

Validity of Daily Physical Activity Measurements of Fitbit Charge 2

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ABSTRACT

Physical activity monitors collect continuous data to provide a summary of daily activity. The Fitbit Charge 2 monitors heart rate as well as steps, calories, and active minutes throughout the day. There is currently no research validating the Fitbit Charge 2 at measuring daily physical activity levels in a real life setting. **PURPOSE:** To compare measures of daily steps and active minutes of Fitbit Charge 2 with a research-grade accelerometer. **METHODS:** Sixteen active college students (Mean±SD; 23±4.9yrs; 16.43±10.19%fat; 9 male) consented to be part of the study. Participants wore an ActiGraph GT3X accelerometer and Fitbit Charge 2 concurrently for seven consecutive days. Both devices were programmed with each participant's information and the participants were instructed to perform their daily activities wearing both devices and only remove them to shower and to sleep. Data were considered valid when participants wore both devices for at least 10 hours on 4 or more days of the week. Steps and active minutes (moderate-vigorous physical activity) were recorded by each device. Mean bias was calculated by subtracting ActiGraph steps and active minutes from those obtained from the Fitbit Charge 2 for each day and an average daily mean bias was calculated using values from all seven days. Absolute percentage error was also calculated [$100(|\text{Fitbit Charge 2} - \text{ActiGraph}|)/\text{ActiGraph}$] to indicate the overall 7-day difference between the Fitbit Charge 2 and ActiGraph. Pearson correlations and paired sample t-test were performed to compare Fitbit Charge 2 measurements with the corresponding ActiGraph measurements with significance considered at $p < 0.05$. **RESULTS:** The Fitbit Charge 2 overestimated steps by 2,451.3±2085.4 compared to the ActiGraph using the daily average steps over the seven days. This was 32.2±40.7% above the ActiGraph measurement. Average mean bias for daily active minutes was -52.1±58.9 with the Fitbit Charge 2 underestimating compared to the ActiGraph. Active minutes for the Fitbit Charge 2 were an average of 69±26.1% away from the ActiGraph. Steps for the Fitbit Charge 2 were significantly correlated to ActiGraph steps ($r=0.575$, $p=0.02$) while active minutes were not significantly correlated ($r=-0.255$, $p=0.34$). Paired sample t-test results showed a significant difference between the Fitbit Charge 2 steps and active minutes compared with the ActiGraph ($p < 0.01$ for both). **CONCLUSION:** The Fitbit Charge 2 may be useful for measuring steps in a free-living environment, however active minutes are significantly underestimated.