

# VALIDITY AND RELIABILITY OF THE FITBIT FLEX™ AND ACTIGRAPH GT3X+ AT JOGGING AND RUNNING SPEEDS

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## ABSTRACT

**Background:** Monitoring levels of physical activity, as an outcome or in guiding rehabilitation, is challenging for clinicians. Personal activity monitors are increasing in popularity and provide potential to enhance rehabilitation protocols. However, research to support the validity and reliability of these devices at jogging and running speeds is limited.

**Purpose:** The purpose of this study was to evaluate the validity of the Fitbit Flex™ and ActiGraph GT3X+ for measuring step count at jogging and running speeds. A secondary purpose was to examine inter-device reliability of the Fitbit Flex™.

**Study Design:** Cross-sectional study

**Methods:** Thirty healthy participants aged between 19 and 50 years, completed a treadmill protocol at jogging and running speeds (8 km/h to 16 km/h). Treadmill speed was progressively increased by intervals of 2 km/h. Each interval was four minutes in duration with a two minute rest period between stages. Participants were encouraged to continue through the graded exercise test until they reached the maximum running speed that they felt they could maintain for four minutes. Step count data was collected for Fitbit Flex™ devices and the ActiGraph GT3X+. Video analysis of step count was used as the criterion measure.

**Results:** At speeds of 8 to 14 km/h Mean Absolute Percentage Errors were  $\leq 1\%$  for the Fitbit Flex™ and the ActiGraph GT3X+ when compared to step count via video analysis. Standard Error of Measurement between the three Fitbit Flex™ devices was  $\leq 7$  steps for speeds of 8 to 14 km/h and varied between 9 to 19 steps at 16 km/h. Fitbit Flex™ devices showed good to excellent between device reliability at speeds of 8 to 14 km/h (ICC 0.723 to 0.999;  $p \leq 0.001$ ). Greater variability was evident with the low participant numbers at 16 km/h (ICC 0.527 to 0.896;  $p \geq 0.02$ ).

**Conclusion:** Both the Fitbit Flex™ and the ActiGraph GT3X+ provide a valid account of steps taken at jogging and running speeds up to 14 km/hr, attainable by non-elite runners on a treadmill. Fitbit Flex™ devices provide equivalent step count output to each other, enabling comparison between devices during treadmill jogging and running.

**Level of evidence:** 2b

**Key words:** Accelerometer, activity tracker, activity monitor, physical activity, step count

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