VALIDATING THE ADIDAS MICOACH AND NIKE+ SPORT KIT FOR ESTIMATING PACE, DISTANCE, AND ENERGY EXPENDITURE DURING OVER-GROUND EXERCISE

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PREVIEW

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Dedication

I dedicate this to my parents,
Gregory and Diane Porta,
without whom my academic achievements would not be possible.

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PREVIEW

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Abstract

There is currently no known published research validating the Adidas miCoach or Nike+ Sport Kit personal training systems for outdoor, over-ground walking and running. To validate these devices for estimating pace ($min \cdot km^{-1}$), distance (km) and energy expenditure (EE) ($kcal \cdot min^{-1}$) during outdoor over-ground walking and running for two different sensor configurations, 6 male and 8 female participants with moderate endurance training (Mean ± SE Age: 28.21 ± 2.27 y; Body Mass: 60.93 ± 2.97 kg; Height: 167.43 ± 2.09 cm; Percent Body Fat: 14.93 ± 1.94% (N=16); and VO_{2max}: 54.44 ± 1.47 $mL \cdot kg^{-1} \cdot min^{-1}$) completed this study. The protocol consisted of walking at 53.6, 80.4 and 107.2 $m \cdot min^{-1}$ and running at 134.0, 160.8, 187.6 and 214.0 $m \cdot min^{-1}$ on an outdoor, 400 meter track, while wearing a portable metabolic measurement unit (COSMED K4b^2). Each sensor was attached on the right (miCoach) and left (Nike+) shoelaces (LC), as well as the midsole (MC) of the shoe. Estimated pace, distance and EE were compared to values determined by criterion methods (AC). Data were analyzed using a MANOVA (pace, distance) or MANCOVA with repeated measures (energy expenditure) to evaluate significant differences. For the miCoach, each subsequent stage elicited a significant change in estimated pace for both the LC and MC ($p \leq 0.001$) except between 53.6 and 80.4 $m \cdot min^{-1}$, and 107.2 and 134.0 $m \cdot min^{-1}$ at the MC. The miCoach LC and MC also demonstrated a significant change for distance ($p=0.019$) and EE ($p=0.032$) with each subsequent speed. For the Nike+, each subsequent stage elicited a significant change in estimated values for pace ($p=0.001$), distance ($p< 0.001$), and EE ($p<0.001$). The miCoach LC and MC pace were significantly different from each other at 80.4 $m \cdot min^{-1}$ ($p=0.021$). There were no other significant differences seen between miCoach LC and MC, or between Nike+ LC and MC for pace; likewise, there were no significant differences between the miCoach LC and MC or Nike+ LC and MC for distance. The miCoach LC and MC EE were significantly different from each other at walking speeds of 53.6 and 80.4 $m \cdot min^{-1}$ ($p \leq 0.012$). There were no other significant differences seen between the miCoach LC and MC, or between the Nike+ LC and MC for EE. For practical purposes, miCoach seems to be useful; however, the Nike+ seems to fall short of the manufacturers' claims. The inability of both the miCoach and Nike+ to correctly estimate pace, distance and EE across the entire range of speeds indicates that these do not appear to be valid assessment instruments for outdoor research purposes.

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Introduction

According to the 2011 physical activity (PA) update by the American College of Sports Medicine, healthy adults aged 18 to 65 years should perform moderate-intensity (M-I) aerobic PA for a minimum of 30 minutes, five days each week, or vigorous-intensity (V-I) aerobic PA for a minimum of 20 minutes, three days per week (Garber et al., 2011). An alternative to these recommendations is to perform a combination of both M-I PA, or brisk walking, at a metabolic equivalent (MET) range of 3.0-6.0, that noticeably accelerates heart rate (HR) and V-I PA, or jogging, at greater than 6.0 METS, causing substantial increase in HR four days per week; twice performing M-I PA for 30 min, and twice performing V-I PA for 20 minutes (Garber et al., 2011). Often people misinterpret these recommendations or do not fully understand PA requirements, believing that their light activities of daily living (ADL) are sufficient to meet M-I PA or that only V-I PA will improve overall health (Garber et al., 2011). However, M-I PA should be accounted for in addition to the light intensity ADL's (e.g. washing dishes, taking out the trash, walking from your car to the store), and can even be separated into more convenient 10-minute periods of M-I PA, provided an accumulated 30 minutes is performed throughout the day (Garber et al., 2011).

In the past, the National Institutes of Health (NIH) had expressed concern over the reliability of PA assessments due to the difficulties of assessing PA under free-living conditions (Schutz, Weinsier, & Hunter, 2001). One method to assist in monitoring PA in the general population is activity monitors such as accelerometers and pedometers, which are being marketed to the average person as motivational and training aids. Physical activity monitors provide an objective method of measuring PA with immediate feedback for the user; however, there appears to be little research on the validity and reliability of a few of these devices. Therefore, the introduction of numerous activity monitors from different manufacturers necessitates the need to validate the use of these monitors; in particular, the Adidas miCoach and Nike+ Sport Kit.

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The Adidas miCoach is a three piece training system that utilizes a stride sensor affixed to the shoe, a HR monitor for assessing intensity, and a pacer system worn by the user which telemetrically records stride and HR data, and provides voice feedback through an earphone. The Nike+ Sport Kit, similar to the Adidas miCoach, is a two part device in which a sensor is affixed to the shoe and wirelessly linked through a receiver attached to an Apple iPod Nano (Apple Inc. CA, USA), which stores and tracks data, as well as gives you feedback while allowing you to listen to your own selected music playlist. There was little reported research on the validation of the Adidas miCoach for PA; however, there has been one published conclusion on the validity of the Nike+ Sport Kit (Kane, Simmons, John, Thompson, & Bassett, 2010), as well as the first known published conclusions supporting the shoelaces sensor placement (Conger, Strath, & Bassett, 2005) and similar experimental design to the current study (King, Torres, Potter, Brooks, & Coleman, 2004) that assisted in the development of experimental design for this study. Although the Nike+ has been validated, the similarities to the miCoach for shoelaces and midsole configurations, for intended use, and the ability to perform similar measurements (pace, distance, and EE) provides direct comparison and reduces inter-subject variance through simultaneous investigation, under identical treatment conditions. Therefore, the purpose of the current study was to validate the accuracy of both the Adidas miCoach, and Nike+ Sport Kit to estimate pace ($min \cdot km^{-1}$), distance (km) and energy expenditure (EE) ($kcal \cdot min^{-1}$), in two different sensor configurations during outdoor, over-ground walking and running.

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1.1 Specific Aims

1.1.1 Sensor Validation.

To validate the Adidas miCoach and Nike+ sport kit by examining EE, pace, and distance, using indirect calorimetry, pacing strategy and known distance on a 400 meter outdoor, over-ground running track at seven different walking and running speeds.

1.1.2 Sensor Placement.

To validate the Adidas miCoach and Nike+ sport kit for both the midsole and laces configurations by examining the sensor placement in a compatible shoe at seven different walking and running speeds.

1.2 References

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