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Resting metabolic rate and development of metabolic disorders in obese children

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Background:

Decreased resting metabolic rate (RMR) is a risk factor for the development and progression of obesity. Childhood obesity is accompanied by the development of metabolic disorders, which often persist in adults. The relationship between the rate of basal metabolism and development of childhood obesity complications is not well understood.

Objective:

Measure resting metabolic rate in obese children and assess the pronouncement of metabolic disorders, depending on the rate of energy metabolism.

Subjects and Methods:

A total of 150 children with simple obesity (SDS BMI +3.35 [2.98, 3.65]) aged from 10 to 17 years (14.5 [12.5, 15.9] years) were studied. Obesity is diagnosed according to WHO criteria. RMR was measured using indirect respiratory calorimetry. The decrease RMR was determined at a difference > -10% between measured level and predicted value calculated by the Molnar formula. All children were evaluated fats, ALT and AST levels, glucose tolerance test with calculation of ISI Matsuda. % of body fat was estimated by bioelectrical impedance analysis.

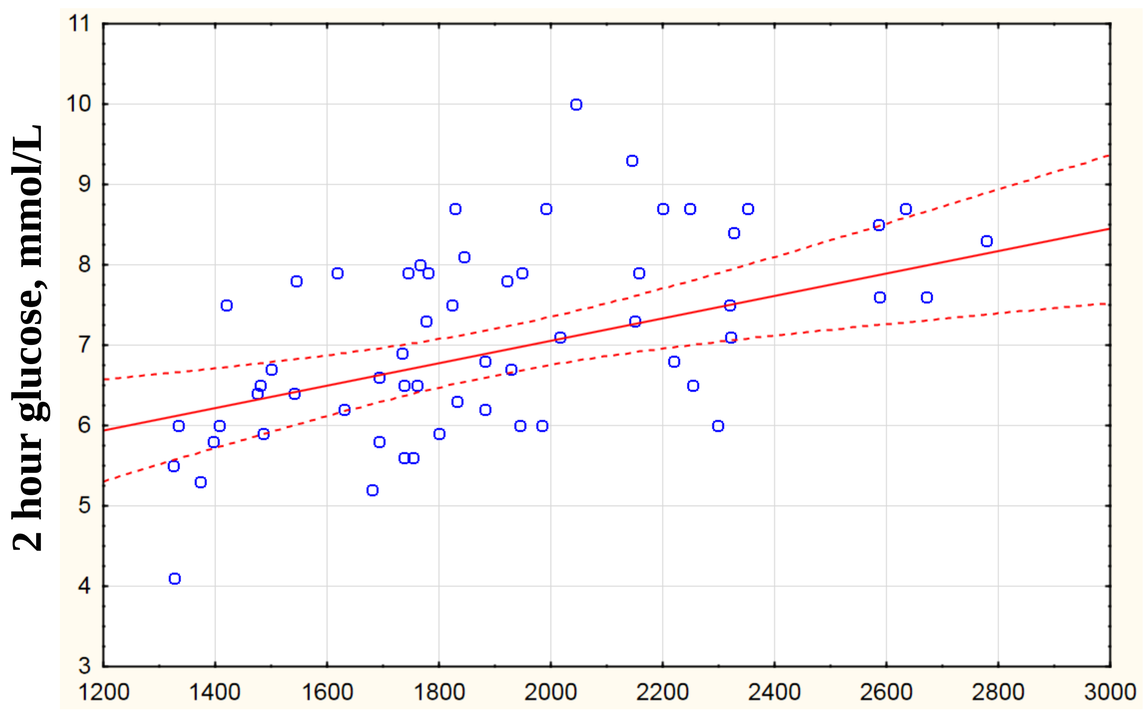
Results:

Children with lowered RMR have a greater degree of obesity compared to peers with normal RMR (SDS BMI 3.6 [3.2; 3.8] vs 3.3 [2.9; 3.5], p = 0.01) and a higher % of body fat (46.3 [41.1; 51.3] vs 43.2 [38.7; 47.2], p = 0.03). In the group of children with reduced energy metabolism, higher 2 hour glucose level after glucose loading (7.1 [6.8; 8.5] vs 6.1 [5.6; 7.4] mmol/l, p = 0.001), lower HDL cholesterol level (0.89 [0.8; 1.05] vs 1.02 [0.92; 1.18] mmol/l, p = 0.03) and decreased ISI Matsuda (1.54 [1.19; 2.64] vs 2.4 [1.99; 3.2], p = 0.02) were identified. Correlation analysis revealed a positive relationship between RMR and 2 hours glycaemic level after glucose loading (r = 0.43, p <0.05) in children with low RMR.

Table 1. Clinical and metabolic parameters in children with obesity in depending on RMR

Characteristics	Low RMR (n=52)	Normal RMR (n=98)	P
Age, y	14,2 [12,8; 15,6]	14,7 [13,1;16,1]	ns
Males/females	25/27	48/50	ns
BMI Z-score	3,6 [3,2; 3,8]	3,3 [2,9; 3,5]	p=0,01
Body fat %	46,3 [41,1; 51,3]	43,2 [38,7; 47,2]	p=0,03
Fasting glucose, mmol/l	4,9 [4,3; 5,2]	5,1 [4,5; 5,4]	ns
2 hour glucose after glucose loading, mmol/l	7,1 [6,8; 8,5]	6,1 [5,6; 7,4]	p=0,001
HDL, mmol/l	0,89 [0,8; 1,05]	1,02 [0,92; 1,18]	p=0,001
LDL, mmol/l	2,9 [2,7; 3,3]	2,8 [2,6; 3,3]	ns
ISI Matsuda	1,54 [1,19; 2,64]	2,4 [1,99; 3,2]	p=0,02
ALT, Un/l	21 [17; 26]	24 [15; 29]	ns
AST, Un/l	14 [10; 18]	12 [9; 20]	ns

Pic. 1. Relationship resting metabolic rate with 2 hour glucose after glucose loading in children with obesity and low RMR



Conclusion:

Decrease in resting metabolic rate is associated with more severe obesity and an unfavorable metabolic profile in children.