ÇOMÜ SPOR BİLİMLERİ DERGİSİ
http://dergipark.gov.tr/comusbd Cilt:6 Sayı:3 Yıl: 2023

Association between Self-Reported Physical Activity and Physical Fitness in Healthy Men

Yetkin Utku KAMUK[1], Tuncay ALPARSLAN[2], Ramiz ARABACI[3]*

ABSTRACT

Purpose: The aim of the present study was to evaluate the association between self-reported physical activity (PA) levels and objective physical fitness measurements in healthy men.

Method: Three hundred and eighty-five subjects (age 29.84±4.55 yrs; BMI 25.61±2.61 kg.m^{-2}) voluntarily participated in the study. The participants were evaluated in groups of 8 to 10 subjects in 4 consecutive days. Physical activity questionnaire (IPAQ-Short Form), anthropometric measurements, strength, force, flexibility, anaerobic power, dynamic balance, and maximal aerobic capacity tests were applied according to a schedule. One-Way ANOVA and Kruskal-Wallis H tests were used to test differences among groups, independent samples t-test and Mann-Whitney U tests were used to compare two groups where appropriate. Correlations between variables were tested by using Spearman's rho. Statistical significance level was set at $p<0.05$.

Results: Positive correlations were found between physical activity levels and obesity, body mass index, and fat percentage. Strength, aerobic and anaerobic performances were found to be negatively correlated to physical activity levels. Although the correlations were significant, no moderate or strong correlations were observed between self-reported physical activity levels and measured physical fitness components.

Conclusion: These results revealed that using self-report in assessing individuals' physical fitness levels was skeptical. The weak (or no) correlation between physical activity and the measured physical fitness components raised the idea that self-report would not be a highly reliable tool to be used as an alternative to objective measurements.

Keywords: Health, Sedentary males, Self-assessment, Reliability

ÖZET

Sağlıklı Erkeklerde Kişi Tarafından Bildirilen Fiziksel Aktivite Düzeyi ve Fiziksel Uygunluk Arasındaki İlişki

Amaç: Bu çalışmanın amacı, sağlıklı erkeklerde beyan edilen fiziksel aktivite (FA) düzeyi ile objektif fiziksel uygunluk ölçümleri arasındaki ilişkinin değerlendirilmesidir.

[1]* Hitit Üniversitesi, Spor Bilimleri Fakültesi, Çorum/TÜRKİYE. ORCID: 0000-0001-5976-7503 yetkinkamuk@hitit.edu.tr
[2] Hava Kuvvetleri Komutanlığı, Uçucu Sağlığı Araştırma ve Eğitim Merkezi, Eskişehir/TÜRKİYE. ORCID: 0000-0003-2164-0085 talparslan@hvkk.tsk.tr
[3] Bursa Uludağ Üniversitesi, Spor Bilimleri Fakültesi, Bursa/TÜRKİYE. ORCID: 0000-0001-8403-5742 ramizar@uludag.edu.tr

Yöntem: Çalışmaya 385 kişi (yaş 29,84±4,55 yıl; vücut kütle indeksi 25,61±2,61 kg.m^{-2}) gönüllü olarak katılmıştır. Katılımcılar birbirini takip eden 4 gün içerisinde ve 10'ar kişilik gruplar halinde ölçümlere iştirak etmişlerdir. Fiziksel aktivite anketi (IPAQ-Kısa Form), antropometrik ölçümler, kuvvet, güç, esneklik, anaerobik güç, dinamik denge ve maksimal aerobik kapasite testleri uygulanmıştır. Çoklu gruplar arasındaki farkları test etmek için One-Way ANOVA ve Kruskal-Wallis H testleri, iki grubun karşılaştırılması için ise bağımsız örneklem t testi ve Mann-Whitney U testleri kullanılmıştır. Değişkenler arasındaki korelasyonlar Spearman's rho testi kullanılarak test edilmiştir. İstatistiksel anlamlılık düzeyi $p<0,05$ olarak belirlenmiştir.

Bulgular: FA düzeyleri ile obezite, vücut kitle indeksi ve yağ yüzdesi arasında pozitif; kuvvet testleri, aerobik ve anaerobik performanslar ile FA düzeyleri arasında negatif ilişki olduğu bulunmuştur. Korelasyonlar anlamlı olmasına rağmen, beyan edilen fiziksel aktivite seviyeleri ile ölçülen fiziksel uygunluk bileşenleri arasında anlamlı bir korelasyon tespit edilmemiştir.

Sonuç: Bu sonuçlar, bireylerin fiziksel zindelik düzeylerinin değerlendirilmesi amacıyla kişisel beyan yönteminin kullanılmasının, doğruluk düzeyi açısından, şüpheli olacağını ortaya koymuştur. Beyan edilen fiziksel aktivite düzeyi ile objektif ölçümler sonucunda elde edilen fiziksel uygunluk bileşenlerine ait değerler arasındaki zayıf korelasyon (ya da hiç korelasyon olmaması), beyan yönteminin objektif ölçümlere alternatif olarak kullanılabilecek çok güvenilir bir araç olmadığı fikrini ortaya çıkartmıştır.

Anahtar Kelimeler: Sağlık, Sedanter erkekler, Öz değerlendirme, Güvenilirlik

INTRODUCTION

Since the beginning of the industrial revolution, the use of human power was gradually decreased and today the human power is not the primary source of work especially for heavy labor. Although the human body was evolved most of its systems (i.e., musculoskeletal, metabolic and cardiopulmonary), it will not be reasonable to expect the human body to function at the desired level unless it is stimulated by sufficient PA (Hallal et al., 2012). Today, physical inactivity is considered as the fourth main risk factor for global mortality and according to the World Health Organization (WHO), adults aged 18 to 64 should perform at least 150 minutes of moderate or at least 75 minutes of intensive aerobic PA during the week, or a combination of moderate and strong intensity activities (WHO, 2020). Accurate assessment of PA is crucial in interventions promoting it and in studies exploring its association with health status (Domingos et al., 2021).

Evidence suggested that the prevalence of many diseases was increased by age and was associated with lower levels of physical fitness (PF), namely aerobic endurance, muscular strength, and balance (McPhee et al., 2016). A positive correlation can be expected between PA level and PF, but an appropriate scale is required to determine PF and the self-reported PA level. Using physical activity questionnaires seem to be a practical approach in investigating the health outcomes of the activity state (Blair et al., 2001). The International Physical Activity Questionnaire-Short Form (IPAQ SF) is the most widely used tool to assess self-reported PA. It was developed as an instrument for standardizing measures of the health-related PA behaviors of the population in multiple countries and different sociocultural contexts (Domingos et al., 2021). Previously, field tests were carried out by using devices such as pedometers and accelerometers and their relationship with IPAQ-SF were examined, but the relationship between objective tests and the physical activity status is curious. Moreover, in previous studies, self-reported PA was shown to underestimate immobility time, but overestimate PA levels of the participants compared to objective PA measurements (Prince et al., 2020; Dyrstad et. Al., 2014, Hagstromer et al., 2010). Along with this, studies in the general population have suggested that self-reported PA measurements were inaccurate and showed poor to moderate similarity compared to objective measurements (Rääsk et al., 2017; Schmidt et al., 2020; Boyle et al., 2015), but no studies comparing the physical activity questionnaire results and all of the physical fitness components (aerobic endurance, muscular fitness, flexibility, and body composition) tested in the laboratory environment were found in the literature.

The aim of present study was to evaluate the associations between self-reported physical activity and the physical fitness of healthy men.

METHOD

Participants

358 males (age 29.84±4.55 yrs; BMI 25.61±2.61 kg.m-2) who reported themselves as healthy, not on medication for at least two weeks, and with no known systemic diseases voluntarily participated. Subjects were informed about the aim and scope of the study and all participants gave their written consents before attendance. The study was approved by the Hitit University Non-interventional Researches Ethics Committee (Protocol No: 2019-132) prior to the study.

Data Collection

Data was collected on weekdays and the participants were warned not to perform any physical activity on the testing days and not to use stimulants such as medicine or coffee for two hours before the tests. The tests were performed in four different days. IPAQ-SF, anthropometric assessment, handgrip strength, leg force, back force, flexibility, and vertical jump measurements were held on the first testing day. The second day was allocated for anaerobic power test. The third day was reserved for the balance and the final testing day was for aerobic resistance assessment.

Measurements

Height of the participants were measured as recommended by ISAK (2001) at 1/10 cm sensitivity (Seca 213 portable stadiometer, seca GmbH, Germany). Weights of the participants were measured by using the bioelectric impedance analysis (BIA) (InBody 270, Biospace Corp., South Korea) device's scale function in 1/100 kilogram (kg). Body mass index (BMI) values of the participants were calculated by using the Quetelet formula. Body fat percentage (BFP) of the subjects were recorded as on the result sheet of the BIA. BFP measurements were performed according to the procedure specified by the user's manual of BIA device. Hip and waist circumferences were measured as explained by ISAK (2001) and waist-to-hip ratio (WHR) was also calculated to categorize the subjects according to their obesity risk. The subjects with a WHR lower than 0.95 were classified at "no risk" category and the others were classified at "risky" (Bray, Bouchard and James, 1998).

IPAQ-SF was used to assess the subjects' physical activity levels relying on their reported activity behaviors during the last 7 days. Total physical activity was estimated in MET min/week and physical activity levels were categorized as low, moderate or high (Silva-Batista et al., 2013).

A hand dynamometer (Takei T.K.K.5401, Takei Scientific Instruments Corp. Ltd., Japan) was used to measure hand grip strength. The arm was abducted 10-15 degrees and best of the three trials was recorded in kg. For the leg strength assessment, the participants were asked to step on the dynamometer's (Takei T.K.K.5402, Takei Scientific Instruments Corp. Ltd., Japan) base plate and pull the dynamometer's grip by producing power only by using legs. For the back strength test, the participants were asked to step on the dynamometer's base plate, and to pull the grip bar by using only back muscles. Best of three trials for both back and leg strength assessments were recorded in kg, separately.

30-second static balance test was held by using Sigma balance platform (Sigma Platforma Balansowa, Poland). Subjects were asked to step on the platform and look at the screen during the test. The platform was equipped with sensors to detect and record any swinging in body position. The length of the path was recorded.

Flexibility of the participants were tested by using a standard sit-and-reach box and the participants were asked to reach with their finger tips on the box as far as possible without bending knees while sitting on the mat. Best of three trials was recorded.

Bounce mat (Smartjump, Australia) was used to measure vertical jump height with a maximum voluntary contraction. Best of three trials was recorded.

Anaerobic power tests were performed by using ergometer (Wattbike WPM ModelB, UK) and Wingate Anaerobic Test (WAnT). Testing equipment recorded the average power in every 5 second interval during the 30-second test and provided the peak and the rate of deterioration. Participants took a 30-second maximal anaerobic exercise test on the cycle ergometer with a resistance of 7.5% of their body mass (Bar-Or, 1987). During this test, verbal motivation was used to encourage participants to exert maximal effort. The mean power, peak power, and relative power were measured by the WAnT.

A treadmill test with the gas analyzer was used to evaluate maximal oxygen consumption (VO_{2max}). The Bruce protocol (h/p/cosmos quasar med 190/65, Germany) was performed. The multi-stage protocol began at 1.7 mph at 10% grade with increasing work rate (speed and grade) at every 3 minutes until VO_{2max} was reached (Fletcher et al., 2001). Expired gas fractions (O_2 and CO_2) were collected at the mouth and analyzed with a metabolic cart (Cosmed Quark CPED metabolic cart, Italy). Measurements were processed in Omnia-Standalone. VO_2max was evaluated by the following criteria and the test was terminated if any one of these criteria was observed: a plateau in oxygen consumption (±2 $ml.kg^{-1}.min^{-1}$), respiratory exchange ratio of >1.10; heart rate within ten beats of predicted maximum (220–age) (Edvardsen, Hem and Anderssen, 2014).

Statistical Analysis

The data were analyzed by using SPSS 25.0 (IBM Corp., USA). Descriptive parameters and confidence intervals were shown in Table 1. Normal distribution assumption was widely rejected (Shapiro-Wilk Test: $p<0.05$). Differences between groups in non-normal data were analyzed by using Mann-Whitney U. Kruskal-Wallis H test was used to test differences among groups. Independent samples t test was used for comparisons in normally distributed groups. ANOVA was used to test differences among groups and Tukey's HSD was used as the post hoc test. Correlations between variables were tested by using Spearman's rho. Statistical significance was set at p<0.05 and Bonferroni correction was applied where appropriate.

RESULTS

The subjects' weight was 80.62±9.50 kg, height was 177.36±5.53 cm, and BFP was 21.11±5.00 %. Mean BMI value of the subjects was 25.61±2.61 kg.m^{-2}. It was clear that the subjects' BMI and BFP values were slightly over the normal range. Normal distribution of the data was tested by using the Shapiro-Wilk test and most of the variables were seen not to be normally distributed (Table 1).

Table 1. Descriptive Characteristics of Subjects (n=385)

Variables	Min	Max	Mean ± SD	*CI* (95%)	*Shapiro-Wilk*	
					Statistics	*p*
Age (yrs)	22.00	38.00	29.84±4.55	20.92-38.76	.908	.00*
Weight (kg)	55.60	110.00	80.62±9.50	62.00-99.24	.991	.03*
Height (m)	160.20	192.20	177.36±5.53	166.52-188.20	.995	.23
BMI (kg.m^{-2})	18.73	33.89	25.61±2.61	20.49-30.73	.980	.00*
Body Fat (%)	8.70	38.30	21.11±5.00	11.31-30.91	.994	.15
BMR (cal)	1429.00	2104.00	1726.99±137.59	1457.31-1996.67	.973	.00*
Waist Circumference (cm)	72.80	115.10	90.33±6.59	77.41-103.25	.982	.00*
Hip Circumference (cm)	87.50	119.80	102.31±5.21	92.10-112.52	.993	0.05*
Waist-to-Hip Ratio	0.77	1.03	0.88±0.04	0.80-0.96	.996	.40
Forearm Circumference (cm)	22.00	33.00	28.28±1.55	25.24-31.32	.984	.00*
Relative HG Strength (kg.weight^{-1})	0.384	0.830	0.58±0.08	0.42-0.74	.991	.02*
Leg Strength (kg)	53.00	300.50	152.54±32.81	88.23-216.85	.976	.00*
Sit and Reach (cm)	10.00	49.50	26.92±7.74	11.75-42.09	.984	.00*
Vertical Jump (cm)	23.00	54.50	37.42±5.20	27.23-47.61	.990	.01*
Balance Path Length (cm)	3.27	21.31	8.53±3.10	2.45-14.61	.944	.00*
Balance Area (cm^2)	0.04	0.93	0.19±0.15	0.00-0.48	.822	.00*
Peak Power (W)	340.00	983.00	711.13±121.82	472.36-949.90	.995	.26
Relative Peak Power (W.kg^{-1})	4.62	13.32	8.87±1.47	5.99-11.75	.995	.22
Anaerobic Capacity (W)	320.00	721.00	509.62±67.70	376.93-642.31	.996	.41
Relative Anaerobic Capacity (W.kg^{-1})	3.57	8.75	6.36±0.80	4.79-7.93	.995	.22
VO_2max (ml.kg^{-1}.min^{-1})	28.00	53.50	39.23±4.99	29.45-49.01	.994	.15

* *p*<0.05 (not normally distributed); *SD:* Standard deviation; *CI:* Confidence interval

MWU results revealed that age, BMI, waist and forearm circumferences, relative hand grip strength (RHGS), vertical jump, and balance path length significantly affected obesity risk (p<0.05). The older subjects were found to be at the risky category along with those who had larger waist and forearm circumferences. Subjects' RHGS was lower in "risky" group because the weight was used as the denominator in the RHGS. Similarly, vertical jump performances of the subjects in risky category were significantly lower than no risk category (p=.02). Balance path length was affected by obesity risk category and the length was longer in the risky category (p=.02).

Table 2. Analysis of differences by obesity risk (variables not meeting the assumption of normality)

Variables	Obesity Risk	*n*	$\bar{X}$±*SD*	Mean Rank	Sum of Ranks	*MWU*	*Z*	*p*
Age (yrs)	*No risk*	352	29.66±4.58	188.63	66398.00	4270.00	-2.53	.01*
	Risky	33	31.73±3.81	239.61	7907.00			
BMI (kg.m^{-2})	*No risk*	352	25.40±2.51	183.78	64692.00	2564.00	-5.31	.00*
	Risky	33	27.91±2.62	291.30	9613.00			
BMR (cal)	*No risk*	352	1722.51±134.58	189.91	66848.00	4720.00	-1.78	.08
	Risky	33	1774.79±1610.05	225.97	7457.00			
Waist Circumference (cm)	*No risk*	352	89.43±5.88	179.80	63289.00	1161.00	-7.60	.00*
	Risky	33	99.92±6.16	333.82	11016.00			
Hip Circumference (cm)	*No risk*	352	102.20±5.16	190.71	67129.00	5001.00	-1.32	.19
	Risky	33	103.42±5.65	217.45	7176.00			
Forearm Circumference (cm)	*No risk*	352	28.21±1.54	188.63	66399.00	4271.00	-2.52	.01*
	Risky	33	29.03±1.45	239.58	7906.00			
RHGS (kg.weight^{-1})	*No risk*	352	0.58±0.08	197.83	69635.50	4108.50	-2.78	.01*
	Risky	33	0.54±0.08	141.50	4669.50			
Leg Strength (kg)	*No risk*	352	151.88±33.17	189.92	66851.50	4723.50	-1.77	.08
	Risky	33	159.61±28.19	225.86	7453.50			
Sit and Reach (cm)	*No risk*	352	26.99±7.64	194.03	68298.50	5445.50	-0.59	.55
	Risky	33	26.14±8.89	182.02	6006.50			
Vertical Jump (cm)	*No risk*	352	37.62±5.26	197.02	69351.00	4393.00	-2.32	.02**
	Risky	33	35.25±4.00	150.12	4954.00			
Balance Path Length (cm)	*No risk*	352	8.42±30.05	189.00	66527.50	4399.50	-2.30	.02**
	Risky	33	9.76±3.40	235.68	7777.50			
Balance Area	*No risk*	352	0.19±0.15	192.23	67664.50	5536.50	-0.44	.66
	Risky	33	0.20±0.15	201.23	6640.50			

*p<.01. **p<0.05

Results of the analysis of the normally distributed variables by using the independent samples t test revealed that peak power and anaerobic capacity did not differ by obesity risk category (p>0.05). Relative values of these variables were found to have significant differences and as the waist-to-hip ratio (WHR) increased, relative values of both relative peak power (p=.03) and relative anaerobic capacity decreased (p<.01). Surprisingly, no significant differences were observed in VO_{2max} levels of the subjects (p>0.05).

Table 3. Analysis of differences by obesity risk (variables meeting the assumption of normality)

Variables	Obesity Risk	N	$\bar{X}$	*SD*	*t*	*df*	*p*
Peak Power (W)	No risk	352	708.91	123.74	-1.17	383.00	.24
	Risky	33	734.79	97.42			
Relative Peak Power ($W.kg^{-1}$)	No risk	352	8.92	1.49	2.19	383.00	.03**
	Risky	33	8.34	1.18			
Anaerobic Capacity (W)	No risk	352	508.70	68.58	-0.86	383.00	.39
	Risky	33	519.36	57.42			
Relative Anaerobic Capacity ($W.kg^{-1}$)	No risk	352	6.40	0.79	3.51	383.00	.00*
	Risky	33	5.90	0.75			
VO_2max ($ml.kg^{-1}min^{-1}$)	No risk	352	39.35	4.97	1.63	383.00	.10
	Risky	33	37.88	50.05			

*p<.01, **p<0.05

Multiple group comparisons for the non-normally distributed data by the physical activity (PA) levels were conducted by using KWH and the results showed that high PA level was significantly different from both moderate and low PA levels ($\chi2(2)=11.525$, p<.01) in hip circumference. MWU test results revealed that the subjects at high level PA had significantly lower hip circumference values than those at moderate and low PA levels. Sit-and-reach scores of the subjects with high PA level significantly differed from both moderate and low PA levels ($\chi2(2)=10.627$, p=.01). Moderate PA level was also different from low PA in flexibility. Vertical jump scores differed by the PA levels ($\chi2(2)=9.915$, p=.01). Those at high and moderate PA levels scored better than those at low PA level (Table 4).

Table 4. Analysis of differences by PA levels by using Kruskal-Wallis H

Variables	PA Level	*n*	Mean Rank	Mean ± *SD*	χ^2	*df*	*p*
Hip Circumference (cm)	*High†‡*	164	213.14	100.72±3.71	11.525	2	.00*
	Moderate	182	183.16	101.84±5.81			
	Low	39	154.24	103.20±5.02			
Sit and Reach (cm)	*High†‡*	164	171.74	28.21±6.50	10.627	2	.01*
	Moderate‡	182	207.25	28.00±8.06			
	Low	39	215.90	25.41±7.44			
Vertical Jump (cm)	*High‡*	164	184.32	40.34±5.56	9.915	2	.01*
	Moderate‡	182	189.53	37.12±5.42			
	Low	39	245.68	370.05±4.65			

* *p*<.01; †: Significantly different from moderate PA; ‡: Significantly different from low PA

ANOVA results revealed that relative peak power [F(2)=2.736, p<.01], relative anaerobic capacity [F(2)=9.536, p<.01], and VO_{2max} levels [F(2)=10.215, p<.01] of the subjects differed by PA levels. Tukey's HSD suggested that those at high PA level was found to be superior to both those at moderate and low PA levels. Relative peak power, relative anaerobic capacity, and VO_{2max} levels decreased as the PA levels decreased (p<0.05).

Table 5. Post-hoc Tukey's *HSD* analysis for the ANOVA

Variables	PA Levels		Mean Difference	*SE*	*p*
Relative Peak Power ($W.kg^{-1}$)	High	Moderate	-.34695	.156	0.05*
		Low	-.83398*	.258	.00*
Relative Anaerobic Capacity ($W.kg^{-1}$)	High	Moderate	-.28441*	.084	.00*
		Low	-.51261*	.139	.00*
VO_2max ($ml.kg^{-1}min^{-1}$)	High	Moderate	-2.08321*	.524	.00*
		Low	-2.87003*	.868	.00*

**p*<.01, *SE*: Standard error

Table 6. Correlations between variables by using Spearman's *Rho*

Variables	BMI		Level of Obesity		Obesity Risk		PA Level	
	rho	*p*	*rho*	*p*	*rho*	*p*	*rho*	*p*
Age (yrs)	.280**	.000	.228**	.000	.129*	.011	-.195**	.000
Weight (kg)	.825**	.000	.731**	.000	.234**	.000	-.115*	.024
Height (m)	-.001	.991	-.003	.952	0.052	.305	-.044	.388
BFP (%)	.668**	.000	.583**	.000	.279**	.000	-.208**	.000
BMR (cal)	.341**	.000	.295**	.000	.091	.075	-0.050	.326
Waist Circumference (cm)	.752**	.000	.636**	.000	.388**	.000	-.130*	.011
Hip Circumference (cm)	.701**	.000	.618**	.000	.067	.187	-.172**	.001
WHR	.381**	.000	.305**	.000	.485**	.000	-.034	.510
Forearm Circumference (cm)	.651**	.000	.578**	.000	.129*	.011	-0.051	.318
RHGS (kg)	-.470**	.000	-.420**	.000	-.142**	.005	.136**	.007
Leg Strength (kg)	.162**	.001	.122*	.016	.091	.076	-.046	.365
Sit-and-reach (cm)	.044	.390	.043	.401	-.030	.554	.163**	.001
Vertical Jump (cm)	-.162**	.001	-.153**	.003	-.118*	.020	.110*	.031
Balance Path Length (cm)	.134**	.009	.097	0.058	.118*	.021	-.047	.361
Balance Area (cm^2)	.030	.558	.010	.848	.023	.657	-.027	.604
Peak Power (W)	.267**	.000	.221**	.000	.064	.208	.063	.216
Relative Peak Power ($W.kg^{-1}$)	-.305**	.000	-.275**	.000	-.136**	.008	.160**	.002
Anaerobic Capacity (W)	.331**	.000	.267**	.000	0.054	.295	.087	.088
Relative Anaerobic Capacity ($W.kg^{-1}$)	-.451**	.000	-.410**	.000	-.195**	.000	.223**	.000
VO_2max ($ml.kg^{-1}.min^{-1}$)	-.262**	.000	-.233**	.000	-.091	.076	.223**	.000

Correlations between variables were tested by Spearman's rho. PA level was found to be negatively correlated to age, weight, BFP, waist and hip circumferences (p<0.05). The correlation between PA level and BFP was relatively higher but the correlation was below moderate (rho=-.208, p<.01). PA was positively correlated to RHGS, sit and reach, vertical jump, relative peak power, relative anaerobic capacity and VO_{2max} (p<0.05). Only relative anaerobic capacity and VO_{2max} variables were correlated to PA at rho=.223 (p<.01) level and the others' correlations to PA were lower. Although the correlation table revealed that peak power and anaerobic capacity had no statistically significant correlations with PA, these variables' relative values were correlated to PA. No correlations were observed between PA and height, BMR, WHR, forearm circumference, leg strength, balance path length, balance area, peak power and anaerobic capacity ($p<0.05$).

DISCUSSION and CONCLUSION

The present study was aimed to evaluate the associations between self-reported physical activity and the physical fitness of healthy men. Obesity levels and physical fitness test results were also compared.

BMI (25.61±2.61 kg/m^2) and BFP (21.11± 5.00 %) of the participants were above average. 8.6% of the participants in the study were above the obesity limit (27.91 ± 2.6 kg/m^2) and 91.4% were pre-obese (25.40±2.51 kg/m^2). The average of the performance tests are not at desired levels and can be considered as low. When the obesity risk and test performances were compared, there were no differences in some values (peak power, anaerobic capacity), but significant differences revealed when relative values were used (relative peak power, relative anaerobic capacity). Therefore, it may be more useful to use relative values when evaluating the results. There was a statistically significant correlation between the PA level and performance tests in favor of those with high PA levels, but the degree of this correlation was low. So, this low-level significant correlation might be accidental. It was found that performances were improved as the PA increased, but there were no sharp cuts between the PA groups by the objective test results. These results were beyond our expectations. The reason for this may be the fact that those who are sufficient and high according to the survey results of the study participants show or assume that they have higher PA levels due to self-esteem.

Previously, there have been studies investigating the consistency of evaluations using physical activity questionnaires with physical activity tests. Firefighters poorly predicted actual PA levels compared to their objective PA measurements, and obese firefighters reported the greatest discrepancy (Kling et al., 2020). Physical activity status among overweight and obese women was higher using the IPAQ-SF self-report method compared to the direct method using a pedometer (Ahmad et al., 2018). In our study, there is consistency between survey results and test results. Except for the balance test, there is a correlation between the high levels of all test results and those with high PA levels, but the level is low, although this correlation is significant. These results are in line with the results of the previous studies (Yosunaga et al., 2017; Santos et al., 2012; Cooper et al., 2015; Silva et al., 2019). In our study, as the BMI increased, the PF level and test performance decreased. Similarly, Durand et al. (2011) reported that increased PA was beneficial regardless of BMI category and high BMI levels had strong side effects on the human body system. In a study conducted with Norwegian adults with achondroplasia, the PA levels of the participants determined by IPAQ were compared to their cardiorespiratory fitness, 6-minute walking test, muscle strength and balance tests. A good level of correlation was observed between the physical activity and performances of the participants (Vries et al., 2021). Domingos et al. (2021) noted that although using the accelerometer to assess physical activity level has the advantage of being an accurate method, self-report surveys may provide valuable information only about the general body of the activities that the person might be involved in.

Maximal oxygen uptake (VO_{2max}) as a measure of cardiorespiratory fitness has been used as an indirect validation criterion in several validation studies on physical activity questionnaires (Montoye & Leon, 1993; Wareham et al., 2003). Aadahl et al. (2007) said that the physical activity questionnaire has acceptable validity in adult men and women compared to VO_{2max}. Furthermore, they suggested that only a simple question on self-rated fitness might objectively reflect the measured VO_{2max}. Although there is a low correlation was found between self-reported PA and PF tests, the results of the physical fitness questionnaire and the VO_{2max} scores were significant.

Despite positive correlations were observed between BMI and peak power and anaerobic capacity, the correlations became negative when relative values were used. This shows us that physical fitness is closely related to BMI and fat percentage.

No moderate or strong correlations were observed between self-reported physical activity levels and measured physical fitness components of the participants. These results make the outcomes of the IPAQ skeptical to be used in assessing individuals' physical fitness levels. The weak (or no) correlation between PA and the measured PF components revealed that IPAQ test would not be a highly reliable tool to be used as an alternative to objective measurements.

This study had some limitations. All of the participants were men. The effect of gender differences was not evaluated. Because the groups were divided according to performance and there could be performance differences depending on gender (Augustsson et al., 2009; Cheuvront et al., 2005). In future studies, a second assessment can be made by first applying the self-esteem scale to the participants.

REFERENCES

Aadahl, M., Kjær, M., Kristensen, J.H., Mollerup, B., & Jørgensen, T. (2007). Self-reported physical activity compared with maximal oxygen uptake in adults. European Journal of Cardiovascular Prevention & Rehabilitation, 14(3), 422–428.

Ahmad, M.H., Salleh, R., Mohamad Nor, N.S., Baharuddin, A., Rodzlan Hasani, W.S., Omar, A. et al. (2018). Comparison between self-reported physical activity (IPAQ-SF) and pedometer among overweight and obese women in the MyBFF@home study. BMC Women's Health, 18(S1), 100. https://doi.org/10.1186/s12905-018-0599-8

Augustsson, S.R., Bersas, E., Thomas, E.M., Sahlberg, M., Augustsson, J., & Svantesson, U. (2009). Gender differences and reliability of selected physical performance tests in young women and men. Advances in Physiotherapy, 11(2), 64–70 https://doi.org/10.1080/14038190801999679

Bar-Or, O. (1987). The Wingate anaerobic test an update on methodology, reliability and validity. Sports Medicine, 4(6), 381–394. https://doi.org/10.2165/00007256-198704060-00001

Blair, S.N., Cheng, Y., & Scott Holder, J. (2001). Is physical activity or physical fitness more important in defining health benefits? Medicine and Science in Sports and Exercise, 33(6S). https://doi.org/10.1097/00005768-200106001-00007

Boyle, T., Lynch, B.M., Courneya, K.S. & Vallance, J.K. (2015). Agreement between accelerometer-assessed and self-reported physical activity and sedentary time in colon cancer survivors. Supportive Care in Cancer, 23, 1121–1126.

Bray, G.A., Bouchard, C. & James, W. (1998). Definitions and proposed current classifications of obesity. In: Handbook of obesity. (Editors: George A. Bray, Claude Bouchard, William Philip James). New York Marcel Dekker pp. 31-40.

Cheuvront, S.N., Carter, R., Deruisseau, K.C., & Moffatt, R. J. (2005). Running performance differences between men and women: An update. Sports Medicine, 35(12), 1017 1024. https://doi.org/10.2165/00007256-200535120-00002

Cooper, A.J.M., Simmons, R.K., Kuh, D., Brage, S. & Cooper, R. (2015). Physical activity, sedentary time and physical capability in early old age: British birth cohort study. PLoS ONE, 10, e0126465.

Domingos, C., Correia Santos, N., & Pêgo, J.M. (2021). Association between self-reported and accelerometer-based estimates of physical activity in Portuguese older adults. Sensors, 21(7), 1-17. https://doi.org/10.3390/s21072258

Dyrstad, S.M., Hansen, B.H., Holme, I.M., Anderssen, S.A. (2014). Comparison of self-reported versus accelerometer-measured physical activity. Medicine and Science in Sports and Exercise, 46, 99-106.

Durand, G., Tsismenakis, A.J., Jahnke, S.A., Baur, D.M., Christophi, C.A., & Kales, S.N. (2011). Firefighters' physical activity: relation to fitness and cardiovascular disease risk. Medicine and Science in Sports and Exercise, 43(9), 1752–1759.

Edvardsen, E., Hem, E., Anderssen, S.A. (2014). End criteria for reaching maximal oxygen uptake must be strict and adjusted to sex and age: a cross sectional study. PLoS ONE 9(1): e85276. https://doi.org/10.1371/journal.pone.0085276

Fletcher, G.F., Balady, G.J., Amsterdam, E.A., Chaitman, B., Eckel, R., Fleg, J. et al. (2001). Exercise standards for testing and training: a statement for healthcare professionals from the American Heart Association. Circulation, 104(14), 1694–1740. https://doi.org/10.1161/hc3901.095960

Hagstromer, M., Ainsworth, B.E., Oja, P., Sjostrom, M. (2010). Comparison of a subjective and an objective measure of physical activity in a population sample. Journal of Physical Activity and Health, 7, 541–550.

Hallal, P.C., Andersen, L.B., Bull, F.C., Guthold, R., Haskell, W., Ekelund, U. et al. (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. The Lancet, 380(9838), 247–257.

International Society for the Advancement of Kinanthropometry (ISAK). (2001). International Standards for Anthropometric Assessment. Australia: ISAK.

Kling, H., Santiago, K., Benitez, L., Schaefer Solle, N., & Caban-Martinez, A.J. (2020). Characterizing objective and self-reported levels of physical activity among Florida firefighters across weight status category: a cross-sectional pilot study. Workplace Health and Safety, 68(11), 513–518. https://doi.org/10.1177/2165079920925505

McPhee, J.S., French, D.P., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: perspectives for healthy ageing and frailty. Biogerontology, 17(3), 567–580. https://doi.org/10.1007/s10522-016-9641-0

Montoye, H.J., & Leon, A.S. (1993). Assessment of the accuracy of physical activity questionnaire occupational data. Journal of Occupational Medicine, 35(10), 1017–1027.

Prince, S.A., Cardilli, L., Reed, J.L., Saunders, T.J., Kite, C., Douillette, K. et al. (2020). A comparison of self-reported and device measured sedentary behaviour in adults: A systematic review and meta-analysis. International Journal of Behavioral Nutrition and Physical Activity, 17, 1-17. https://doi.org/10.1186/s12966-020-00938-3

Rääsk, T., Mäestu, J., Lätt, E., Jürimäe, J., Jürimäe, T., Vainik, U. et al. (2017). Comparison of IPAQ-SF and two other physical activity questionnaires with accelerometer in adolescent boys. PLoS ONE, 12, e0169527.

Santos, D., Silva, A., Baptista, F., Santos, R., Vale, S., Mota, J., Sardinha, L. Sedentary behavior and physical activity are independently related to functional fitness in older adults. Exp. Gerontol. 2012, 47, 908–912.

Schmidt, C., Santos, M., Bohn, L., Delgado, B.M., Moreira-Gonçalves, D., Leite-Moreira, A. et al. (2020). Comparison of questionnaire and accelerometer-based assessments of physical activity in patients with heart failure with preserved ejection fraction: Clinical and prognostic implications. Scandinavian Cardiovascular Journal, 54, 77–83. https://doi.org/10.1080/14017431.2019.1707863

Silva, F.M., Petrica, J., Serrano, J., Paulo, R., Ramalho, A., Lucas, D. et al. (2019). The sedentary time and physical activity levels on physical fitness in the elderly: A comparative cross sectional study. International Journal of Environmental Research and Public Health, 16(19). https://doi.org/10.3390/ijerph16193697

Silva-Batista, C., Urso, R.P., Silva, A.E.L., & Bertuzzi, R. (2013). Associations between fitness tests and the International Physical Activity Questionnaire-Short form in healthy men. The Journal of Strength and Conditioning Research, 27(12), 3481–3487. https://doi.org/10.1519/JSC.0b013e31828f1efa

Silva, F.M., Petrica, J., Serrano, J., Paulo, R., Ramalho, A., Lucas, D. et al. (2019). The sedentary time and physical activity levels on physical fitness in the elderly: A comparative cross sectional study. International Journal of Environmental Research and Public Health, 16(19). https://doi.org/10.3390/ijerph16193697

Vries, O.M., Johansen, H., & Fredwall, S.O. (2021). Physical fitness and activity level in Norwegian adults with achondroplasia. American Journal of Medical Genetics, 185A, 1023-1032. https://doi.org/10.1002/ajmg.a.62055

Wareham, N.J., Jakes, R.W., Rennie, K.L., Schuit, J., Mitchell, J., Hennings, S. et al. (2003). Validity and repeatability of a simple index derived from the short physical activity questionnaire used in the European Prospective Investigation into Cancer and Nutrition (EPIC) study. Public Health Nutrition, 6(4), 407-413. https://doi.org/10.1079/phn2002439

WHO Guidelines on Physical Activity and Sedentary Behaviour. (2020). Geneva: World Health Organization.

Yasunaga, A., Shibata, A., Ishii, K., Koohsari, M.J., Inoue, S., Sugiyama, T. et al. (2017). Associations of sedentary behavior and physical activity with older adults' physical function: An isotemporal substitution approach. BMC Geriatrics, 17, 280-287.