Validation of energy expenditure by multisensor armband in overweight lactating women

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Background

Reproduction is a risk factor for excessive weight gain and postpartum weight retention, especially in women who are already overweight or obese.

Valid, affordable and easy-to-use methods for measuring physical activity during the reproductive cycle are needed to tailor appropriate treatment.
Aim

To validate Total Energy Expenditure (TEE) from the portable armband SenseWear SWA Pro 2 against TEE from Doubly Labeled Water (TEE_{DLW}) in overweight and obese lactating women

Inner View software versions SWA 5.1 and SWA 6.1
Subjects and methods

Breastfeeding, non-smoking women with a BMI >25 kg/m$^2$ who had singleton, term deliveries with a birth weight > 2500 g and were able to perform physical activity were recruited for the study at 10 weeks postpartum.
Subjects and methods

TEE was measured using doubly labeled water during 2 weeks and the SWA Pro 2 armband was worn simultaneously during the first seven 24-hour periods.
Subjects and methods

Resting Energy Expenditure (REE) was measured by indirect calorimetry.

Physical Activity Level (PAL) was calculated as $\text{TEE}_{\text{DLW}}/\text{REE}$. 
Subjects and methods

TEE (mean of seven 24 hour periods) as provided by the Inner View programs (TEE_{SWA5.1} and TEE_{SWA6.1}) were used for comparisons to TEE_{DLW}. 
Results

62 women with a percent “on body time” for SWA of >90% were included in the analysis.

<table>
<thead>
<tr>
<th></th>
<th>Mean (sd)</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>33.2 (4.2)</td>
<td>24.6 to 41.3</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>30.0 (2.8)</td>
<td>25.2 to 37.4</td>
</tr>
<tr>
<td>TEE&lt;sub&gt;DLW&lt;/sub&gt;</td>
<td>2765 (380)</td>
<td>1990-3895</td>
</tr>
<tr>
<td>TEE&lt;sub&gt;SWA5.1&lt;/sub&gt;</td>
<td>2850 (435)</td>
<td>1905-3950</td>
</tr>
<tr>
<td>TEE&lt;sub&gt;SWA6.1&lt;/sub&gt;</td>
<td>2524 (295)</td>
<td>1875-3070</td>
</tr>
<tr>
<td>Resting Energy Expenditure, indirect calorimetry, kcal</td>
<td>1507 (143)</td>
<td>1210 to 1840</td>
</tr>
<tr>
<td>PAL&lt;sub&gt;DLW&lt;/sub&gt;</td>
<td>1.83 (0.17)</td>
<td>1.47-2.35</td>
</tr>
</tbody>
</table>
Results

\( \text{TEE}_{\text{SWA} \ 6.1} \) was underestimated with 241 kcal compared to \( \text{TEE}_{\text{DLW}} \) (\( p<0.001 \)).

\( \text{TEE}_{\text{SWA} \ 5.1} \) was overestimated with 85 kcal compared to \( \text{TEE}_{\text{DLW}} \) (\( p=0.040 \)).
Results

Forty-four percent (27 of 62) were within a predefined level of agreement of ± 10% (277 kcal) using SWA 5.1 and 52% (32 of 62) were within this level of agreement using SWA 6.1.
Figure 1 A. Graphic plot of difference (TEE_{DLW} - TEE_{SWA5.1}) and TEE_{DLW}, R = 0.231, p=0.070 (horizontal lines, mean ±1.96SD).

Figure 1 B. Graphic plot of difference (TEE_{DLW} - TEE_{SWA6.1}) and TEE_{DLW}, R = 0.638, p<0.001 (horizontal lines, mean ±1.96SD).
Conclusions

• SenseWear armband Pro 2 combined with the InnerView software version 5.1 can be used to estimate TEE within 3% of TEE_{DLW}

• The Inner View software version 6.1, underestimates TEE with about 9% with a systematic underestimation at higher levels of TEE, PAL and BMI.
Take home message

• Choice of software version is important to consider when estimating TEE using SenseWear Pro 2 armband in overweight subjects

• The Inner View software version 5.1 is preferable to version 6.1 for measuring TEE at a group level in overweight lactating women