CARDIORESPIRATORY FITNESS EFFECTIVENESS IS RELATED TO ABDOMINAL ADIPOSITY AND INSULIN SENSITIVITY IN OVERWEIGHT ADOLESCENTS

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OBJECTIVES

The main pitfall of weight management programs is effective and safe fitness regimen choice. According to HELENA Study (2013) physical activity readiness is negatively correlated with markers of insulin resistance (IR) and central adiposity in adolescent population. Meanwhile, very little is known about cardiorespiratory fitness effectiveness in relation to hepatic, peripheral and whole body insulin sensitivity (IS).

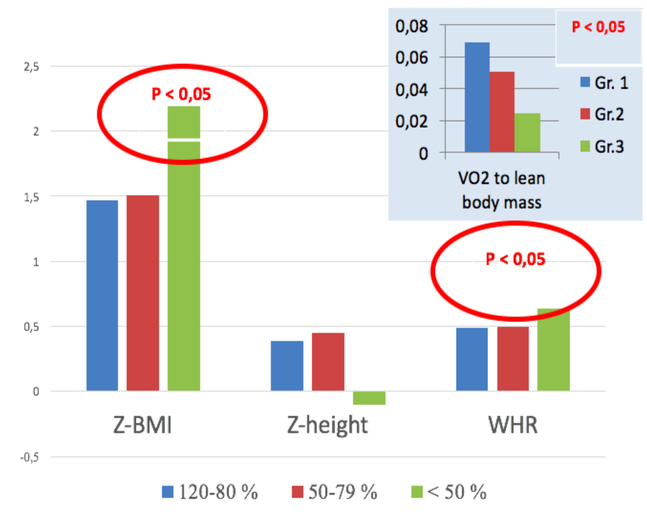
METHODS

64 adolescents aged 13,56 + 2,47 y.o. with different BMI were examined. Waist-to-height-ratio (WHR) used to know the degree of abdominal adiposity. Laboratory assessment of metabolic profile included fasting glucose (mmol/l) and insulin (μIU/ml) followed by standard multistage cycling procedure (Bruce protocol) with subsequent glucose and insulin measurement. Fasting insulin sensitivity assessed by HOMA-IR, peripheral IS – by ISI0,120, whole body IS - by Matsuda index.

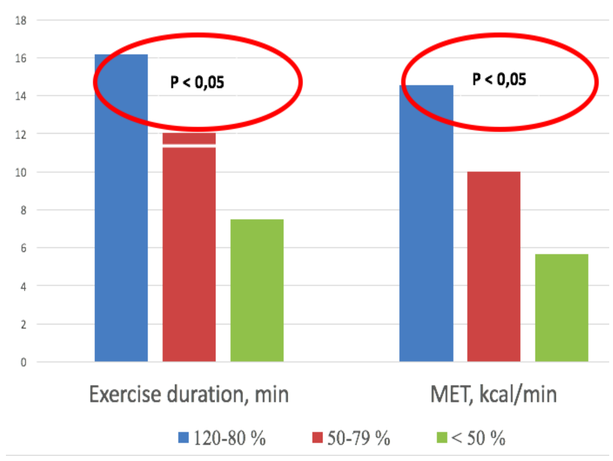
Cardiorespiratory fitness effectiveness determined by the % of Predicted VO2 max, which used for grouping: Gr.1 - 120-80%, Gr.2 - 50-80%, Gr.3 - less than 50%.

Standard statistical methods were used for the data analysis by SPSS soft. Quantitative variables were described as means + SD. Differences between groups were established by ANOVA. Reported P-values are two-tailed and P-values <0.05 were considered to be statistically significant.

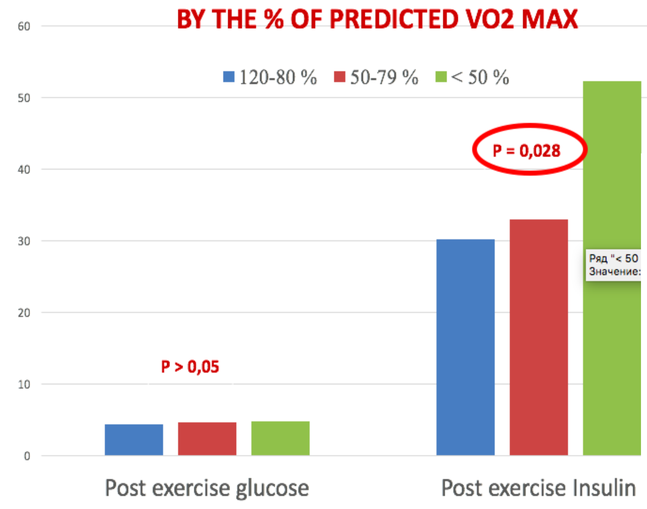
ANTHROPOMETRY DEPENDING ON THE % OF PREDICTED VO2 MAX



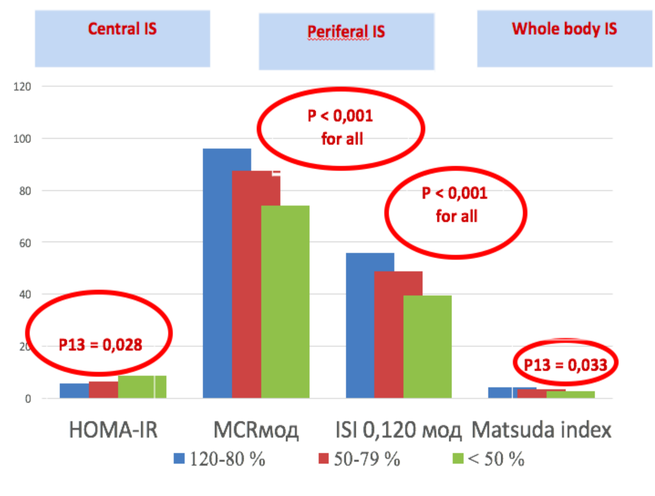
EXERCISE TOLERANCE DEPENDING ON THE % OF PREDICTED VO2 MAX



POST EXERCISE GLUCOSE AND ISULIN BY THE % OF PREDICTED VO2 MAX



INSULIN SENSITIVITY (IS) BY THE % OF PREDICTED VO2 MAX



RESULTS

O2 consumption normalized to the lean body mass reflects progressive reduction of the actual parameter (Gr.1 – 0.069+0,03; Gr.2 - 0.051+0.033; Gr.3 - 0,025+0.049; P12=0.04; P23=0.14; P13=0.002). Energy cost of physical activity (by MET) is greater in effective VO2 uptake (Gr.1 – 14.59+3.05; Gr.2 - 9.99+3.038; Gr.3 – 5.66+2.46 kcal/min; P12, 23, 13 <0.01).

There was gradual decrease of Predicted VO2 max with growing WHR (Gr.1 – 0.49+0,149; Gr.2 - 0.502+0.147; Gr.3 - 0,640+0.208; P12=0.825; P23=0.039; P13=0.019), but BMI and height of patients were not different in groups.

There was no significant difference in blood glucose concentration after the exercise boost. Meanwhile insulin level twice as little in subjects, who successfully achieved predicted VO2 (Gr.1 – 30.139+19.676; Gr.2 - 32.910+24.212; Gr.3 – 52.260+41.653 μIU/ml; P12=0.651; P23=0.107; P13=0.028).

Group with lowest O2 consumption was characterized by higher insulin resistance for fasting (HOMA-IR = 5.62+3.11 vs. 8.93+5.03, P13<0.02), lower total body insulin sensitivity (Matsuda index = 4.39+1.75 vs. 3.00+1.65, P13=0.03) and deficient glucose metabolic clearance with the relevant peripheral insulin sensitivity (ISI 0,120 = Gr.1 – 55.97+12.91; Gr.2 - 48.81+9.64; Gr.3 – 39.39+7.16; P12, 23, 13<0.01).

CONCLUSIONS

1. Exercise effectiveness in overweight adolescents is related to the abdominal adiposity and highly dependent on peripheral insulin sensitivity.
2. Higher insulin concentration after the exercise boost associated with impaired energy expenditures better than glucose level on its own