Accuracy of a wrist-worn medical device to identify fertile window and ovulation day

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Introduction

• More than 60% of women do not know when they can conceive during their menstrual cycle.¹

• Accurately identifying the fertile window and properly timing intercourse can increase the probability for conception.

• Urine-based Luteinizing Hormone (LH) kits can routinely be used to detect the rise in LH occurring 24-36 hours prior to ovulation, identifying only the end of the fertile window.²

• The Ava Fertility Tracker is a wearable device measuring five physiological parameters to identify an average of 5 days in the fertile window prospectively with 90% accuracy.³

• Research aim: determine the accuracy of the Ava Fertility Tracker compared to urinary LH tests.

Methods

• This study included 205 ovulatory cycles, confirmed by LH tests, from 61 women who wore the Ava Fertility Tracker nightly for up to six cycles.

• The Ava Fertility Tracker measured pulse rate, respiratory rate, skin perfusion, heart rate variability, and skin temperature during sleep and employed two machine learning algorithms to track fertility in a smartphone application:
  1. Retrospective algorithm determining the fertile window after cycle end
  2. Prospective algorithm predicting the fertile window in real time

• Ovulation day was defined as the day following a positive LH test; the fertile window included ovulation day and the five preceding days.

• Accuracy was determined based on the number of wrongly identified ovulation days as compared to LH test results tolerating ±2 days (i.e., equivalence interval).

• Sensitivity and specificity of the algorithms were calculated by means of a mixed effects model.

References


Results

• Mean participants’ age: 26.5 ± 4.2 years

• Mean duration of included cycles: 29.9 ± 3.2 days

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<thead>
<tr>
<th>Variables</th>
<th>Retrospective Algorithm</th>
<th>Prospective Algorithm</th>
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<tbody>
<tr>
<td>Accuracy to identify ovulation day, no. (%)</td>
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<tr>
<td>Cycles with errors ±2 days</td>
<td>168 (82)</td>
<td>148 (72.2)</td>
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<tr>
<td>Cycles with 0 days errors</td>
<td>57 (27.8)</td>
<td>126 days (87)</td>
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<tr>
<td>Cycles with errors larger than ±2 days</td>
<td>37 (18)</td>
<td>57 (27.8)</td>
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<td>Accuracy to label fertile/infertile days (95% confidence interval)</td>
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<tr>
<td>Sensitivity</td>
<td>0.80 (0.76, 0.83)</td>
<td>0.77 (0.71, 0.82)</td>
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<tr>
<td>Specificity</td>
<td>0.95 (0.94, 0.95)</td>
<td>0.91 (0.90, 0.92)</td>
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Figure 1. The Ava Fertility Tracker and its mobile application.

Figure 2. Mean error in detecting ovulation was 0.31 days (95% confidence interval - 0.13 to 0.75) for the retrospective and -0.04 days (95% confidence interval -0.64 to 0.55) for the prospective algorithm.

Conclusion

• The Ava Fertility Tracker was as accurate in identifying ovulation day as LH tests, suggesting it could serve as a reliable marker of ovulation for real-world users as well as researchers.

• Leveraging machine learning and wearable sensor technology, the Ava Fertility Tracker also provides a larger and prospective fertile window than LH tests thereby enabling women to increase their chances of conception sex.⁴

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