

SWACSM Abstract

Determining Validity and Reliability of Caloric Expenditure Recorded by Wearable Technology While Walking and Running

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ABSTRACT

With growing interest in tracking exercise progress, wearable technology is increasingly popular. While heart rate and step count are typically accurate for consumer-available devices, research from our laboratory indicates that caloric expenditure is not. **PURPOSE:** The current investigation aimed to evaluate the validity and reliability of caloric expenditure in multiple wearable devices during a self-paced walk and run. **METHODS:** Ten participants were tested (5F, 5M, age = 26.9± 9.43 years, body mass = 72.64± 7.73 kg, height = 168.66± 9.37 cm). Participants were asked to wear 5 devices: 2 Garmin Instinct watches (one on each wrist), 2 Polar Vantage M2 watches, and a K5 portable metabolic analysis system (criterion measure). Data was collected from all devices while participants completed a 5-minute self-paced walk, followed by a 5-minute rest period, then a 5-minute self-paced run. Validity was evaluated using the mean absolute percent error (MAPE) with a threshold of below 10 percent and Lin's Concordance Correlation Coefficient (CCC) with significance above 0.7. Reliability was evaluated using the Intraclass Correlation Coefficient (ICC) and Coefficient of Variation (CV). **RESULTS:** For validity, neither device met the predetermined threshold for MAPE or CCC (see results table for reference). For reliability, only the Polar device during the running condition returned consistent results for both measures. **CONCLUSION:** These results indicate neither brand of watch produced valid energy expenditure estimates. Reliability was also poor. This poses a challenge to people relying on wearable devices to keep an accurate, consistent log of caloric expenditure. Our research does not indicate that technology is keeping up with how rapidly it is being developed and sold to the public.

Validity	Walking			Running		
	Calories	MAPE	CCC	Calories	MAPE	CCC
K5	24.2 (6.6)			51.89 (11.03)		
Garmin Instinct	35.56 (8.57)	57.72	-0.16	62.67 (10.58)	30.14	0.26
	35.33 (11.5)			67.89 (12.41)		
Polar Vantage M2	34.89 (5.35)	43.39	0.15	61.22 (11.29)	18.23	0.63
	33.89 (2.98)			56.44 (9.51)		
Reliability	Calories	CV	ICC	Calories	CV	ICC
Garmin Instinct 1	35.56 (8.57)	17.29	0.507	62.67 (10.58)	9.999	0.139
Garmin Instinct 2	35.33 (11.5)			67.89 (12.41)		
Polar Vantage M2 1	34.89 (5.35)	5.68	0.557	61.22 (11.29)	5.32	0.797
Polar Vantage M2 2	33.89 (2.98)			56.44 (9.51)		