Board #23  May 29 9:30 AM - 11:00 AM
Accuracy of Activity Monitors in Measuring Energy Expenditure and Heart Rate During a Gym-based Routine
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No relationships reported

PURPOSE: Two wrist-worn monitors (FBS and GVF) and an armband (SWA) were evaluated in measuring energy expenditure (EE) and heart rate (HR) during a gym-based routine.

METHODS: Men (n = 21) and women (n = 16) completed a gym-based routine comprised of 15-min stationary cycling (SC), 15-min treadmill running (TR), and 35-min resistance training (RTR) at self-selected intensities while wearing the monitors. All monitors were compared to a portable metabolic analyzer (OM) for EE. The FBS and GVF were compared to a chest HR monitor (PM) for maximal HR (HRmax) and average HR (HRavg).

RESULTS: Compared to the OM, the FBS and GVF produced higher EE estimates while the SWA overestimated EE during TR and underestimated EE for the rest (Table 1). Equivalence testing determined that no monitor was equivalent to the OM, although the SWA yielded the most favorable agreement for whole session as the 90% CI (410.9-500.1 kcal) overlapped the higher end of the equivalence zone (423.6-517.7 kcal) by only 12.7 kcal. Acceptable measurement error (± 20%) for whole session was produced by the SWA and for TR by the SWA and GVF, while for RTR the GVF had the highest measurement error (Table 1). Significant bias was observed for the FBS and GVF during SC (10.1 ± 39.2 kcal and 18.6 ± 33.7 kcal), RTR (47.4 ± 52.7 kcal and 82.0 ± 79.2 kcal), and whole session (83.2 ± 93.7 kcal and 104.4 ± 131.9 kcal). In regards to HRmax, and HRavg max, both monitors’ 90% CIs fell in the equivalence zones with the exception of HRmax measured by the FBS for RTR. The GVF had an improved accuracy over the FBS as indicated by lower error rates for HRmax (SC: 2.0% vs 5.9%; TR: 2.4% vs 3.1%; and RTR: 2.4% vs 9.5%) and HRavg max (SC: 0.8% vs 1.4%; TR: 0.9% vs 1.5%; and RTR: 0.9% vs 7.0%).

CONCLUSION: The study protocol simulated real-world conditions to facilitate naturalistic application of the findings. No monitor accurately estimated EE, however, the SWA had the most favorable estimates. The FBS and GVF demonstrated comparable performance for both HR and EE estimates.

Board #24  May 29 9:30 AM - 11:00 AM
Innovations in Heart Rate Monitoring Devices and Smart Applications: Physical Configuration Matters!
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No relationships reported

Bluetooth/ANT+ heart rate monitors and smart device applications have the potential to advance heart rate monitoring in non-clinical settings. New innovative applications allow for heart rate monitoring on multiple users simultaneously; however, preliminary attempts to use a particular commercially available model in a typical university gymnasium session revealed persistent issues with signal interruption; thus, the trustworthiness of the data was limited.

PURPOSE: To reduce the prevalence of signal interruption by determining the best physical configuration of components.

METHODS: A quasi-experimental repeated measures design was utilized to determine the best configuration of the system components. Cluster and ANOVA analyses determined good, better, and best configurations. The dependent variable was signal interruption and the unit of analyses was the number of signal interruptions per two-minute session. The independent variables were height (1.8m, 3.6m, and 5.4m), angle (60°, 75°, and 90°), and location (left corner, middle, right corner) of the transmitter component. University students, male and female adults ages 19-25 with no apparent heart health problems, were recruited to participate during undergraduate physical education teacher education lab classes. Participants were monitored while participating in physical activities during normal class sessions. Classes were conducted in a typical indoor gymnasium slightly larger than a single standard collegiate-sized basketball court.

RESULTS: Inspection of the graphs and ANOVA analyses revealed that the best configuration of the system was transmitter device placement at a height of 1.8m and angle of 60° in both hands pushing setting while the absolute validity was high when the device applied on the wrist of non-dominant hand. The dependent variable was signal interruption and the unit of analyses was the number of signal interruptions per two-minute session. The independent variables were height (1.8m, 3.6m, and 5.4m), angle (60°, 75°, and 90°), and location (left corner, middle, right corner) of the transmitter component. University students, male and female adults ages 19-25 with no apparent heart health problems, were recruited to participate during undergraduate physical education teacher education lab classes. Participants were monitored while participating in physical activities during normal class sessions. Classes were conducted in a typical indoor gymnasium slightly larger than a single standard collegiate-sized basketball court.

RESULTS: Inspection of the graphs and ANOVA analyses revealed that the best configuration of the system was transmitter device placement at a height of 1.8m and angle of 60° in both hands pushing setting while the absolute validity was high when the device applied on the wrist of non-dominant hand.

CONCLUSIONS: The height, angle, and location of the transmitter component all played a significant role in reducing the prevalence of signal interruption. It was determined that the best results were found with the lowest height and smallest angle chosen. Therefore, random placement of transmitter height, angle and location will not yield the best heart rate monitoring results.

Board #25  May 29 9:30 AM - 11:00 AM
Absolute Validity And Test-retest Reliability Of Step Counts For Fitbit Flex 2 In Pram Walking
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No relationships reported

PURPOSE: To test the absolute validity and test-retest reliability in two kinds of pram walking settings and help researchers and postnatal women to choose suitable tools for monitoring physical activity levels.

METHODS: 12 participants who were adult women (23.2 ± 0.7 years old) wore Fitbit Flex 2 on both wrists to perform the outdoor protocol: Two rounds of state distance pram walking of two settings (one round for each setting): (1) Both hands pushing setting; (2) One hand pushing setting. The step counts from Fitbit Flex 2 were compare to video recording to assess the absolute validity and test-retest reliability.

RESULTS: The average Mean Absolute Percentage Error (MAPE) of step counts for left and right wrists in both hands pushing setting were 43.1% and 49.1%. In one hand pushing setting, the average MAPE of step counts for wrist of dominant hand was 52.6%, and 5.1% for wrist of non-dominant hand. In both hands pushing setting, the Fitbit Flex 2 had a low correlation (ICC=0.40) for wrist of dominant hands while the correlation of wrist of non-dominant hand was good (ICC= 0.85). In one hand pushing setting, the correlations are excellent (ICC=0.99) for wrist of non-dominant hand and moderate for wrist of dominant hand (ICC=0.68).

CONCLUSIONS: The absolute validity of step counts for Fitbit Flex 2 was poor when device applied on the wrists of both hands in both hands pushing setting and dominant hand in one hand pushing setting while the absolute validity was high when the device applied on the wrist of non-dominant hand in one hand pushing setting. The test-retest reliability is excellent to good when the device wore on the wrist of non-dominant hand and moderate to poor on the wrist of dominant hand.

Board #26  May 29 9:30 AM - 11:00 AM
Comparisons of Portable Metabolic Sensors During Outdoor Cycling
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No relationships reported

Wearable technology has increased in prevalence and in the ability to monitor health related data. Additionally, the ability to record training data through various sensors has become essential in developing highly personalized training programs. Metabolic measurements have typically been confined to laboratory settings, but portable metabolic carts make the collection of these metrics in real world conditions possible.

PURPOSE: The purpose of this study was to compare measurements of VO2max from two different portable metabolic carts, a new consumer focused cart (A) and a research grade cart (B), in outdoor cycling under steady state conditions.

METHODS: A total of 10 participants were included in the study. All participants were recreationally trained cyclists who had track racing experience. Participants completed a ramp VO2max test with lactate sampling from capillary blood at one minute intervals. Lactate threshold (LT) was estimated as the first stage prior to an increase of >1 mmol in lactate concentration.

No relationships reported