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Letter to editor

Validation of the Oxycon Mobile metabolic system in healthy subjects

Dear Editor-in-chief,

Oxygen uptake (VO_2) and carbon dioxide production (VCO_2) are commonly measured under laboratory conditions by using automated metabolic gas analysis systems (Macfarlane, 2001). Nowadays, gas exchange measurements take place more often under functional conditions e.g. in sports medicine (Smekal et al., 2003); and in assessing physiologic limitations during the performance of activities of daily life or during different exercise training modalities in patients with chronic organ failure (Sillen et al., 2008; 2011; Spruit et al., 2011; Vaes et al., 2011a; 2011b). So, there is a great need to accurately measure metabolic requirements under different 'dynamic' non-laboratory conditions. The objective of this study was to compare the Oxycon Pro with two Oxycon Mobile devices on gas exchange responses in healthy subjects during constant work rate cycle ergometry. Furthermore we aimed to investigate the agreement between two oxycon mobile metabolic systems.

Twenty-two healthy adults (11 women; age: 33.2±11.2 years; body mass index: 23.4 ± 2.9 $kg \cdot m^{-2}$) consented to perform three cycle exercise tests on the same electromagnetically braked bicycle ergometer (Ergoline Ergoselect 200 P, Carefusion Netherlands, Houten, The Netherlands) with different ergospirometers, which were randomly assigned. Each test consisted of three minutes rest followed by 5 minutes of cycling at 100 Watts (60 revolutions per minute). One Oxycon Pro and two Oxycon Mobiles (second generation; all Carefusion Netherlands, Houten, The Netherlands) were used to assess breath-by-breath VO_2, VCO_2, and minute ventilation (VE). Prior to each test the devices were calibrated automatically. The facemask was connected to the skin of the subject and it was verified that there was no leakage of air. All measurements were carried out at room temperature between 20 and 22°C, in an air conditioned laboratory.

Data are presented as mean ± SEM, coefficients of variation and intraclass correlations were calculated. Exercise values were averaged per 30 seconds for all subjects. Agreement between the three devices was graphically displayed with Bland-Altman plots. SPSS 17.0 was used for analyses.

All participants completed the exercise protocol. VO_2 averaged between 1439 and 1448 $mL \cdot min^{-1}$ during exercise; VCO_2 between 1346 and 1375 $mL \cdot min^{-1}$; and VE between 35.7 to 36.2 $L \cdot min^{-1}$. Differences between the three metabolic devices were non-significant. Coefficients of variation between the three devices were low (Table 1). Bland and Altman plots for VO_2, VCO_2, and VE showed good agreement between the 3 metabolic devices (Figure 1). Indeed, intraclass correlations ranged between 0.798 and 0.925 ($p < 0.01$).

This is the first study in which the Oxycon Mobile metabolic system has been evaluated against the Oxycon Pro. The Oxycon Mobile metabolic system is reliable for determination of VO_2, VCO_2 and VE during a constant work rate test at 100 Watts in healthy subjects. A good consistency and a good reliability of measurements were found amongst the three metabolic devices. This is in line with the findings of Rosdahl et al. (2010) who validated the Oxycon Mobile against the Douglas Bag method. Obviously, the current findings need to be replicated in diseased populations and at higher workloads in healthy subjects. Furthermore, this study was conducted on a stationary bicycle ergometer under strictly controlled laboratory conditions, while the Oxycon Mobile is an apparatus suitable for field tests. This warrants further studies.

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Table 1. Intra Class Correlations, 95% Confidence Interval and Significance level for metabolic parameters during exercise.

	Mobile 1 – Pro			Mobile 2 – Pro			Mobile 1 – Mobile 2		
	ICC	95% CI	P value	ICC	95% CI	P value	ICC	95% CI	P value
VO_2	.858	.688 - .938	≤.01	.824	.622 - .923	≤.01	.872	.718 - .945	≤.01
VCO_2	.798	.574 - .911	≤.01	.760	.506 - .893	≤.01	.885	.744 - .951	≤.01
VE	.902	.779 - .958	≤.01	.893	.761 - .954	≤.01	.925	.829 - .968	≤.01

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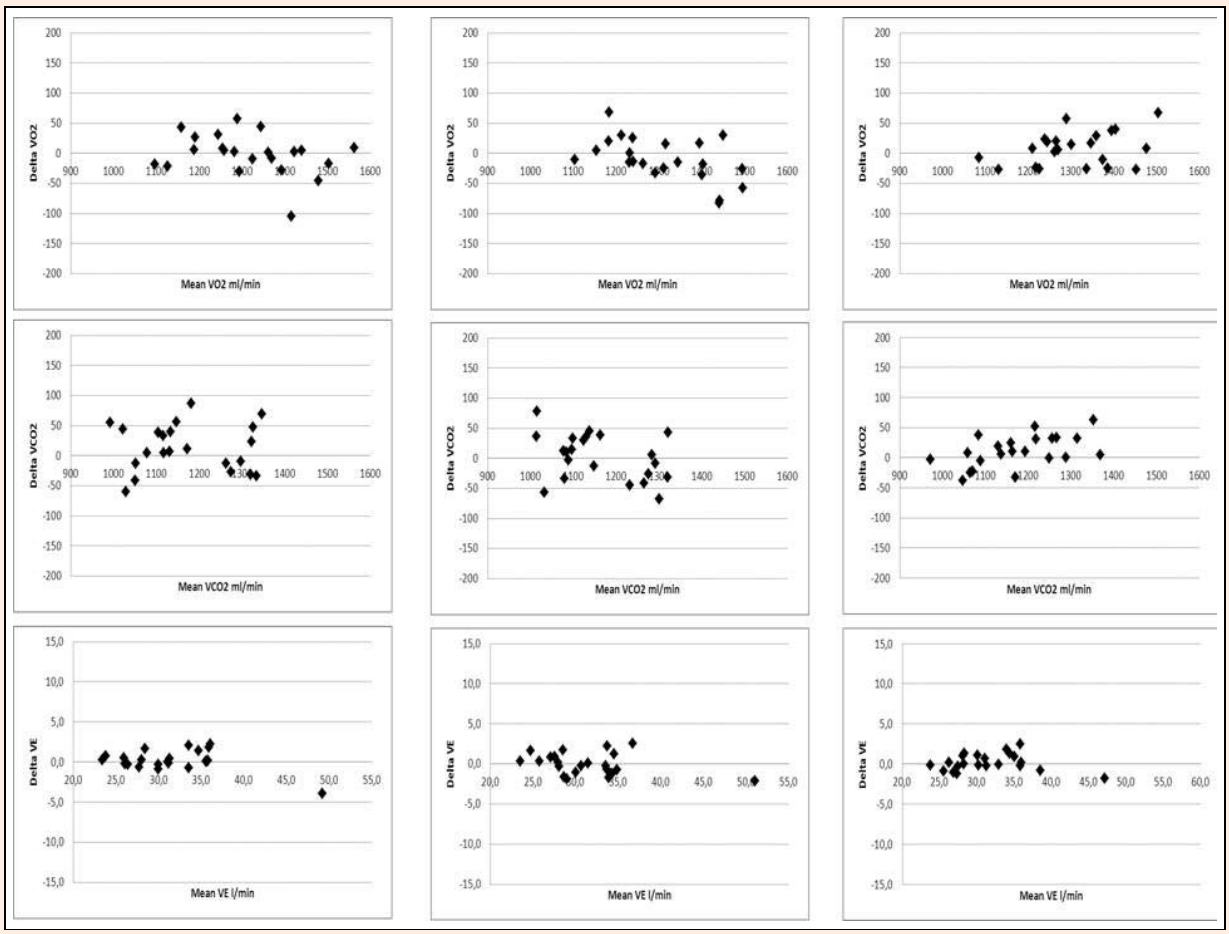

Figure1. Bland and Altman plots for oxygen uptake (VO_2), carbon dioxide production (VCO_2) and minute ventilation (VE) for Mobile Oxycon 1 (M1), Mobile Oxycon 2 (M2) and the Oxycon Pro (Pro). All data points represent single measurements collected during cycling at 100 Watts. X-axis: mean of two measurements. Y-axis: difference between two measurements.

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