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POSTER PRESENTATION – P19

SUBMAXIMAL OXYGEN DEFICIT DURING INCREMENTAL TREADMILL EXERCISE IN ELITE YOUTH FEMALE HANDBALL PLAYERS

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Background: Laboratory-based assessment of cardiorespiratory function is a widely applied method in sports science. Most performance evaluations focus on oxygen uptake parameters. Despite the well-established concept of oxygen deficit introduced by Hill in the 1920s, relatively few studies have examined its behaviour during submaximal exercise, with limited exploration of deficit dynamics.

Objective: To analyse oxygen deficit during graded exercise in young female handball players and examine its relationship with morphological and physiological characteristics.

Subjects and methods: Forty-two female handball players (15.4±1.3 years) performed a quasi-ramp treadmill spiroergometry test. Oxygen deficit was estimated using the American College of Sports Medicine (ACSM) algorithm, restricted to exercise segments below the anaerobic threshold. Body composition was assessed by Dual Energy X-ray Absorptiometry (DEXA). Cluster and principal component analyses were applied to identify athlete profiles.

Results: Cluster and principal component analyses revealed two distinct athlete profiles with statistically significant differences in both morphological and physiological traits. Cluster 2 showed significantly higher relative VO_2 peak (51.43±3.70 vs. 45.70±2.87 $mL \cdot kg^{-1} \cdot min^{-1}$; $p<0.001$; Cohen's $d=1.76$), yet also exhibited a greater oxygen deficit per kilogram (39.03±16.71 vs. 32.56±14.33 $mL \cdot kg^{-1}$; $p=0.018$; $d=0.80$). Cluster 1 had higher absolute body mass (69.67±8.13 vs. 59.66±6.81 kg; $p<0.001$), skeletal muscle mass ($p<0.001$), and fat mass ($p<0.001$), indicating that body composition strongly influenced oxygen deficit values. The observed differences in oxygen deficit profiles suggest a strong influence of genetic predispositions, particularly in cardiovascular and muscular oxygen utilization capacity. Age also emerged as a critical factor in determining the potential for adaptation.

Conclusions: Oxygen deficit during submaximal exercise appears to be a multifactorial phenomenon shaped by structural and physiological traits. While certain influencing factors can be modified through training, others especially those of genetic origin pose inherent limitations. Early development of cardiorespiratory capacity may offer the most effective strategy for long-term optimization.

Keywords: Handball; Oxygen deficit; Spiroergometry; Body composition.