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Objective versus Self-Reported Physical Activity in Overweight and Obese Young Adults

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Abstract

Background—To compare moderate-to-vigorous intensity physical activity (MVPA) assessed via questionnaires to an objective measure of MVPA in overweight or obese young adults.

Methods—MVPA was assessed in 448 [median BMI = 31.2 (Interquartile Range: 28.5–34.3) kg/m^2] young adults [median age: 30.9 (Interquartile Range: 27.8–33.7) years]. Measure included

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the SenseWear Armband ($MVPA_{OBJ}$), the Paffenbarger Questionnaire ($MVPA_{PAFF}$), and the Global Physical Activity Questionnaire (GPAQ). The GPAQ was used to compute total MVPA ($MVPA_{GPAQ\text{-}TOTAL}$) and MVPA from transportation and recreation ($MVPA_{GPAQ\text{-}REC}$).

Results—The association between $MVPA_{OBJ}$ and $MVPA_{PAFF}$ was r_s=0.40 (p<0.0001). Associations between $MVPA_{OBJ}$ and $MVPA_{GPAQ\text{-}TOTAL}$ and $MVPA_{GPAQ\text{-}REC}$ were r_s=0.19 and r_s=0.32, respectively (p<0.0001). $MVPA_{GPAQ\text{-}TOTAL}$ was significantly greater than $MVPA_{OBJ}$ (p<0.0001). Median differences in MET-min/week between $MVPA_{OBJ}$ and $MVPA_{PAFF}$ or $MVPA_{GPAQ\text{-}REC}$ were not significantly different from zero. There was proportional bias between each self-reported measure of MVPA and $MVPA_{OBJ}$. There were significant associations between all measures of MVPA and fitness. $MVPA_{OBJ}$ was significantly associated with BMI and percent body fat.

Conclusions—Objective and self-reported measures of MVPA are weakly to moderately correlated, with substantial differences between measures. $MVPA_{OBJ}$ provided predictive validity with fitness, BMI, and percent body fat. Thus, an objective measure of MVPA may be preferred to self-report in young adults.

BACKGROUND

Physical activity has been shown to be associated with improved health outcomes and reduced morbidity and mortality.[1] Given the public health concern over high prevalence rates of overweight and obesity, physical activity has also been identified as an important behavior to prevent weight gain and to facilitate weight loss. Within weight control studies a variety of methods have been used to assess physical activity that include both self-report and objective techniques,[2–4] with the majority of studies using self-report techniques such as questionnaires. However, many of the commonly used questionnaires have not been validated for specific use in obesity-related research.

The EARLY (Early Adult Reduction of Weight through Lifestyle Intervention) Consortium,[5] a group of studies evaluating varying treatments to prevent and treat obesity in young adults (18–35 years of age), has adopted common measures of self-reported physical activity across these studies. However, the questionnaires that have been adopted in the Early Consortium, the Paffenbarger Questionnaire[6–8] and the Global Physical Activity Questionnaire (GPAQ),[9] were not developed specifically for use in a population of young adults who are overweight or obese. Thus, comparison of these questionnaires to criterion measures would provide important information when interpreting the physical activity data from the studies included in the EARLY Consortium.

A Paffenbarger Questionnaire has commonly been used to assess leisure-time physical activity.[6–8] The original questionnaire queried individuals about their physical activity patterns over the previous 12 months. The validity and reliability of this questionnaire has been previously reported.[10–14] However, some intervention trials and cross-sectional or longitudinal observational studies have modified the Paffenbarger Questionnaire to query leisure-time physical activity over the prior week rather than the prior 12 months, as originally intended. While this modified questionnaire has been shown to be sensitive to detecting change in physical activity,[2,15–17] the validity of the questionnaire, especially in a population of young adults who are overweight or obese, with this modification has not been reported.

The GPAQ[9] was developed for surveillance of physical activity in diverse populations. While the GPAQ has shown moderate to good concurrent validity with other physical activity questionnaires,[18] the limited data available on the validity of the GPAQ as compared with objective measures of physical activity have shown poor agreement with cross-sectional assessment of physical activity.[19,20] Moreover, whether this questionnaire is valid for use specifically with an overweight and obese population is unclear.

The IDEA (Innovative approaches for Diet, Exercise, and Activity) Study within the EARLY Consortium also included objective assessment of physical activity and an objective measure of fitness. This presents an opportunity to examine the validity of these questionnaires to assess moderate-to-vigorous intensity physical activity (MVPA) compared to an objective measure, which is the purpose of this study. Specifically, the results presented will focus on data available from the baseline assessment.

METHODS

Subjects

Subjects were recruited for participation in a university-based weight loss intervention study between October 2010 and October 2012. Recruitment occurred primarily through direct mail advertisements in the Greater Pittsburgh Area, with the catchment area being within 10 miles of the University of Pittsburgh. Eligibility requirements included body mass index (BMI) ≥25.0 to <40.0 kg/m^2, age between 18 to <36 years, medical clearance from their primary care physician for participation in this study, and no contraindications to exercise being identified from a baseline graded exercise test. Exclusion criteria included: 1) past or planned weight loss surgery, 2) current participation in a commercial weight loss program, 3) current or planned enrollment in another diet, physical activity, or weight loss intervention study, 4) current treatment for an eating disorder, 5) history of a cardiovascular event or of other cardiovascular disease, 6) current use of medication that would affect heart rate or blood pressure responses to exercise, or taking medication that could affect metabolism or change body weight, 7) self-report of losing >5% of current weight in the previous 3 months, 8) treatment for malignancy other than non-melanoma skin cancer, 9) current treatment for diabetes mellitus, 10) women or are currently pregnant or gave birth within the last 6 months, currently lactating or breastfeeding within the last 3 months, or actively planning pregnancy within the next 24 months. Each subject provided written informed consent, completed a detailed medical history and a physical activity readiness questionnaire, and obtained written consent from their physician. Subjects were not compensated for their participation in this study. The University of Pittsburgh Institutional Review Board approved all study procedures. An external Data and Safety Monitoring Board was appointed by the funding agency to oversee this study.

Assessments

Baseline data prior to randomization from subjects who were deemed eligible for participation were used for the analyses.

Body Mass Index (BMI)—BMI (kg/m^2) was computed from weight and height. Weight was assessed on a digital scale with the subject clothed in a light-weight cloth hospital gown. The average of two measures that varied by ≤0.2 kg were used to represent weight, and if necessary a third measure was taken. If the criteria of ≤0.2 kg difference between 2 of these 3 measures was not met, then the average of the 3 measures was used to represent weight.

Height was assessed on a wall-mounted stadiometer with shoes removed. The average of two measures that varied by ≤0.5 cm were used to represent height, and if necessary a third measure was taken. If the criteria of ≤0.5 cm difference between 2 of these 3 measures was not met, then the average of the 3 measures was used to represent height.

Body Composition—Body composition was assessed using dual-energy x-ray absorptiometry (iDXA, GE Lunar, Madison, WI). Prior to the scan, women completed a urine pregnancy test to confirm non-pregnancy.

Cardiorespiratory Fitness—Cardiorespiratory fitness was assessed using a submaximal graded exercise test performed on a treadmill. Speed was 80.4 m/sec with grade starting at 0% and increasing by 1% until the point of test termination. The test was terminated at the point at which the subject achieved 85% of age-predicted maximal heart rate, with age-predicted maximal heart rate computed as 220 minus age. A 12-lead electrocardiogram was used to assess heart rate at each minute and at the point of test termination. The presence of heart rate or blood pressure response that indicated a contraindication to continued exercise resulted in test termination. Only subjects who achieved the 85% of age-predicted maximal heart rate are included in this study. Oxygen consumption was assessed using a calibrated metabolic cart (Carefusion Encore). Time to termination and oxygen consumption at the point of termination were used for data analysis.

Objective Assessment of Moderate-to-Vigorous Physical Activity ($MVPA_{OBJ}$)—The Body Media SenseWear device was used to provide an objective assessment of physical activity. This device is worn on the posterior surface of the upper arm and has been shown to provide a valid measure of laboratory-based[21] and free-living[22] energy expenditure. Prior to leaving the laboratory, subjects were instructed to wear the armband for all waking hours over a period of 7 days. No additional contact to encourage compliance with the protocol was initiated by the investigators with the subject during the period that the device was worn. The device is able to detect when it is being worn. Data were used for analysis if the device was worn for ≥10 hours on ≥4 days.[23,24] Minute-by-minute data were used to identify minutes of MVPA, defined as an intensity ≥3 metabolic equivalents (METs), that were performed in bouts of ≥10 minutes. MET-min/week were computed to represent $MVPA_{OBJ}$.

Self-Reported MVPA—A modified version of the Paffenbarger Questionnaire[6–8] was used to assess MVPA ($MVPA_{PAFF}$) over the week prior to the baseline assessment. Subjects were queried, using a trained interviewer, on the amount of daily brisk walking performed for the purpose of exercise or transportation, and participation in other forms of sport, recreational, or fitness activities. Participants were also asked whether the prior week reflected their typical pattern of physical activity. Brisk walking was converted to MET-min/week. The Compendium of Physical Activity[25,26] was used to assign METs to the other activities reported on this questionnaire, and for activities of ≥3 METs per minute, the frequency and duration of the activity was used to compute MET-min/week. The sum of MET-min/week from brisk walking and other activities of ≥3 METs per minute was used to compute $MVPA_{PAFF}$.

Subjects also completed the GPAQ.[9] For this investigation only responses to questions pertaining to MVPA were included. Total MVPA ($MVPA_{GPAQ\text{-}TOTAL}$) was determined from responses to questions pertaining to activity performed for recreation, household, occupation, and transportation. In addition, recreational MVPA ($MVPA_{GPAQ\text{-}REC}$) was determined from responses to questions pertaining to activity performed for the purpose of recreation or transportation. Data were converted to MET-min/week based on a published analysis guide.[27]

Statistical Analysis

Descriptive statistics summarize baseline characteristics. Frequencies and percentages are reported for categorical data. Medians, interquartile ranges (IQR), and ranges are reported for continuous data.

Spearman's rank order correlation was used to assess the strength of associations between estimates of MET-min/week of MVPA based on self-report ($MVPA_{PAFF}$, $MVPA_{GPAQ\text{-}TOTAL}$, $MVPA_{GPAQ\text{-}REC}$) and the armband ($MVPA_{OBJ}$), and to test whether associations differed significantly from 0. The Wilcoxon signed-rank test was used to determine whether the median difference between each self-reported measure of MVPA and $MVPA_{OBJ}$ differed significantly from zero. Agreement between measures was examined with Bland-Altman plots.[28] The means of the differences between each self-reported measure of MVPA and $MVPA_{OBJ}$ (X axis) and the differences between measures (self-report of MVPA – $MVPA_{OBJ}$; Y axis) were plotted on a $\log_{10}$ scale to improve visualization due to the wide range of values. The plots include three horizontal lines: a line of equality, indicating the same value for self-report and objective measures of MVPA, and the limits between which 95% of values fall. Because the differences between measures were not normally distributed, the 2.5^{th} and 97.5^{th} percentiles of differences were used as limits.

Spearman's correlation coefficients were used to estimate strength of association and test whether the associations between measures of MVPA and fitness, BMI, and percent body fat differed significantly from zero.

Analyses were conducted using SAS for Windows statistical software package version 9.3 (SAS Institute, Cary, NC, USA). All reported p-values are two-sided; p-values less than 0.05 are considered to be statistically significant.

RESULTS

Participant characteristics for 448 participants with usable armband wear time are shown in Table 1. Valid physical activity data from the armband were available for 80.8%, 13.0%, 4.5%, and 1.8% of participants on 7, 6, 5, and 4 days, respectively. Median armband wear time was 13.9 (IQR: 13.1–14.5) hours per day (range: 10.7 to 17.4 hours per day). The armband identified no MVPA during the assessment period for 13.0% (n=58) of participants, whereas 21.2% (n=95) reported no $MVPA_{PAFF}$, 9.6% (n=43) reported no $MVPA_{GPAQ\text{-}TOTAL}$, and 33.9% (n=152) reported no $MVPA_{GPAQ\text{-}REC}$. For the subsample of 385 participants who self-reported that the data on the Paffenbarger Questionnaire for the prior week reflected their typical pattern of physical activity ($MVPA_{PAFF\text{-}TYPICAL}$), 23.6% (n=91) reported no $MVPA_{PAFF}$.

There was a moderate correlation between $MVPA_{OBJ}$ and $MVPA_{PAFF}$ (r_s=0.40, p<0.0001), and a similar association was found with $MVPA_{PAFF\text{-}TYPICAL}$ (r_s=0.42, p<0.0001). There was a significant, but weak, correlation between $MVPA_{OBJ}$ and $MVPA_{GPAQ\text{-}TOTAL}$ (r_s =0.19, p<0.0001). The correlation with $MVPA_{GPAQ\text{-}REC}$ was r_s=0.32 (p<0.0001).

Distributions and comparisons of objective vs. self-reported MVPA (MET-min/week) are shown in Table 2. Based on objective measurement, median (IQR) $MVPA_{OBJ}$ was 430.2 (123.6–866.2) MET-min/week. Median differences of MET-min/week between $MVPA_{OBJ}$ and $MVPA_{PAFF}$ (p=0.13), $MVPA_{PAFF\text{-}TYPICAL}$ (p=0.92) or $MVPA_{GPAQ\text{-}REC}$ (p=0.73) were not significantly different from zero. However, participants reported significantly more MET-min/week of $MVPA_{GPAQ\text{-}TOTAL}$ compared to $MVPA_{OBJ}$ (p<0.0001).

Bland-Altman plots (Figure 1) illustrate the differences between the self-reported measures of MVPA ($MVPA_{PAFF}$, $MVPA_{PAFF\text{-}TYPICAL}$, $MVPA_{GPAQ\text{-}TOTAL}$, $MVPA_{GPAQ\text{-}REC}$) and $MVPA_{OBJ}$ by the mean of each respective self-reported and objective MPVA measure. For all comparisons between self-reported MVPA and $MVPA_{OBJ}$, the fairly even distribution of data points above and below the line of equality demonstrates there was not a strong systematic bias, in which one measure consistently had higher values than the other. However, for all comparisons, there was a proportional bias, whereby the difference between the self-report and objective measure increased with mean MVPA. Additionally, the limits between which 95% of observations fell for the difference between self-reported MVPA and $MVPA_{OBJ}$ were extremely wide. These limits ranged from 1988 to 11533 more MET-min/week self-reported than $MVPA_{OBJ}$, and from 1888 to 2393 fewer MET-min/week self-reported than $MVPA_{OBJ}$.(Figure 1). The most extreme values were either due to participants self-reporting MVPA when the armband measured none (6.7% for $MVPA_{PAFF}$, 11.4% for $MVPA_{GPAQ\text{-}TOTAL}$, 5.6% for $MVPA_{GPAQ\text{-}REC}$), or participants self-reporting no MVPA when the armband measured MVPA (15.0% for $MVPA_{PAFF}$, 8.0% for $MVPA_{GPAQ\text{-}TOTAL}$, 26.6% for $MVPA_{GPAQ\text{-}REC}$).

Spearman's correlation coefficients were also computed between both self-reported measures of MVPA and $MVPA_{OBJ}$, and fitness, BMI, and percent body fat (Table 3). Significant associations were found between fitness and both $MVPA_{OBJ}$ and all self-reported measures of MVPA. Only $MVPA_{OBJ}$ was significantly associated with both BMI and percent body fat.

DISCUSSION

This study compared measures of MVPA assessed using both objective ($MVPA_{OBJ}$) and self-reported measures ($MVPA_{PAFF}$, $MVPA_{PAFF\text{-}TYPICAL}$, $MVPA_{GPAQ\text{-}TOTAL}$, $MVPA_{GPAQ\text{-}REC}$,). There were significant, but weak to modest, correlations between $MVPA_{OBJ}$ and all measures of self-reported MVPA. Median differences in MET-min/week between $MVPA_{OBJ}$ and both $MVPA_{PAFF}$ and MVPA were not significantly different (Table 2). However, there was proportional bias between all self-reported measures of MVPA and $MVPA_{OBJ}$, with greater differences at higher MVPA, and the range of differences between each self-report measure and the objective measure of MVPA were large (Figure 1). These findings indicate that self-reported and objectively measured MVPA should not be used interchangeably to represent MVPA in overweight and obese young adults.

Physical activity assessed with the original version of the Paffenbarger Questionnaire has shown modest associations with objectively measured physical activity across a variety of populations. Correlations of 0.29 in men and women 21 to 59 years of age,[10] 0.30 post-menopausal women,[11] and 0.34 in a Latino population 18 to 55 years of age[13] have been reported between total self-reported physical activity from the Paffenbarger Questionnaire and activity counts from an accelerometer. These correlations are similar in magnitude to the correlation of 0.40 between $MVPA_{OBJ}$ and $MVPA_{PAFF}$ reported in this current study of overweight and obese young adults.

Studies have also reported the cross-sectional association between objectively measured physical activity and self-reported physical activity measured with the GPAQ. Hermann et al. reported correlations of 0.28 and 0.48 in adults 18 to 65 years of age between accelerometry and total moderate intensity and total vigorous intensity physical activity, respectively.[19] Hoos et al. reported correlations between recreational physical activity assessed with the GPAQ and both MVPA (r=0.38) and total physical activity (r=0.33) measured with an accelerometer in a study of adult Latinos.[20] These are of similar magnitude with the correlation of 0.32 between $MVPA_{OBJ}$ and $MVPA_{GPAQ\text{-}REC}$ found in this study. However, a more modest correlation of 0.19 was observed between $MVPA_{OBJ}$ and $MVPA_{GPAQ\text{-}TOTAL}$ in this study.

The modest, but significant, correlations between $MVPA_{OBJ}$ and self-reported measures of MVPA should be interpreted with caution, as they measure association, not agreement. Additionally, the lack of significant difference in median differences of MET-min/week between $MVPA_{OBJ}$ and both $MVPA_{PAFF}$ and $MVPA_{GPAQ\text{-}REC}$ could have resulted from the broad range of variability in the data for each method of measurement, which results in widely dispersed distributions.[29] Thus, it is important to determine the size of the difference between methods for each participant to discern the level of agreement. Despite the non-significant differences in MET-min/week between $MVPA_{OBJ}$ and both $MVPA_{GPAQ\text{-}REC}$ and $MVPA_{PAFF}$, the IQR of differences (Table 2) illustrate that the differences between measures was clinically relevant among the majority of participants. For example, while the median difference between $MVPA_{OBJ}$ and $MVPA_{PAFF}$ was zero, a quarter of participants' self-reported MVPA was at least 439 MET-min/week more than the accelerometer, and another quarter of participants' self-reported MVPA was at least 356.9 MET-min/week less than the accelerometer. The differences between which 95% of values fell were wide. These data show disagreement between self-reported measurements of MVPA and $MVPA_{OBJ}$, suggesting that these measures of self-reported MVPA should not be used interchangeably with $MVPA_{OBJ}$.

This study also examined the predictive validity of $MVPA_{OBJ}$ and measures of self-reported MVPA with cardiorespiratory fitness, BMI, and percent body fat (Table 3). Significant associations with cardiorespiratory fitness were found with $MVPA_{OBJ}$ and all self-reported measures of MVPA. The correlation of 0.22 between oxygen consumption and $MVPA_{PAFF}$ is comparable in magnitude to the correlation of 0.29 reported by Siconolfi et al. in men and women with an approximate mean age of 41 years[14], but less in magnitude than the correlations of 0.52 found in a sample of post-menopausal women[12] and 0.60 found in men and women with an age range of 21 to 59 years[10] that have been reported by others. However, these other studies used a maximal exercise test, whereas the current study used a submaximal exercise test to assess oxygen consumption. The weak correlation between oxygen consumption and $MVPA_{GPAQ\text{-}REC}$ is similar in magnitude to the correlation between oxygen consumption measured from a maximal exercise test and MVPA measured by the GPAQ that was reported by Hermann et al.[19]

Only $MVPA_{OBJ}$ was found to be significantly associated with BMI and percent body fat, with an inverse relationship found for both measures (see Table 3). Other studies have shown moderate-to-strong associations between $MVPA_{PAFF}$ and both BMI and percent body fat.[10,11] The lack of significant associations between either $MVPA_{GPAQ\text{-}TOTAL}$ or $MVPA_{GPAQ\text{-}REC}$ and BMI or percent body fat is not consistent with past studies.[19,30] The lack of significant associations between the self-reported measures of MVPA and either BMI or percent body fat may be a result of the current study including only overweight and obese young adults, whereas other studies have included a wider spectrum of weight, including normal, healthy weight adults.

There are potential limitations to this study that should be considered. For example, this study used a multi-sensor armband system to objectively assess physical activity, and different results may have been observed if an accelerometer or other wearable device was used. Moreover, the population was primarily Caucasian, female, white, well-educated, and with a relatively moderate to high income level. These characteristics may limit the generalizability of the results beyond this population group. This study also used a submaximal graded exercise test for cardiorespiratory fitness, whereas other studies reported data based on a maximal exercise test,[10,12,14,19] which might explain differences between the findings reported here and those of others. Although this study included two measures of self-reported MVPA, the GPAQ and the Paffenbarger Questionnaire, it is unclear if similar results would be found if other self-reported measures of MVPA were to be examined. It is also recognized that both the Paffenbarger Questionnaire and the GPAQ do not necessarily coincide with the week that the objective measure of MVPA was conducted, and this too could influence the comparison of these measures. In addition, an important consideration is that this study was not specifically designed to test the validity of the physical activity measurements that are included, but rather takes advantage of baseline data from an existing study to compare self-report and an objective measure of MVPA. Strengths of this study include the relatively large sample (N=448), the ability to examine the findings specific to young adults, the inclusion of objectively measured MVPA and fitness, and the use of dual-energy x-ray absorptiometry to measure body composition.

In summary, the results of this study suggest that objective and self-reported measures of MVPA do not necessarily provide comparable results in overweight and obese young adults. On an individual basis, there is wide variability in the difference between objectively and the self-reported measures of MVPA. Moreover, when predictive validity was examined, the strongest and most consistent associations were found with objectively measured MVPA. These findings suggest that when feasible, inclusion of an objective measure of MVPA is preferred rather than GPAQ or Paffenbarger Questionnaire to a measure of MVPA in a population of young adults who are overweight or obese. Whether similar results would be observed with other self-reported measures of MVPA cannot be determined from this study and warrants further investigation. Moreover, future studies should examine components of these self-reported measures to determine how to improve their ability to accurately measure MVPA in a population of young adults who are overweight or obese.

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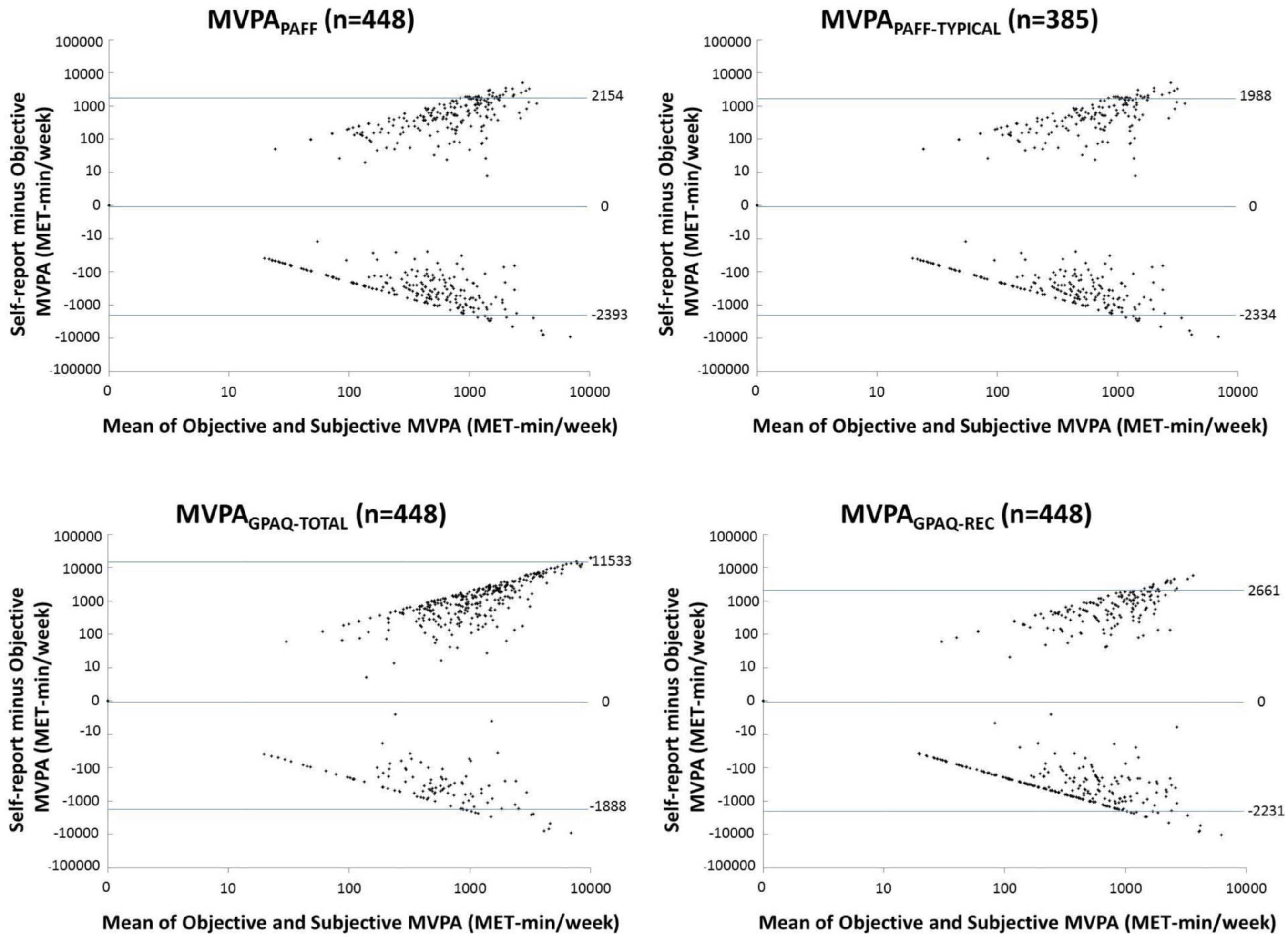

Figure 1.

Mean vs. difference between self-reported and objectively measured MVPA (MET-min/week).

Table 1

Participant Characteristics (n=448)

Variable	
Sex n (%)	
Female	315 (70.3)
Male	133 (29.7)
Race, n (%)	
White*	351 (78.3)
Non-white*	97 (21.7)
Education, n (%)	
High school graduate or General Education Development (GED)	107 (23.9)
College graduate	187 (41.7)
Masters or Doctoral Degree	154 (34.4)
Household income, n (%)	
less than $50,000	179 (40.0)
$50,000–<$75,000	97 (21.7)
$75,000 or more	172 (38.4)
Age, years	
median (IQR**)	30.9 (27.8–33.7)
Range	18.4 – 35.9
Body Mass Index (BMI), kg/m2	
median (IQR**)	31.2 (28.5–34.3)
Range	24.4 – 39.9
Percent Body Fat, (%)	
median (IQR**)	40.8 (36.7–45.1)
Range	18.0 – 56.0
Fitness test: termination time, seconds	
median (IQR**)	620 (500–760)
Range	140 – 1420
Fitness test: oxygen consumption at test termination, ml/kg/min	
median (IQR**)	26 (22.9–30.0)
Range	14.4 – 50.1

IQR = Interquartile rang

*13 white and 5 non-white participants are Hispanic ethnicity.

Table 2

Distribution and comparison of objective vs. self-reported MVPA (MET-min/week) in overweight and obese young adults (n=448)

	median	(IQR)	[range]	*P*
$MVPA_{OBJ}$	430.2	(123.6 – 866.2)	[0–11393.3]	
$MVPA_{PAFF}$	432.0	(96.0, 1029.0)	[0,5250.0]	
$MVPA_{PAFF}$ minus $MVPA_{OBJ}$	0.0	(−286.2 – 439.2)	[−8999.3–4977.7]	0.13
$MVPA_{PAFF\text{-}TYPICAL}$ (n=385)[*]	345.6	(48.0, 933.8)	[0.0,5250.0]	0.92
$MVPA_{PAFF\text{-}TYPICAL}$ minus $MVPA_{OBJ}$	0.0	(−312.9 – 360.0)	[−8999.3–4977.7]	
$MVPA_{GPAQ\text{-}TOTAL}$	1180.0	(480.0–2520.0)	[0,28320.1]	
$MVPA_{GPAQ\text{-}TOTAL}$ minus $MVPA_{OBJ}$	599.4	(0 – 1851.1)	[−8993.3–27491.3]	<.0001
$MVPA_{GPAQ\text{-}REC}$	360.0	(0.1080.0)	[0, 19200.0]	
$MVPA_{GPAQ\text{-}REC}$ minus $MVPA_{OBJ}$	−32.3	(−356.9 – 434.2)	[−10433.3–18303.9]	0.73

GPAQ=Global Physical Activity Questionnaire
MVPA=moderate to vigorous intensity physical activity
IQR=Interquartile range

$MVPA_{OBJ}$: MVPA in bouts of ≥10 minutes measured objectively with the SenseWear Armband.
$MVPA_{PAFF}$: MVPA measured using the Paffenbarger Questionnaire

[*] $MVPA_{PAFF\text{-}TYPICAL}$: MVPA measured using the Paffenbarger Questionnaire that excludes 63 (14.1%) participants who reported that the past week was not typical of their physical activity.

$MVPA_{GPAQ\text{-}TOTAL}$: Total MVPA measured using the Global Physical Activity Questionnaire
$MVPA_{GPAQ\text{-}REC}$: Recreational and transportation MVPA measured using the Global Physical Activity Questionnaire

Table 3

Spearman's correlation coefficients between measures of physical activity and measures of cardiorespiratory fitness, body mass index, and percent body fat in overweight and obese young adults (n=448)

Measures of MVPA	Cardiorespiratory Fitness: Termination Time (seconds)	Cardiorespiratory Fitness: Oxygen Consumption at Termination (ml/kg/min)	Body Mass Index (kg/m^2)	Percent Body Fat
$MVPA_{OBJ}$	0.37 <.0001	0.37 <.0001	−0.23 <.0001	−0.28 <.0001
$MVPA_{PAFF}$	0.25 <.0001	0.22 <.0001	−0.05 0.33	−0.10 0.04
$MVPA_{PAFF\text{-}TYPICAL}$ (n=385*)	0.24 <.0001	0.22 <.0001	−0.04 0.43	−0.08 0.10
$MVPA_{GPAQ\text{-}TOTAL}$	0.11 0.02	0.12 0.01	0.02 0.64	−0.015 0.76
$MVPA_{GPAQ\text{-}REC}$	0.22 <.0001	0.21 <.0001	−0.04 0.44	−0.07 0.12

MVPA=moderate to vigorous intensity physical activity

$MVPA_{OBJ}$: MVPA (MET-min/week) in bouts of ≥10 minutes measure objectively with the SenseWear Armband.

$MVPA_{PAFF}$: MVPA (MET-min/week) measured using the Paffenbarger Questionnaire

*$MVPA_{PAFF\text{-}TYPICAL}$: MVPA (MET-min/week) measured using the Paffenbarger Questionnaire that excludes 63 (14.1%) participants who reported that the past week was not typical of their physical activity.

$MVPA_{GPAQ\text{-}TOTAL}$: Total MVPA (MET-min/week) measured using the Global Physical Activity Questionnaire

$MVPA_{GPAQ\text{-}REC}$: Recreational and transportation MVPA (MET-min/week) measured using the Global Physical Activity Questionnaire