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HOW ACCURATE ARE WEARABLE ACTIVITY TRACKERS FOR MEASURING STEPS?

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ABSTRACT

Wearable activity trackers have become popular for tracking individual’s daily physical activity, but little or no information is available to substantiate the validity of these devices in step counts.

PURPOSE: The purpose of this study was to systematically examine the validity of newly developed wearable activity trackers for measuring steps compared to the criterion measure (hand tally) in two different conditions.

METHODS: Twenty (28.2±4.8 years) healthy males (n=19) and females (n=17) participated in the study. The participants were fitted with eight wearable activity trackers while walking and running on a treadmill (speeds of 2.5, 3, 3.5, 4, and 5 mph) for 3 minutes at each speed. For overground protocol, participants walked at three-self-determined speeds; gradually becoming faster (slow, normal, and fast) for one lap on an indoor track (200 meter track). The number of actual steps taken was manually tallied by researchers using hand-tally counter. The monitors included the Basis B1 band (BB), Misfit Shine (MS), Polar Loop (PL), and Jawbone UP (UP) worn on the right wrist; the Nike+FuelBand (NF), Garmin VivoFit (GV), and Fitbit Flex (FF) worn on the left wrist; and Withings Pulse (WP) and Fitbit Zip (FZ) worn with a clip on the waist.

RESULTS: Total step counts (means ± SD) were 329.5±70.1, 267.8±89.9, 295.6±105.1, 305.2±73.2, 282.2±65.1, 294.5±58.8, 329.5±70.0, 302.1±75.7, 310.8±82.8, and 318.1±76.7, for manual counts, NF, MS, WP, PL, FF, GV, UP, and BB, respectively. Corresponding absolute error rates (computed as the average absolute value of the individuals’ errors) were 19.8±16.4%, 18.5±12.2%, 17.4±15.8%, 11.3±13.1%, 7.2±7.4%, 6.6±12.6%, and 3.5±6.0%, respectively. ANOVA and Post hoc analyses with Bonferroni revealed the MS, WP, FZ, UP, GV, and BB were the devices to give non-significant differences (p>0.05) compared to the manual step counts, but significant differences were found with NF, PL, and FF. CONCLUSION: The results demonstrate that the waist-oriented trackers, FZ and WP, show the most accuracy in measuring steps. However, promising preliminary findings were observed with the wrist-oriented trackers, BB, UP, and GV.

INTRODUCTION

Wearable activity trackers have become popular for tracking individual’s daily physical activity, but little or no information is available to substantiate the validity of these devices in step counts.

PURPOSE: The purpose of this study was to systematically examine the validity of newly developed wearable activity trackers for measuring steps compared to the criterion measure (hand tally) in two different conditions.

METHODS

Participants

Table 2: Total steps for treadmill and overground

Table 3: Correlation matrix for total number of steps

RESULTS

• ANOVA and Post hoc analyses with Bonferroni revealed the MS, WP, FZ, UP, GV, and BB were the devices to give non-significant differences (p>0.05) compared to the manual step counts, but significant differences were found with NF, PL, MS, and FF.
• Fitbit zip, Withing Pulse, Jawbone UP, Basis B1, Garmin VivoFit, and BodyMedia Fit are in the 10% equivalent zone.
• Fitbit zip, Withing Pulse, Jawbone up are in the 5% equivalent zone.
• Jawbone UP is the only wrist-oriented monitor that is in the 5% equivalent zone.

DISCUSSION

• The present study demonstrated the waist-oriented trackers, Fitbit Zip and Withing Pulse, show the most accuracy in measuring steps.
• However, promising preliminary findings were observed with the wrist-oriented trackers, BB, UP, and GV.
• Additional research is needed to examine these trackers in free-living settings.