Active with the Activ8?

A validation study of the activity monitor Activ8

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Background

Objective information about sedentary behaviour and physical activity can make contributions to health. Researchers get insight into the dose-response relationship between physical activity and health and an individual gets information about his own physical activity for self-monitoring and goal setting. The Activ8, a triaxial accelerometer, that can be carried in a subject's trouser pocket, recognizes postures and types of physical activity (lying, sitting, standing, walking, running and cycling) [1]. Based on the registered time, in a posture or activity, and the measured accelerations (m/s^2) the energy expenditure is estimated.

The research question for these studies was: How accurate is the estimation of energy expenditure for the Activ8 in various simulated daily activities, compared to the Actigraph GTX3 +, heart rate measurement and Cortex (indirect calorimetry using breath by breath analysis)?

Method & results study 1

19 adults performed three walking activities at 2 km/h, 4 km/h and 6 km/h, three running activities at 8 km/h, 11km/h and 14 km/h on a treadmill and three cycling activities at 50 watt (40rpm), 125 watt (60rpm) and 200 watt (80rpm) on a stationary bike[2]. Physical activity energy expenditure (PAEE) was estimated by heart rate, Activ8 and Actigraph in kJ/kg/min.

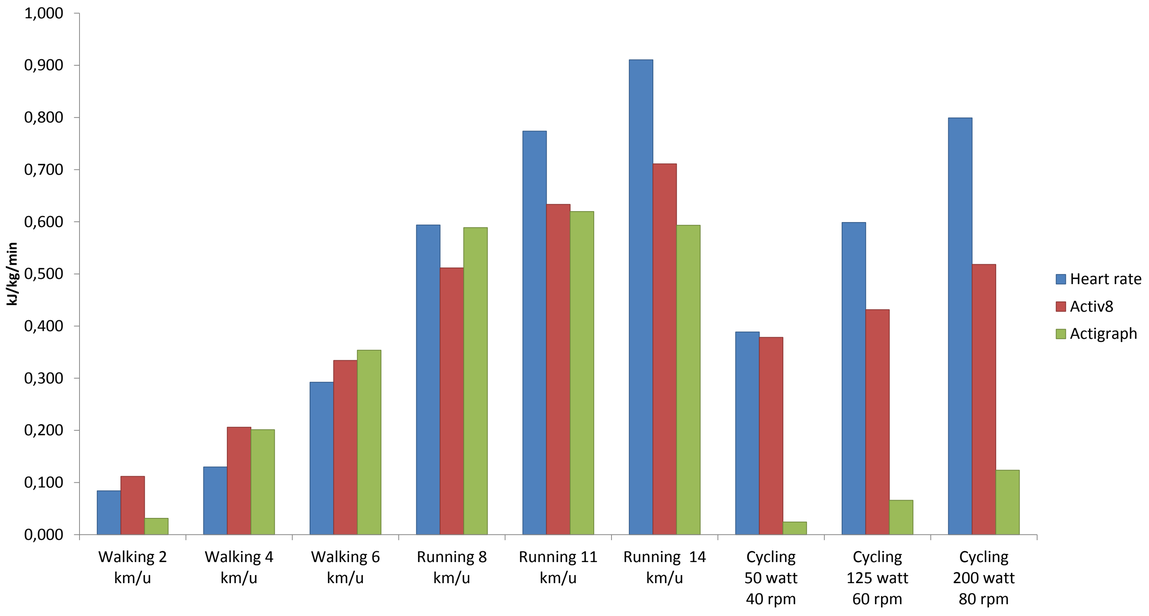

Figure 1: estimation of energy expenditure in kJ/kg/min by heart rate, Activ8 and Actigraph for different exercise activities.

Method & results study 2

6 adults performed the same protocol as described in study 1. Physical activity energy expenditure (PAEE) was estimated by indirect calorimetry (Cortex) and the Activ8 in kJ/kg/min.

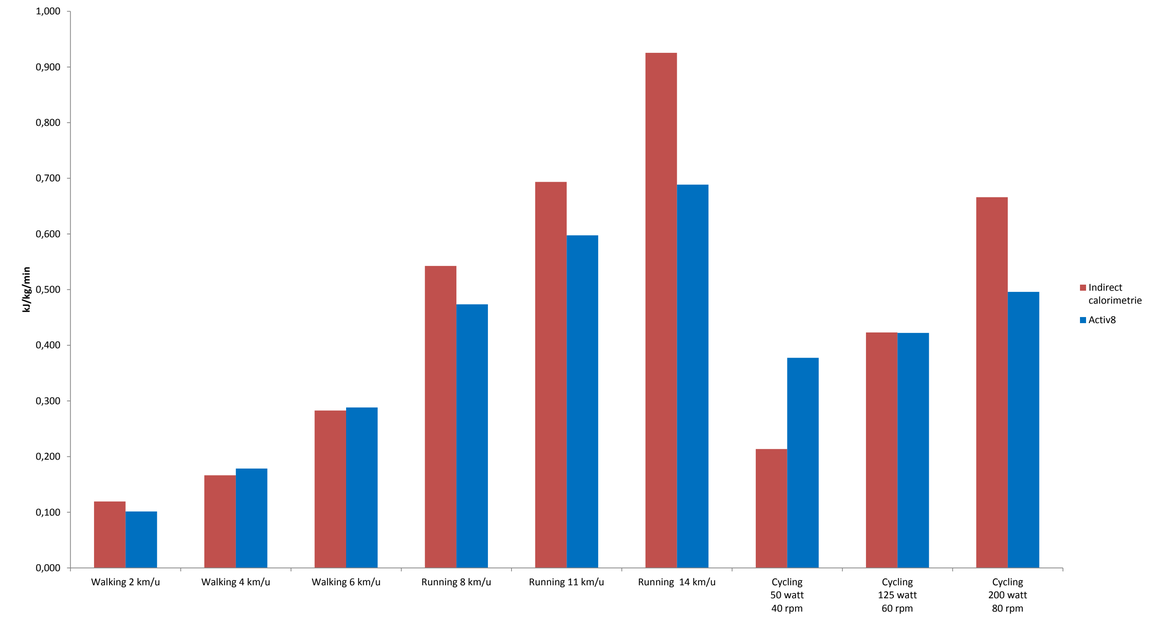

Figure 2: estimation of energy expenditure in kJ/kg/min by indirect calorimetry and Activ8 for different exercise activities.

	Indirect calorimetry	Activ8	Actigraph	Heart rate
Indirect calorimetry	1	0,874**	-	-
Activ8	0,874**	1	0,893*	0,912*
Actigraph	-	0,893*	1	0,853*
Heart rate	-	0,912*	0,853*	1

*Table 1: correlation (r value, P <0.001) between instruments when **walking** and **running**.*
** Study 1 **Study 2*

Discussion & conclusion

Study 1

With regard tot walking and running the instruments show high correlations, although both accelerometers estimate energy expenditure using different methods. The Activ8 seems tot recognize and measure cycling activities more accurate than the Actigraph. These differences may be related to the (recommended) placement of the Actigraph on the hip, and activity recognition capacity of the Activ8

Study 2

The results from study 2 reveal that the estimated energy expenditure by the Activ8 is largely in line with indirect calorimetry. At higher running speeds an adjustment in the Activ8 algorithm might improve the estimation of energy expenditure. The workrate (energy expenditure) of cycling is determined by force x acceleration (RPM). Acceleration can be low but with a great force (cycling uphill). The Activ8 only registers acceleration and no force. Therefore the development of a validation protocol in real-life conditions is needed to have accurate estimations of energy expenditure.

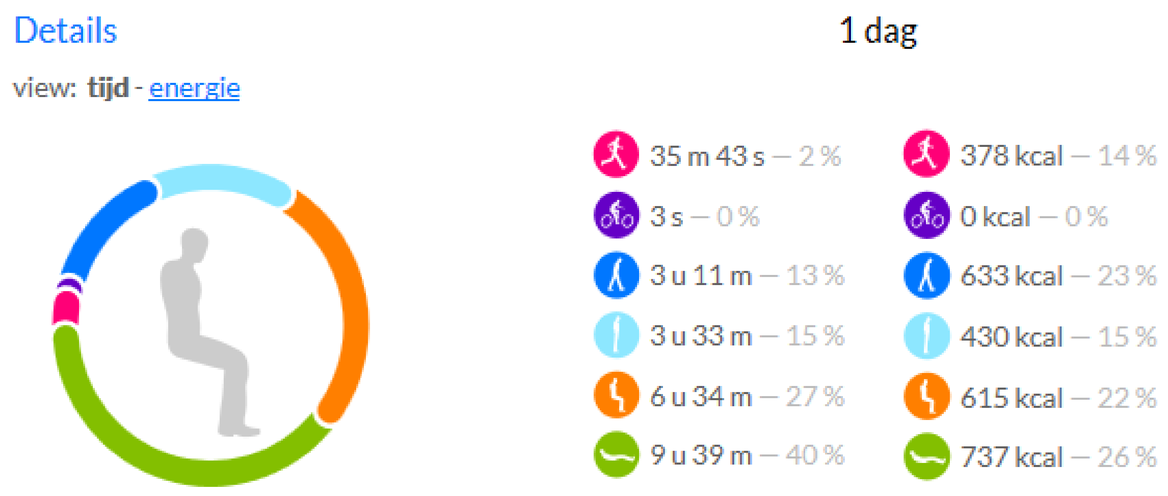

Figure 3: dashboard of the Activ8 in the online coaching module. Data on time and energy expenditure of different postures and types of activity.

Relevance

The Activ8 is an affordable activity monitor which is easy to use and seems to make acceptable estimations of energy expenditure. This makes it a promising device for both large scale research purposes and the consumer market. The Activ8 also has two additional features; it recognizes different postures and types of physical activity (lying, sitting, standing, walking, running and cycling) and is supported by an online coaching module that allows the use of the Activ8 as a means for interventions. Future research will have to demonstrate the accuracy of the Activ8 in real life validation studies and its potential as a coaching tool.

Referenties:
1. Erasmus MC, U. M. C. R. (2013). Validation of the Active8 Activity Monitor - Posture en movement detection.
2. Arts, D., Borghouts, L., Oomen, J., & Vos, S. (2013). Validatieprotocol Activ8. Meten van energieverbruik & sedentair gedrag.

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