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Validation Of Accelerometers Combined With Machine Learning For Estimating Energy Expenditure Of Health Qigong Baduanjin

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Accelerometer (ACC) is considered as a practical wearable device in quantifying daily physical activity while the accuracy of its built-in algorithms in estimation of energy expenditure (EE) of a specific exercise hasn't been validated yet. Health Qigong Baduanjin (HQB) as a traditional Qigong with various varied body-postures and movements, ACCs combined with machine learning provides a new idea to estimate EE.
PURPOSE: To determine the validity of artificial neural networks combined ACCs model (ANNs model), a kind of non-linear machine learning algorithms, for estimating metabolic equivalents (METs) of HQB.
METHODS: 21 subjects (10 males, 11 females; age: 21.3±1.5 yrs) who had been practicing HQB for 2.4±0.8 years voluntarily engaged in this study where they were required to practice HQB wearing a portable metabolic analyzer and 3 ACCs that worn on right wrist (RW), right thigh (RT), and right ankle (RA). Raw data from portable metabolic analyzer and ACCs were collected and then divided into 24 30-s windows for statistical analysis. Thirty-six processed independent variables (3 ACCs×3 axes× 4 variables (average counts, max counts, minimal counts and standard deviation)) were selected to develop an ANNs model and then the model was trained and tested. METs values were determined and compared between data from the metabolic analyzer, results of the built-in algorithm of ACCs and estimation of ANNs model.
RESULTS: Taking the data from metabolic analyzer as the gold standard, METs values of HQB was 2.9±0.9 and the results of ACC's built-in algorithm of RW, RT and RA were 1.9±0.3,1.2±0.1,1.0±0.3 respectively while the estimation of ANNs model was 2.8±0.8. To compare the validity of the ANNs model with the built-in algorithm of ACC, the correlation with the gold standard of ANNs was higher than those of RW, RT and RA (r = 0.77 vs. 0.09,0.48,0.21) and RMSE was lower (0.6 vs. 1.1, 1.8, 1.9 METs).
CONCLUSIONS: The estimation of the ANNs model in predicting Energy Expenditure of HQB is much closer to the gold standard comparing with using the in-built algorithm of ACC directly. Further studies should focus on the application of ACCs combined with machine learning in estimating EE in HQB and other physical activities.

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The Effect Of Quarantine On Daily Physical Activity Differs Between Athletes And Non-athletes

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After the World Health Organization declared COVID-19 a global pandemic, quarantine orders reduced opportunities for public engagement in physical activity (PA).
PURPOSE: To determine the effect of quarantine on PA levels in athletes and non-athletes across the lifespan.
METHODS: A questionnaire evaluating PA and exercise behaviors prior to and during quarantine was completed by 189 males and females aged 14-73yr. Chi-squared analyses compared behavior differences between age groups and athletic statuses; logistic regression models estimated the odds of behavior changes based on pre-quarantine characteristics.
RESULTS: Mean age was 28.1±16.2yr, BMI was 25.0±5.2kg/m^2, and 25.4% of subjects participated in individual or team athletics. Pre-quarantine, athletes reported greater engagement in PA ($p<0.001$) and were more likely to maintain levels during quarantine (64.6% vs. 41.1%; $p=0.005$). Sedentary behavior was reported by 0% of athletes and 15.6% of non-athletes before quarantine ($p=0.004$), and 30.2% of athletes and 46.8% of non-athletes during quarantine ($p=0.059$). Age and sedentism were positively correlated prior to ($p=0.014$) but not during ($p=0.706$) quarantine. Highly active lifestyles were reported by 56.3% of athletes and 19.9% of non-athletes prior to quarantine ($p<0.001$), and 30.2% of athletes and 12.9% of non-athletes during quarantine ($p=0.010$). Age was inversely correlated with high activity prior to ($p=0.017$) but not during ($p=0.213$) quarantine. Subjective reasons for reduced PA were lack of motivation (59.7%), gym closure (32.8%), stress (23.1%), and equipment availability (6.0%). Holding age and athletic status constant, predictors of a reduction in PA were whether the subject was highly active before (95% CI of OR: 1.937 to 9.683; $p<0.001$) and possession of a gym membership (95% CI of OR: 1.784 to 6.304; $p<0.001$). Predictors of sedentary behavior during quarantine were a lack of motivation (95% CI of OR: 2.307 to 17.380; $p<0.001$), gym closure (95% CI of OR: 1.408 to 12.809; $p=0.010$), and an absence of home equipment (95% CI of OR: 1.216; $p=0.034$).
CONCLUSIONS: Athletes and non-athletes across the lifespan experienced a reduction in PA during quarantine. Access to equipment, motivation, and pre-quarantine exercise behaviors emerged as determinants of activity level during quarantine.

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Sleep Regularity Metrics Are Associated With Lower Levels Of Physical Activity In Children

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Healthy lifestyle behaviors are developed during childhood and influence future cardiovascular disease (CVD) risk. Relations between short sleep duration (total time asleep), attenuated physical activity (PA), and augmented sedentary behavior (SB) have previously been established; however, sleep health is multidimensional and extends beyond duration alone. Sleep regularity is one metric of sleep health that is operationalized as the variability in sleep duration (sleep duration standard deviation (SDSD)) and sleep timing (sleep midpoint standard deviation (SMSD)). Not yet known is if sleep regularity is related to PA and SB in children.
PURPOSE: To evaluate if sleep regularity metrics are associated with PA and SB in apparently healthy children. We hypothesized that less regular sleep would be associated with decreased PA and increased SB in healthy children.
METHODS: Sleep regularity metrics (SDSD, SMSD), PA metrics (METS, steps/day), and a metric of SB (sedentary bouts) were recorded in 29 apparently healthy 7-12-year-old children (10±2 yrs, 12 B/17 G) for 7 consecutive days and nights via wrist accelerometry. Linear regression models were used to evaluate associations between sleep regularity, PA, and SB metrics, with and without consideration of sleep duration.
RESULTS: SDSD averaged 0.8±0.5 hours/night and SMSD averaged 49±36 minutes/night. Sedentary bouts were significantly and positively associated with SDSD and SMSD and remained significant in regression models adjusting for sleep duration ($p\leq0.05$). METS were unrelated to SDSD and SMSD prior to adjustment. However, after adjusting for sleep duration, METS were significantly and positively associated with SDSD and SMSD ($p\leq0.05$).
CONCLUSION: Less regular sleep is associated with decreased PA and increased SB in children ages 7-12 after adjusting for sleep duration. Recently, it has been suggested that the 24-hour balance between PA, SB, and sleep are related to health indicators in youth, and this data signals that sleep regularity should be included in addition to sleep duration when considering this framework. Therefore, promoting healthy behaviors like adequate PA and regular sleep/wake habits in addition to adequate sleep duration likely benefits CV health starting in youth.
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Concordance Between Accelerometer-derived And Self-reported Physical Activity And Sedentary Time In Adults With Autism

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Despite the overall poor health profiles documented in adults with autism spectrum disorder (ASD), there is little information on physical activity (PA) and sedentary time in this population, and the agreement between objective and subjective measures of these variables in adults with ASD is unknown.
PURPOSE: To examine the concordance between accelerometry-measured and self-reported PA and sedentary time in adults with ASD.
METHODS: Twenty-four adults with ASD wore GT3X+ tri-axial accelerometers (ActiGraph, Pensacola, FL) for seven consecutive days and completed the International Physical Activity Questionnaire-Short Form (IPAQ-SF) on the last day of their study participation to estimate PA and sedentary time. The standardized IPAQ-SF guidelines and commonly used ActiGraph data cleaning principles were employed to process subjective and objective measurements, respectively. Paired sample t-tests and Bland-Altman plots were utilized to assess the difference and magnitude of agreement between the two measures.