

Anaerobic Performance in Obese Populations: Underestimation of Power Profiles

Asian Journal of Sports Medicine, Volume 4 (Number 1), March 2013, Pages: 82-83

82

We read with interest the article recently published in the September issue of the Asian Journal of Sports Medicine by Loenneke et al^[1]. We were particularly interested in the section that stated; ‘The BIA device investigated in this study did not provide a valid estimate of fat free mass index (FFMI) in male and female collegiate athletes. Although there was a general tendency for the bioelectrical impedance analysis (BIA) to underestimate FFMI compared to DEXA, 98% of the estimates were within plus or minus 2 kg/m². Therefore, while slightly biased, BIA may provide a reasonable (± 2 kg/ m²) estimate of nutritional status for practitioners who are unable able to afford more expensive equipment’.

In relation to the use of fat-free mass (FFM) as a correction factor in the study highlighted above, we would like to comment on the measurement of anaerobic ability in overweight and obese subjects using resistive forces derived from fat free mass (FFM) and total body mass (TBM). High intensity cycle ergometry has been widely employed to assess indices of muscle performance during maximal exercise. Traditionally, the resistive force established for such a test is determined from TBM multiplied by a ratio standard; e.g. 75g.kg⁻¹ x TBM.

McInnis and Balady^[2] observed that individuals who weigh the same have very different body compositions that include variations in lean body mass and fat content. Van mil et al^[3] recommended that optimal performance during high intensity cycle ergometry is highly related to an individual’s FFM, or to the mass of the muscles that contribute to the test. Inbar et al^[4] have suggested that fat-free mass or active muscle mass may provide a more realistic assessment of anaerobic ability during high intensity exercise performance.

These statements agree with the earlier suggestions of Wilkie^[5] who stated that resistive forces used during

cycle ergometry should be matched as closely as possible to active muscle output.

Body mass and not composition is the most commonly used index to determine resistive force selection during high intensity cycle ergometer exercise, and because power is the product of both resistive force and velocity, over or underestimations in power performance and assessment may occur. This may be particularly pronounced in overweight populations. Authors^[6] investigated the anaerobic potential of an overweight and obese population using two resistive force selection procedures namely, TBM and FFM. The TBM resistive force protocol was inclusive of the fat component of body composition, whereas the FFM protocol was not.

The study examined maximal exercise performance during friction braked cycle ergometry of 10 s duration. Subjects were assigned in a random order to either the TBM or FFM experimental condition. Eleven apparently healthy male university students (age 22.3 \pm 2 yrs, body fat 27.1 \pm 2 %; determined hydrostatically) participated in the study (see tables 1 and 2). Large significant differences ($P < 0.01$) in peak power output (PPO) were found between the TBM and FFM experimental protocols (1029 \pm 98 W TBM vs. 1397 \pm 146 W FFM). The findings of the study indicated that greater peak power outputs were obtainable when resistive forces reflected FFM as opposed to TBM. These results have serious implications and relate to

Table 1: Subject Means (SD) for age and anthropometric characteristics (n=11)

Variable	Means (SD)
Age (yrs)	22.3 (2)
Stature (cms)	188.5 (7)
Total Body Mass (kg)	100 (5)
% Fat	27.1 (2)
Fat Free Mass (kg)	73.2 (5)

SD: Standard Deviations

Table 2: Means (SD*) for cycle ergometer test results (n=11)

Variable	Total Body Mass Means (SD*)	Fat Free Mass Means (SD)	P. value
Peak power output (W)	1029 (98)	1397 (146)	<0.01
Time to peak power output (s)	4 (1.4)	2 (1)	<0.01
Resistive force (kg)	7.5 (0.4)	5.5 (0.4)	<0.01
Pedal revolutions (rpm)	98 (8)	139 (6)	<0.01
Heart Rate (bpm) pre	68 (10)	66 (11)	>0.05
Heart Rate (bpm) post	167 (8)	165 (8)	>0.05

* SD: Standard Deviations

effective exercise prescription, diagnostic capacity, clinical examination and associated biochemistries in overweight and obese individuals. The findings also suggest that resistive force selection methods need to be reassessed, in obese and non-obese populations, when anaerobic ability is the diagnostic measure under investigation.

Key Words: Obesity; Performance; BMI; Body Composition

Julien S. Baker*, PhD; Bruce Davies, PhD; Duncan Buchan, PhD; Lon Kilgore, PhD

Institute for Clinical Exercise and Health Science, Exercise Science Research Laboratory, School of Science, Faculty of Science and Technology, University of the West of Scotland, Scotland

* **Corresponding Author;**

Address: University of the West of Scotland, Hamilton, Lanarkshire, ML3 0JB, Scotland

E-mail: jsbaker@uws.ac.uk

REFERENCES

- [1] Loenneke JP, Wilson JM, Wray ME, et al. The estimation of the fat free mass index in athletes. *Asian J Sports Med* 2012;3: 200-3.
- [2] McInnis KJ, Balady GJ. Effects of body composition on oxygen uptake during treadmill exercise: Body builder's verses weight matched men. *Res Q Exerc Sport* 1999;70:150-6.
- [3] Van mil E, Schoeber N, Calvert R, Bar Or O. Optimization of force in the Wingate Test for children with a neuromuscular disease. *Med Sci Sports Exerc* 1996;28:1087-92.
- [4] Inbar O, Bar Or O, Skinner S. The Wingate Anaerobic Test. Leeds: Human Kinetics. 1996; Pp:20-21.
- [5] Wilkie DR. Man as a source of mechanical power. *Ergonomics* 1960;3:1-8.
- [6] Baker JS, and Davies B. Brief high-intensity exercise and resistive force selection in overweight and obese subjects: body mass or body composition? *Res Sports Med* 2006;14:97-106.

Authors' Reply;

Estimate of Body Composition Not Anaerobic Performance

Asian Journal of Sports Medicine, Volume 4 (Number 1), March 2013, Pages: 83-84

We appreciate the authors' interest in our published article [1], but we do not necessarily see the significance of our work as it relates to theirs [2]. The authors state that they were particularly interested in our conclusions that stated;

'The BIA (bioelectrical impedance analysis) device investigated in this study did not provide a valid estimate of fat free mass index (FFMI) in male and female collegiate athletes. Although there was a general tendency for the BIA to underestimate FFMI