Accuracy of Fitbit Charge 2 at Estimating VO₂max, Calories, and Steps on a Treadmill

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ABSTRACT

Current fitness activity trackers can account for steps, calories burned, heart rate, and distance traveled. A new feature has recently been introduced on the Fitbit Charge 2, "Cardio Fitness Level," which is comparable to a VO2max score in that it allows consumers to be aware of their aerobic fitness level. **PURPOSE:** To assess the accuracy of the Fitbit Charge 2 at estimating VO2 score ("Cardio Fitness Level"), calories, and steps when compared to indirect calorimetry and video analyzed steps, respectively. **METHODS:** Twenty-two healthy adults (Mean±SD; 24.1±4.2yrs; 16.9±9.0%fat; 15 male) completed two separate visits. On the first visit, anthropometric measurements were taken followed by a 10-minute outdoor run. Participants ran for 10 minutes at their own pace on flat terrain as recommended by Fitbit to generate a Cardio Fitness score. On the second visit, participants came fasted, at least 8 hours, and completed a standardized VO2max protocol (Arizona State protocol) using a PARVO TrueOne2400 metabolic cart. The treadmill was set at 3mph for the first 3 minutes with 0% grade. Following the first stage, the speed was raised to the participant's pre-selected speed (between 5-8mph) with 0% grade. After stage 2 the grade increased every minute by 1.5% and speed was kept constant until fatigue was reached. Calories and step counts from the Fitbits were correlated with the metabolic cart and tally counter respectively, using 2-tailed Pearson correlations. Significance was set at $p<0.05$. Mean bias scores for calories and steps from the Fitbits were also calculated between the metabolic cart and tally counter respectively. **RESULTS:** Participants completed the VO2max test in an average of 11:05. Eight of the 22 estimated VO2max ranges given by Fitbit included the value given by the metabolic cart. Fitbit ranges for seven participants were below the metabolic cart values and the Fitbit ranges for the remaining seven participants were above the metabolic cart values. Calories were correlated between the Fitbit and metabolic cart ($r = 0.874$, $p<0.01$) with a mean bias of 11.4±14.3kcal; Fitbit Charge 2 overestimated kcal compared to a metabolic cart. Nineteen participants successfully recorded step values from the Fitbit and video recording. Steps were correlated between the Fitbit and tally counter ($r = 0.97$, $p<0.01$) with a mean bias of -44.95±41.86 steps; Fitbit Charge 2 underestimated steps compared to the tally counter. **CONCLUSION:** VO2 scores given by the Fitbit Charge 2 did not always match values given by the metabolic cart but may serve as a rough estimate of fitness level. Fitbit Charge 2 may also be useful in tracking calories and steps in a controlled setting, but results may differ in real world conditions.