INSULIN ACTION IN ELITE ENDURANCE AND SPRINT ATHLETES

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Physical training improves the insulin action and enhances the glucose uptake from tissues at rest. The aim of the present study was to investigate the effect of chronic aerobic and anaerobic training on the dynamic response of the glucose homeostatic system. After administering orally a certain amount of glucose.

Eight Endurance Athletes (EA) (age: 24±3.2 yr, BF: 8±3.6 %, FFM: 52.9±3.1 kg, VO_{2peak}: 72.6±4.9 mL/kg/m, PP (Wingate test): 11.4±0.62 W/kg), eight Sprint Athletes (SA) (age: 23.8±1.7 yr, BF: 7.8±1.4 %, FFM: 68.7±5.4 kg, VO_{2peak}: 51±2.8 mL/kg/m, PP: 13.54±0.64 W/kg) and seven Untrained control Subjects (US) (age: 23±1 yr, BF: 20.9±7.3 %, FFM: 55.4±5.6 kg, VO_{2peak}: 44.8±6.7 mL/kg/m, PP: 11.82±1.21 W/kg) participated in the study. After following a 4-day standardized diet, an overnight fast and refraining for at least 48h from any form of strenuous activity, all subjects performed an oral glucose tolerance test by consuming 75g of glucose ($OGTT_{\text{-}75g}$). Venous blood was obtained for measurement of glucose and insulin concentrations just before and 30, 60, 90, and 120 min after glucose ingestion (Cederholm, & Wibell, 1985). One-way ANOVA, Pearson correlation and multiple regression were used for statistical analysis.

All subjects presented similar, adequate and normal glucose homeostatic response after $OGTT_{\text{-}75g}$, expressed as the total area under the glucose curve (AUCG). However, the insulin release, expressed as the total area under the insulin curve (AUCI), was higher in US than in athletes ($p<0.05$), whereas no differences were observed between the two groups of athletes (Fig. 1). Relative peripheral resistance against glucose uptake promoting factors (rel-Rbw), mainly associated with insulin action in the present study, was lower in EA compared with SA ($p=0.002$) (Fig. 2). Furthermore, BF was proven the most important factor of total insulin resistance ($R^2=0.48$, $p<0.001$).

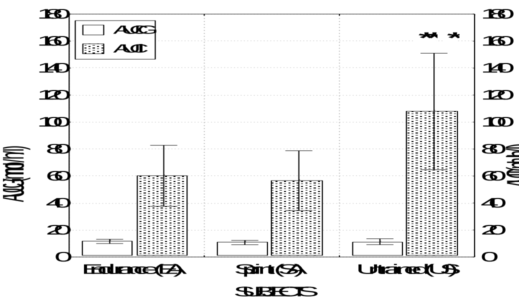

Figure 1. Areas under glucose curves (AUCG) and insulin curves (AUCI). **US vs SA (p<0.01), *US vs EA (p<0.05).

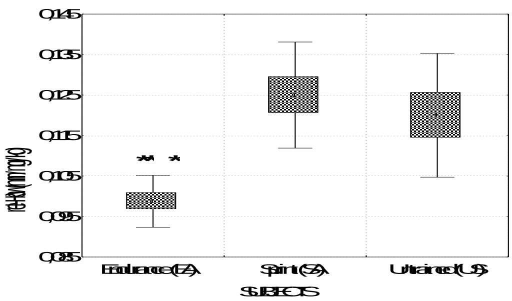

Figure 2. Relative peripheral resistance (rel-Rbw). **EA vs SA (p<0.01), *EA vs US (p<0.01).

In accordance with the results: a) Insulin action was higher in EA compared with SA, which could be attributed to differences in the ability of glucose transporters (GLUT4), the capacity of oxidative enzyme activities and the insulin ability to suppress the hepatic glucose production. b) Since SA demanded significantly lower insulin secretion, compared with US, it can be inferred that insulin action was probably higher in SA, despite the fact that the rel-Rbw was not statistically different between the two groups. Further to the effect of BF, this could be related also to the higher nonoxidative glucose metabolism of SA (Miller et. al., 1994). We conclude that chronic adaptations of both aerobic and anaerobic training have a positive effect to insulin sensitivity, but those induced by the aerobic type of training have a more pronounced effect.

REFERENCES

Cederholm & Wibell (1985). *Scand J Clin Invest* 45:741-751

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