ACTIHEART VS. SENSEWEAR ARMBAND FOR PREDICTION OF ENERGY EXPENDITURE IN CONTROLLED AND FREE-LIVING CONDITIONS

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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.

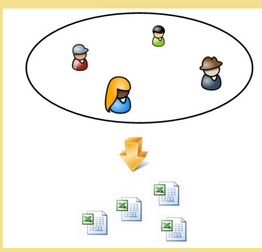
Methods All volunteers were normal weight and wore both monitors (Actiheart & Armband)

In calorimetric room (0:00-17:00)

23 men, 26 women 45 ± 5y

Activities: sleep, rest, walking 3, 4, 5, 6 km.h^{-1}, step …

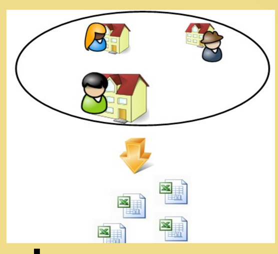
Reference method: **Indirect calorimetry**



In **free living conditions (10 days)**

27 men, 28 women, youngsters: 28 ± 5y, adults:46 ± 5y

Activity : free



Reference method: **Doubly-labelled water**

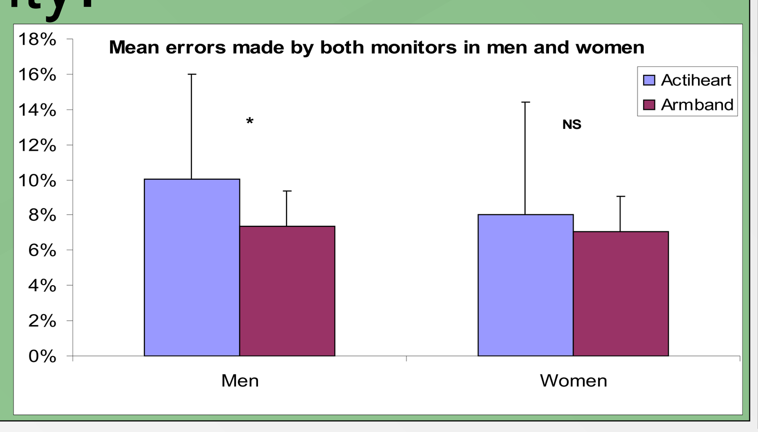
Data mining and EE calculation over activity periods by **Finder2E software**, developed in-house

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

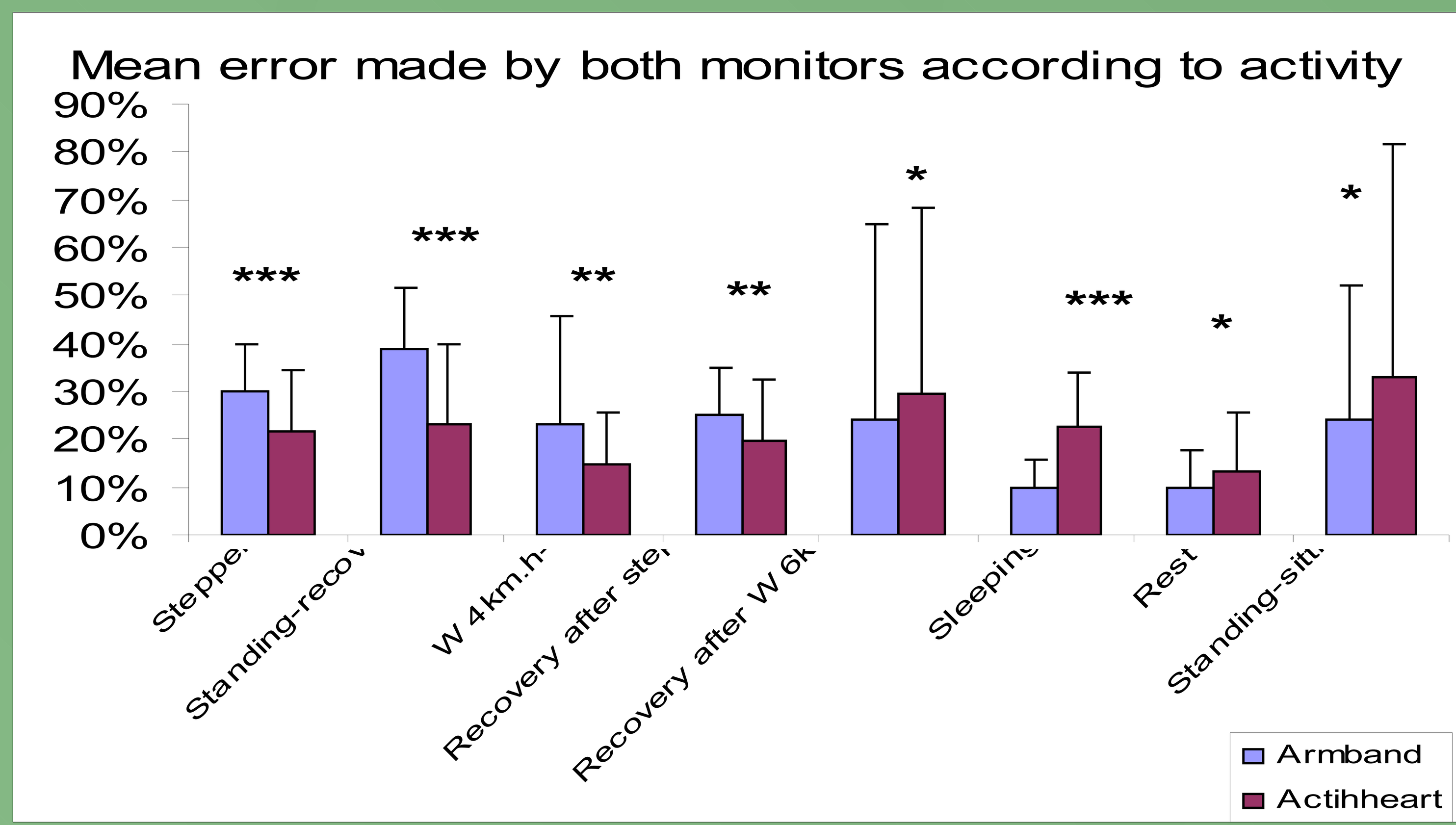
Concordance prediction/reference: Bland & Altman plots

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

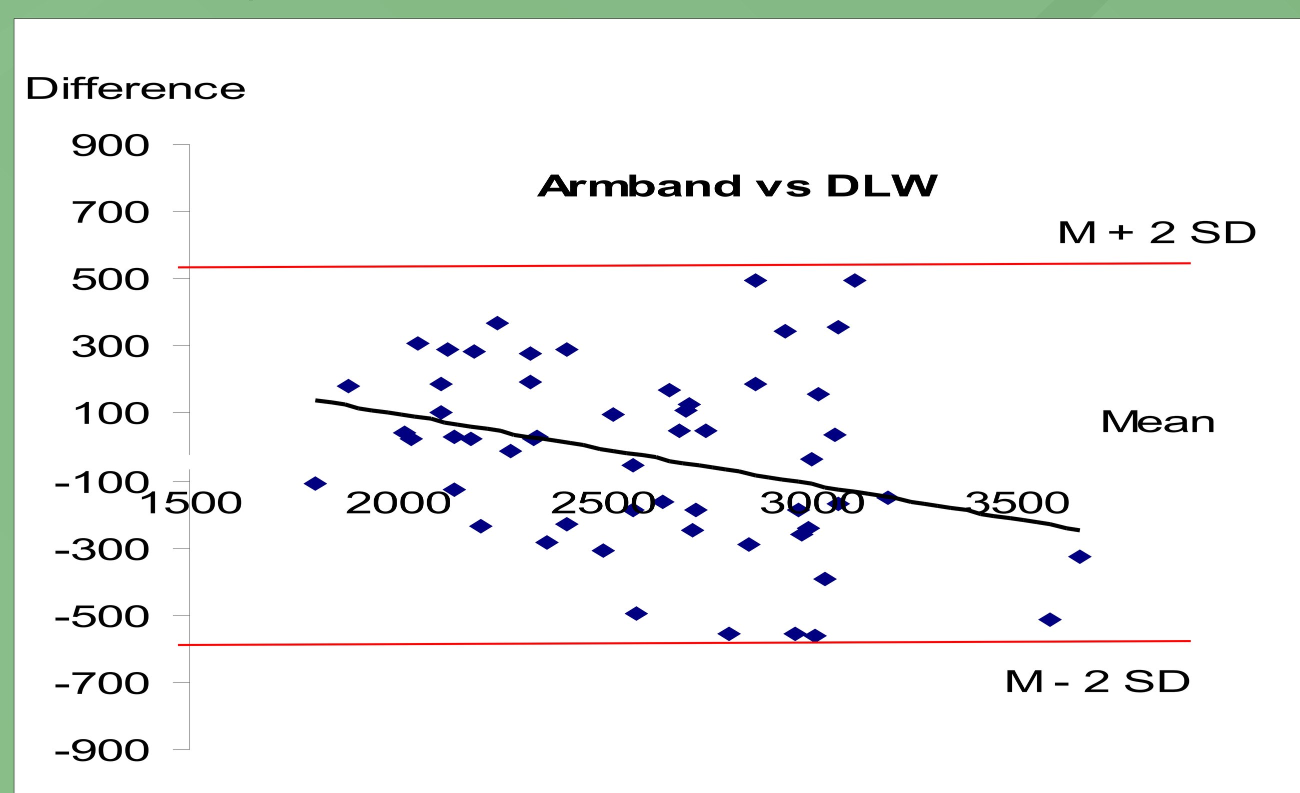
Results **Comparison of EE predictions compared to indirect calorimetry** Mean errors of Actiheart and Armband during the stay in calorimetric room was similar in women. In men Actiheart error was higher than that of Armband. Analysis by activity showed that Actiheart more effectively predicted EE during standing recovery, walking 4km.h-1, exercising with a stepper and recovery after stepper activity.

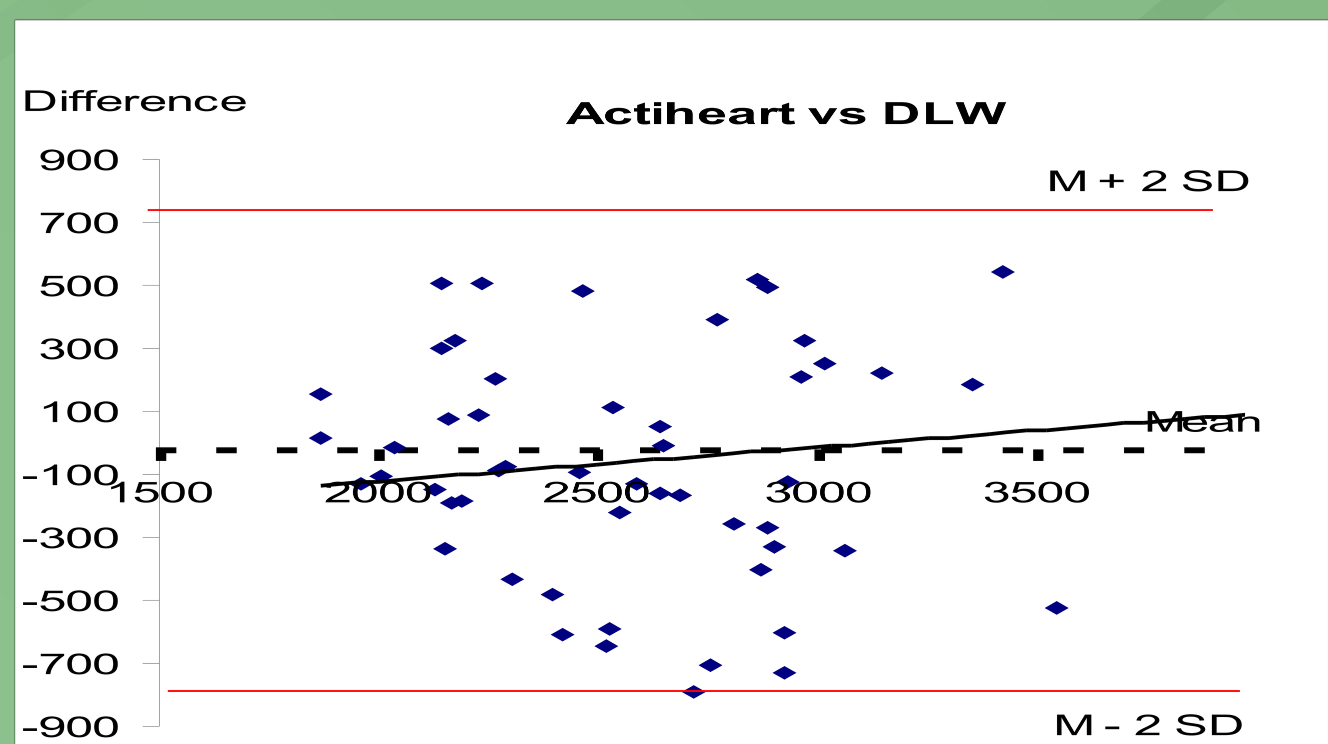


In contrast, the prediction of EE during post-absorptive rest, sleeping, standing-sitting and recovery after walking 6km.h^{-1} was improved with the Armband.



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 were different in youngsters (7.5±4.7% and 11.5 ±7.9%, t=-3.3, p=0.003), and similar in adults (9.1±6.0% and 11.9 ±7.4%, t=-1.5, p=0.13) for the Armband and Actiheart. The Armband underestimated EE in the high value range (> 3100 kcal/d) and *vice versa* for Actiheart.





Conclusion The measurements of energy expenditure using Actiheart may be altered by either the delicate procedure for skin preparation, the positioning of the device on the body 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 Actiheart prediction. Armband could improve its prediction in the range of intense activities.