

2015

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Recommended Citation

Motz, Zachary; Bail, Yang; Kim, Youngwon; Dinkel, Danae M.; and Lee, Jung-Min, "Validity of Wearable Activity Monitors for Estimation of Resting Energy Expenditure in Adults" (2015). *Research Presentations*. 19.

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Validity of Wearable Activity Monitors for Estimation of Resting Energy Expenditure in Adults

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INTRODUCTION

- Wearable accelerometers have become the standard method for assessing physical activity for both individuals and field-based research [1]. These new devices allow consumers to have the ability to estimate total energy expenditure and track it over time.
- Resting Energy Expenditure plays a critical role in estimating daily total energy expenditure as it contributes 60-70% of total energy expenditure [2,3].
- Little to no information is available to substantiate the validity of these consumer-based activity monitors under free-living conditions.

PURPOSE

The purpose of this study was to evaluate the validity of Resting Energy Expenditure estimates from Fitbit Flex and SenseWear Mini in adults

ABSTRACT

- Purpose:** To evaluate the validity of Resting Energy Expenditure (REE) estimates from Fitbit Flex and SenseWear Mini in adults
- Methods:** Sixty healthy adults (26.4±7.7 years) participated. REE measurements were performed in the morning after a 10-hour fast via open-circuit indirect calorimetry (IC) following previously published guidelines [4]. Estimates of REE from the Fitbit Flex and SenseWear Mini were computed and compared to IC and estimated REE values from Institute of Medicine and the World Health Organization equations.
- Results:** Analyses of covariance (ANCOVA) showed no significant effects of gender for any of the comparisons with IC REE; therefore, males and females were combined for all analyses. No significant difference were observed between the measured REE and the estimates from Fitbit Flex, SenseWear Mini and the equations from the Institute of Medicine and the World Health Organization
- Conclusion:** The derived REE value from the Fitbit Flex and the SenseWear Mini provide reasonable estimates of measured REE. The equations from Institute of Medicine and the World Health Organization are also consistent with the measured REE from IC

METHODS

Table 1: Participant demographics

	Females (N=30)		Males (N=30)	
	Mean ± SD	Range	Mean ± SD	Range
Age	24.2 ± 4.1	18.0 - 38.0	28.6 ± 6.4	18.0 - 43.0
Height (cm)	166.0 ± 7.0	154.2 - 187.0	176.1 ± 5.4	166.4 - 186.5
Weight (kg)	60.3 ± 8.5	47.6 - 85.2	75.4 ± 9.4	56.3 - 93.1
Body Fat (%)	20.4 ± 5.8	8.3 - 35.6	17.7 ± 6.2	5.7 - 31.7
Body Mass Index (kg/m ²)	21.8 ± 2.7	18.1 - 31.2	24.3 ± 2.6	19.5 - 28.0

Procedures

- Participants signed an informed consent
- Participants fasted for 10 hours before coming into lab the next morning
- Resting energy expenditure was measured using open-circuit indirect calorimetry following previously published guidelines [4]
- Estimates of REE from the Fitbit Flex and the SenseWear Mini were obtained from the corresponding software and website

Fitbit Flex



SenseWear Mini



RESULTS

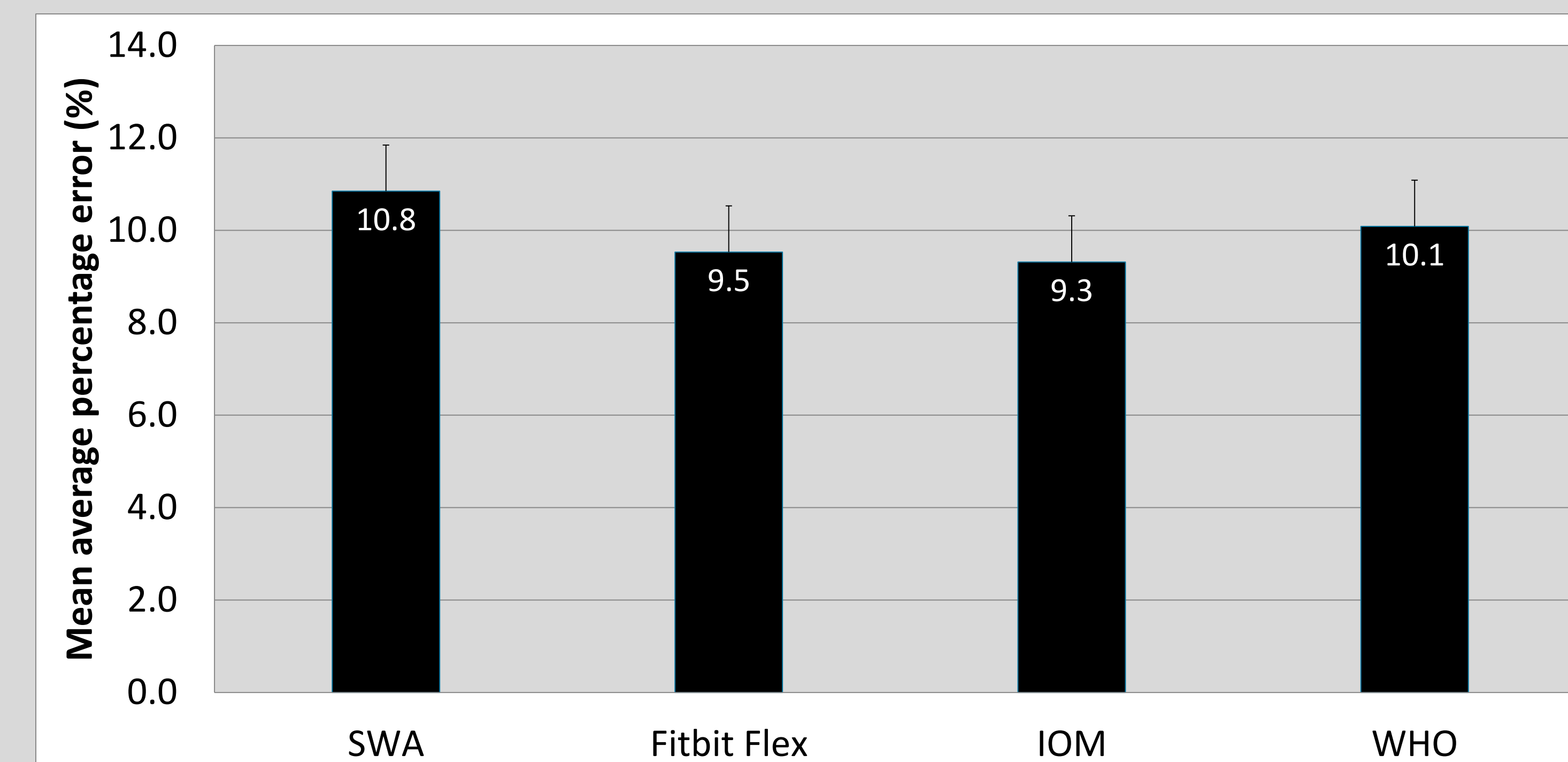
Table 2: REE (kcal/day) from each method of measure measurement

	Mean ± SD	Range
Measured Resting (IC)	1554.2 ± 249.3	1189.0 - 2500.2
SenseWear Mini	1587.1 ± 247.7	1239.8 - 2101.3
Fitbit Flex	1528.0 ± 213.0	1152.0 - 1920.0
Institute of Medicine	1559.1 ± 217.7	1218.5 - 1986.8
World Health Organization	1598.3 ± 246.0	1180.1 - 2099.8

- ANOVA and post-hoc analyses showed no significant effects of gender for any of the comparisons with REE from IC

RESULTS (Continued)

Figure 1: Mean Absolute Percentage Error for Activity Monitors



- No significant differences (p-values < 0.05) were observed between the measured REE, FF, SWA, IOM, and WHO in REE estimates
- Pearson correlation coefficients for the Fitbit Flex, SenseWear Mini, Institute of Medicine, and World Health Organization in relation to IC were 0.635, 0.640, 0.657, and 0.683, respectively.

CONCLUSIONS

- The estimates of REE from the Fitbit Flex, SenseWear Mini, Institute of Medicine, and World Health Organization are consistent with IC REE measurement
- The derived REE value from the two wearable devices as well as the equations from the Institute of Health and World Health Organization provide reasonable estimates of REE

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