The Validity of Apple Watch For Energy Expenditure Estimation In Physical Activity

Peng Zhang[1], Chad Witmer[1], Steven Godin[2], Dongsheng Che[1].Matthew Owens[1], Amanda Hanna[1], Thomas Casey[1], Rebecca Finnegan[1], Cleo Niewojt[1],[1]East Stroudsburg University, East Stroudsburg, PA, [2]University of Utah, Salt Lake City, UT.

As the technology advance, both consumers and researchers become more interested in using wearable fitness devices to monitor and measure physical activity (PA). Apple Watch® (Apple Inc, Cupertino CA) is designed to track individual's PA and has a built-in exercise application, Workout App which tracks user's energy expenditure and exercise time. Even though Apple Watch claims to be a useful wearable fitness technology, the validity of its PA measures is unknown. **PURPOSE:** The purpose of the study was to investigate the validity and reliability of the energy expenditure estimation of Apple Watch among college students. **METHODS:** A total of 30 college students (17 males and 13 females) from a state public university in Pennsylvania participated into the study. All participants completed two sets of three 10-minute treadmill walking and running trials while wearing three apple watches and being connected to indirect calorimetry. The two sets of bouts were arranged on two separate days with a randomization and >48-hour rest in between. The three walking trials were at speeds of 54, 80, and 107 $m \bullet min^{-1}$ while the running trials were at speeds of 134, 161, 188 $m \bullet min^{-1}$. Resting Metabolic Rate was collected by the indirect calorimetry along with a familiarization trial prior to the execution of the exercise protocol. Energy expenditure comparisons was made using Two-way ANOVA with repeated measures. Reliability was analyzed by Introclass Correlation. **RESULTS:** There was no significant device x speed interactions ($F(15, 696) = 1.113$, $p > 0.05$) between the indirect calorimetry (criterion) and watches. Bonferroni post hoc analysis revealed no significant differences between the criterion energy expenditure estimates and Apple Watch (B) ($p = 0.117$). The reliability analysis: A moderate to high agreement among the three apple watches examined in this research. The Inter-Class Correlation (ICC) scores were 0.49 (95%CI) at 2mph, 0.66 (95%CI)) at 3mph, 0.72(95%CI)) at 4mph & 5mph, 0.71(95%CI)) at 6mph & 7mph. **CONCLUSION:** Apple watches demonstrated a moderate to high level of validity and reliability on measuring physical activity. **Supported by a University Leveraging Grant #** 2015021.