on age, sex, BMI and diabetes control (1). To improve the low frequency of lipid lowering treatment (2), a diagnostic algorithm of LDL-, non-HDL- and HDL-C has been established for diabetic adolescents and healthy peers (3).

Methods

Databases of diabetic adolescents (DPV, n=26,147) and healthy peers (KiGGS, n=14,057) were calculated according the influencing factors age (<10 vs. >10 years of age), sex, BMI (< 90th vs. >90th perc.) and 4 categories of HbA1c-levels.

Table I. Characteristics of children with type 1 diabetes and non-diabetic peers

Characteristic	Patients	Peers	P
Age, years	13.7 ± 3.9	10.6 ± 4.7	<.0001 [‡]
Age range, years	1.0-17.9	1.0-17.9	NS
Male sex, %	53	51	.0049 [§]
BMI, kg/m ²	21.3 ± 4.1	18.8 ± 4.0	<.0001 [‡]
BMI SDS	0.301 ± 0.861	-0.002 ± 1.000	<.0001 [‡]
HbA1c, %*	8.3 ± 1.7	4.9 ± 0.4	<.0001 [‡]
Non-HDL-C, mg/dl†	117 ± 36 (n=25 260)	107 ± 27 (n=14 055)	.0001 [‡]
HDL-C, mg/dl†	60 ± 16 (n=25 425)	56 ± 13 (n=14 55)	.0001 [‡]

Data are means ± SD unless otherwise indicated. *Standardized according to the Diabetes Control and

Table 2

Distribution of LDL cholesterol (mg/dL)* by age, sex, BMI, and HbA1c in pediatric type 1 diabetes (T1D, n=26,147) compared to non-diabetic peers (Peers, n=14,057)

Age (years)	1 - 10								>10 - <18							
	<90 th percentile				≥90 th percentile				<90 th percentile				≥90 th percentile			
	≤6	<7.5	<9	≥9	≤6	<7.5	<9	≥9	≤6	<7.5	<9	≥9	≤6	<7.5	<9	≥9
Females#	‡	†	NS	‡	NS	NS	NS	NS	NS	‡	†	NS	NS	‡	†	NS
50 th percentile T1D	90	91	94	101	89	94	96	97	88	91	95	107	89	98	106	111
75 th percentile T1D	103	107	112	125	104	111	119	111	104	109	113	130	116	118	125	135
90 th percentile T1D	113	122	131	151	120	129	139	130	120	127	133	155	133	139	143	159
97 th percentile T1D	135	135	159	174	125	146	151	153	140	147	154	175	153	161	161	177
50 th percentile Peers	97				97				91				100			
75 th percentile Peers	113				116				108				118			
90 th percentile Peers	129				135				127				136			
97 th percentile Peers	147				152				146				153			
Males#	‡	†	§	NS	NS	NS	NS	NS	‡	†	†	†	NS	‡	NS	§
50 th percentile T1D	81	87	89	93	98	90	88	89	76	82	87	95	86	93	99	107
75 th percentile T1D	93	103	105	114	113	106	108	107	92	99	105	116	96	109	118	131
90 th percentile T1D	110	119	121	139	119	128	120	117	110	115	122	137	112	130	139	150
97 th percentile T1D	131	143	139	170	128	133	139	148	126	132	143	160	131	147	152	168
50 th percentile Peers	92				96				85				97			
75 th percentile Peers	108				113				101				116			
90 th percentile Peers	123				134				118				134			
97 th percentile Peers	140				147				134				151			

*To convert values to mmol/L, multiply by a factor of 0.0259. #Dunnnett's test for multiple comparisons between T1D and Peers: ‡, <.05; §, <.01; †, <.001; NS, not significant.

Conclusions:

- The algorithm facilitates the decision to treat the patient or not.
- Overweight or obese girls over 10 years of age with a poor diabetes control should be especially considered for therapy, because of the most atherogenic lipid profile.
- Young normal-weight boys with a good diabetes control have a less atherogenic lipid profile compared to healthy controls

Results:

Considering a patient's sex, age-group, weight-, and HbA1c-categories, the flowcharts of the algorithm, developed separately for LDL-, and non-HDL-cholesterol, allow to compare his/her cholesterol levels with population-based reference percentile values of children and adolescents with type 1 diabetes and non-diabetic peers, see table 2 and table 3. HDL-C values of diabetic children and adolescents were generally higher than their age-matched peers (results not shown).

Table 3

Table 3 - Distribution of non-HDL cholesterol (mg/dL)* by age, sex, BMI, and HbA1c in pediatric type 1 diabetes (T1D, n=26,147) compared to non-diabetic peers (Peers, n=14,057)

Age (years)	1 - 10								>10 - <18							
	<90 th percentile				≥90 th percentile				<90 th percentile				≥90 th percentile			
	≤6	<7.5	<9	≥9	≤6	<7.5	<9	≥9	≤6	<7.5	<9	≥9	≤6	<7.5	<9	≥9
Females#	NS	NS	§	†	NS	NS	NS	NS	NS	†	†	†	NS	NS	NS	†
50 th percentile T1D	103	109	113	127	102	115	116	120	107	109	115	136	105	118	132	140
75 th percentile T1D	118	127	133	151	113	131	138	138	128	129	137	164	141	142	151	170
90 th percentile T1D	127	143	153	175	130	145	164	158	146	147	159	196	164	166	175	198
97 th percentile T1D	148	159	177	212	138	165	185	201	166	171	183	226	179	185	197	230
50 th percentile Peers	109				114				104				118			
75 th percentile Peers	127				134				123				140			
90 th percentile Peers	144				153				141				164			
97 th percentile Peers	164				177				161				179			
Males#	NS	NS	NS	†	NS	NS	NS	NS	‡	NS	†	†	NS	NS	NS	†
50 th percentile T1D	100	104	105	115	112	108	107	113	95	100	107	120	101	112	123	136
75 th percentile T1D	116	120	124	137	130	122	126	124	112	117	127	147	113	135	143	162
90 th percentile T1D	132	138	142	162	143	141	142	154	126	135	148	175	130	155	166	189
97 th percentile T1D	160	163	163	194	162	156	165	171	148	156	174	209	162	178	188	224
50 th percentile Peers	104				110				98				121			
75 th percentile Peers	121				129				117				140			
90 th percentile Peers	138				148				134				162			
97 th percentile Peers	156				174				153				183			

*To convert values to mmol/L, multiply by a factor of 0.0259. #Dunnnett's test for multiple comparisons between T1D and Peers: ‡, <.05; §, <.01; †, <.001; NS, not significant.

References:

1. Schwab KO et al. (2006): Spectrum and prevalence of atherogenic risk factors in 27,358 children, adolescents and young adults with type 1 diabetes – Cross-sectional data from the German diabetes documentation and quality management system (DPV). *Diabetes Care* 29: 218-225
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