



HAL
open science

Senswear Armband for prediction of energy expenditure in controlled and free-living conditions

Sylvie Rousset, Christophe Montaurier, S. Normand, V. Sauvinet, Philippe Lacomme, Yves Boirie, Béatrice Morio

► To cite this version:

Sylvie Rousset, Christophe Montaurier, S. Normand, V. Sauvinet, Philippe Lacomme, et al.. Senswear Armband for prediction of energy expenditure in controlled and free-living conditions. 2. International Conference on Ambulatory Monitoring of Physical Activity and Movement (ICAMPAM 2011), May 2011, Glasgow, United Kingdom. 2011, 2th. International Conference on Ambulatory Monitoring of Physical Activity and Movement (ICAMPAM 2011). hal-01601783

HAL Id: hal-01601783

<https://hal.science/hal-01601783v1>

Submitted on 3 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License

Rousset S.¹, Montaurier C.¹, Normand S.², Sauvinet V.², Lacomme P.³, Boirie Y.¹, Morio B.¹

¹ INRA, Unité de Nutrition Humaine UMR1019, CRNH d'Auvergne, Clermont Ferrand, France

² CRNH Rhône-Alpes, Lyon, France

³ Laboratoire d'Informatique (LIMOS, UMR CNRS 6158), Campus des Cézeaux, 63177 Aubière Cedex, France



Introduction Evaluating variations in free-living energy expenditure during the day and on a day-to-day basis is of major interest in clinical trials as well as for individual use. Several monitors are available today for research on energy expenditure (EE) prediction.

Aim The aim of our study was to compare the accuracy of EE estimation of two of these devices (Actiheart and Armband), compared to measurements using calorimetric chambers for the assessment of changes of energy expenditure during the day, and the doubly-labelled water (DLW) technique for the evaluation of free-living total energy expenditure.

Methods All volunteers were normal weight and wore both monitors (Actiheart & Armband)

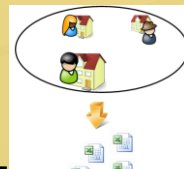
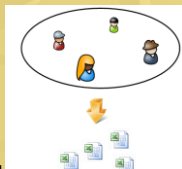
Calorimetric room(0:00-17:00) **Free living conditions(10 days)**

Reference Indirect calorimetry **Doubly-labelled water**

Size 23 men, 26 women **27 men, 28 women**

Age 45 ± 5y **juniors: 28 ± 5y, seniors:46 ± 5y**

Activity sleep, rest, walking 3, 4, 5, 6 km.h⁻¹ step ... **free**



Data mining and EE calculation over activity periods by F... developed in-house

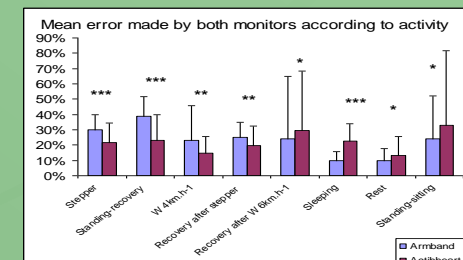
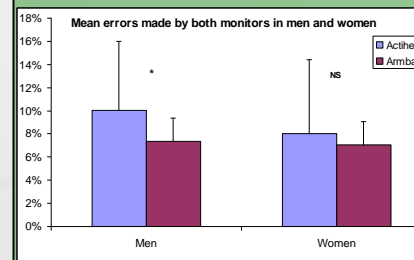
Error of EE estimation (%) : $\frac{EE \text{ predicted by monitor} - EE \text{ reference}}{EE \text{ reference}}$

Concordance prediction/reference: Bland & Altman plots

Paired t-test to compare the levels of errors from the 2 monitors

Conclusion The measurements of energy expenditure using Actiheart may be altered by either the delicate procedure for skin preparation or the positioning of the device or of the algorithm. Thus, the error of energy expenditure predicted by Actiheart during sleeping was higher. Since this period is long, the sleeping energy expenditure error accounts for a significant part of the total error. An adaptation in the algorithm for low intensity activity and low heart rate might improve prediction accuracy.

Results Comparison of EE predictions compared to indirect calorimetry Mean errors of Actiheart and Armband during the stay in calorimetric room was similar in women. In men Actiheart error was higher than that of Armband. Analysis by activity showed that Actiheart more effectively predicted EE during standing recovery, walking 4kmh⁻¹, exercising with a stepper and recovery after stepper activity. In contrast, the prediction of EE during post-absorptive rest, sleeping, standing-sitting and recovery after walking 6kmh⁻¹ was improved with the SenseWear Armband.



Comparison of EE predictions compared to doubly-labelled water In free-living conditions, the mean error was significantly higher for Actiheart (11.6±7.8%) compared to the Armband (8.30±5.5%) (t=-3.1, p=0.003) mainly for men. The errors averaged 7.5±4.7% and 11.5 ±7.9% in juniors, and 9.1±6.0% and 11.9 ±7.4% in seniors for the SenseWear Armband and Actiheart, respectively. The Armband underestimated EE in the high value range (> 3100 kcal/d) and vice versa for Actiheart.

