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Relationship between maximum fat oxidation during a graded cycling test and subcutaneous adipose tissue measured using ultrasound in elite triathletes

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INTRODUCTION:
In endurance sports, such as triathlon, body mass and fat are of great importance. On the one hand, carrying low body mass and fat as well might be an advantage, on the other hand providing sufficient energy for high amount of training hours and multiple competitions is essential. Consequences of insufficient energy availability may have adverse effects on performance and long-term health of athletes. Therefore, an accurate (1) and reliable (2) measurement method for measuring subcutaneous adipose tissue (SAT) may provide relevant data to enhance athletes` performance. The aim of this study is to analyse a potential relation between SAT and parameters of fat oxidation in elite triathletes.
METHODS:
A sample of 12 male national team triathletes (age 22.3±2.9y, body height 1.85±0.06m, body mass 73.7±4.9kg, BMI 21.7±1.1kgm-2, VO2peak 4922.1±313mL) performed a graded exercise test with measurement of respiratory gases. The last 90 s of oxygen uptake and carbon dioxide production for each stage were averaged and fat oxidation was calculated using stoichiometric equations (3). Using this data, maximal fat oxidation (MFO) and FATmax (expressed as % of VO2peak) was calculated for each participant. SAT thickness was measured at eight defined body sites using ultrasound according to a published protocol (1). SAT thickness sums of all sites (in terms of DI; I fibrous structures incl.) were used: upper-and lower abdomen, front-and lateral thigh, medial calf, erector spinae, distal triceps, and brachioradialis. Further, SAT thickness sums of the lower limbs (DI,LL; front-and lateral thigh, and medial calf) were used. Ultrasound images were calculated using a semi-automatic image evaluation software (NISOS-BCA Fat Analysis Tool, v.4.2, nisos.at). To assess strength of the relation between parameters Pearson moment correlations have been used (GraphPad Prism version 9.0.0).
RESULTS:
Results showed non-significant correlations between DI (14.83±7.67 mm) and MFO (0.57±0.13 g/min; r=-0.347, p=0.269) and for DI and FATmax (2.4±0.2 W/kg; r= 0.08, p=0.808). Moreover, non-significant correlations were found between DI,LL (6.34±3.80 mm) and MFO (r=-0.484, p=0.111) and FATmax, (r=0.553, p=0.062). Five of 12 males had ‘extremely low’ and four had ‘very low’ DI values according to a preliminary assessment schedule (4).
CONCLUSION:
The main findings indicate that thickness of adipose tissue does not predict the athlete’s capability to maximise fat oxidation. Also, SAT of lower limbs, which might be more specific in the type of physical load, did not show a relationship to parameters related to fat oxidation during exercise. A transfer of SAT values on interpretation of training zones and training recommendations in concern of fat oxidation might not be justified. However, the influence of SAT values on performance in competition should be observed and SAT changes should be noted for each athlete individually.
(1) Müller et al., 2016 (2) Störchle et al., 2017 (3) Brouwer, 1957 (4) Ackland & Müller, 2022

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