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Original Article

Adaptation of the Global Physical Activity Questionnaire (GPAQ) into Turkish: A validation and reliability study

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ABSTRACT

Objectives: The aim of this study was to adapt the World Health Organization's (WHO) Global Physical Activity Questionnaire (GPAQ) into Turkish and evaluate its reliability and validity among Bornova Municipality employees.

Patients and methods: The questionnaire was given its final Turkish form after its translation by two independent translators, a consensus meeting with both translators and the revision of the back-translation. An expert panel was organized for face validity and expert opinions were collected for content validity. The data of the study were collected in Municipality of Bornova district, Izmir province of Turkey between August 2016 and November 2016. Test-retest was used for reliability, International Physical Activity Questionnaire (IPAQ) was used for concurrent validity, and a pedometer was used for criterion validity. Among a total of 2,137 workers, a sample size of 352 employees was determined using 33% prevalence with 5% error margin, 95% confidence interval, and 20% non-response rate. The participants were selected with systematic sampling and 287 (81.5%) workers (183 males, 104 females; mean age: 38.9±8.5 years; range, 22 to 63 years) participated in the study.

Results: Reliability coefficients were substantial, near perfect (Kappa 0.74-0.87, p<0.001; Spearman rho 0.77-0.91, p<0.001). A substantial, near perfect relationship was found between IPAQ and GPAQ (r=0.79-0.94, p<0.001). For criterion validity, a fair relationship was found between the pedometer results and GPAQ (r=0.32, p=0.001). As for discriminant validity, the participants with physically active jobs had higher levels of physical activity compared to others (median: 3,240, 960 metabolic equivalent [MET]-min/per week, p<0.001). Those with an income below the poverty line had median 2,400 MET-min/week compared to 1,200 for participants above the poverty line (p<0.001). A significant difference was found among different education duration of employment groups.

Conclusion: The Turkish version of GPAQ is reliable and valid. Further validity and reliability studies of the GPAQ among non-working groups such as housewives, students, and unemployed ones can be recommended. Based on these findings, the GPAQ can be used as a valid and reliable tool in the Turkish population.

Keywords: Activities of daily living, metabolic equivalent, sedentary behavior, surveys and questionnaires, validation study.

Rapid urbanization in developing countries has led to significant changes in health and has increased the burden of chronic illnesses.[1] Physical activity is a major, independent, and commutable risk factor of chronic diseases. Physical activity has substantial effects that protect from cardiovascular disease, stroke, type II diabetes, colon cancer, breast cancer,[2] psychological problems,[3] injuries, falls, and obesity.[4]

Physical activity is an area of public health interest around the world. According to systematic reviews, low level of physical activity increases all-causes mortality.[5] A meta-analysis including 80 studies with 1,338,143 participants (118,121 deceased), a 65% increased risk of mortality was found (95% confidence interval [CI], 0.60-0.71) while comparing the highest and lowest levels of physical activity.[5]

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Moderate-intensity physical activity is defined as activities during which a person spends three to six times more calories (3-6 metabolic equivalent [MET]) compared to sitting and vigorous-intensity physical activity as activities during which a person spends more than six times more calories (>6 MET) compared to sitting. The World Health organization (WHO) recommends that adults aged 18 to 64 should engage in at least 150 min of moderate-intensity aerobic physical activity or 75 min of vigorous-intensity aerobic physical activity weekly to remain healthy and promote health. Each aerobic activity should last at least 10 min.[6]

It is important to use a standard protocol in surveying the levels of physical activity in the society. Surveillance is necessary to intervene on risk factors. Questionnaires and objective tools (e.g., pedometers and accelerometers) are the methods used most commonly for the evaluation of the physical activity. Surveys are frequently used in wide-scale epidemiological studies as a method of measurement, as they are low-cost, are not interventional, and enable to reach a high number of participants.[7] Additionally, pedometers and accelerometers used for objective measurement are inadequate in differentiating activities done in different areas (i.e., work, transit, and leisure activities).

The International Physical Activity Questionnaire (IPAQ) is a scale commonly used in evaluating physical activity. It has short and long forms (IPAQ short, IPAQ long). However, it has certain disadvantages. The short form does not question about areas of activity such as work, transit, and leisure activities. The long form is, on the other hand, not suitable for community screening due to its length. Also, only the previous week is evaluated in the IPAQ, bringing a limitation on seasonality, and the representativeness of the past week during periods such as vacation and illness. The Global Physical Activity Questionnaire (GPAQ) was developed by the WHO to overcome these three disadvantages.[8]

The WHO recommends the STEPwise approach to Surveillance (STEPS) to identify chronic disease risks. The GPAQ is a component of STEPS.[2] The STEPS comprises 10 sections, including demographic information, use of tobacco products, use of alcohol, diet, physical activity, history of hypertension, history of diabetes, history of high total cholesterol, history of cardiovascular disease, and a scan for cervical cancer for women.

The GPAQ individually asks about the places where physical activity is done (activity at work, travel to and from places, and recreational activities). It comprises 16 questions. Vigorous and moderate-intensity physical activities are described and their durations are asked in the workplace and leisure activities sections, and moderate-intensity physical activity (walking, bicycling) is questioned in the travel to and from places section. There is an additional question for the duration of the sedentary period.[9]

The MET is defined as the metabolic speed in a person at rest. A MET is defined as the energy spent while sitting in a relaxed manner and is equivalent to 1 kcal/kg/h caloric expenditure. The GPAQ measures how many MET-min of physical activity is engaged during a typical week. The MET-min per week obtained from the GPAQ is a scale-type variable. Moderate-intensity physical activity corresponds to 4 MET/min, and vigorous-intensity physical activity corresponds to 8 MET/min.[6] During the calculation of weekly total MET-min, the durations of each type of physical activity are multiplied by these coefficients.

In the present study, we aimed to adapt the GPAQ into Turkish and to evaluate its reliability and validity among employees of Bornova Municipality.

PATIENTS AND METHODS

This methodological study was conducted at Department of Public Health, Ege University Faculty of Medicine between August 2016 and November 2016. A total of 2,137 individuals worked in Municipality of Bornova district, Izmir province of Turkey. The reason for choosing municipal employees was to reach a heterogenous group in terms of socioeconomic level and physical activity. The frequency of physical activity in Turkey was found to be 33%.[10] The size of the smallest sample necessary for the study was determined to be 352 employees, assuming a 33% prevalence, 5% error margin, 95% CI, and 20% non-response rate. The sampling list was taken from the Bornova Municipality Human Resources Department, and 352 employees were systematically selected from the 2,137 employees. Among the target group, 287 employees (183 males, 104 females; mean age: 38.9±8.5 years; range, 22 to 63 years) were participated in the study. Sixteen employees declined to participate in the research (n=6 due to intensity of work, and n=10 not giving consent). In addition, 49 employees could not be reached, despite being contacted twice. The response rate was 81.53%.

Criterion validity and sample size for test-retest

The sample-size calculation for criterion validity was done with the G*Power version 3.1.9.2 software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf,

Germany). The sample size was calculated as 129 with a correlation coefficient of 0.31[9] calculated with a pedometer in the GPAQ reliability and validity study conducted in nine countries (Bangladesh, Brazil, China [Shanghai, Taiwan], Indonesia, Ethiopia, South Africa, India, Japan, and Portugal). A pedometer was used for criterion validity and was administered to the first 112 employees who agreed to participate. The retest was applied to the same group one week later, when pedometers were returned. The acceptance rate was 86.82%.

Collection of data

The data were gathered between August 17, 2016 and November 4, 2016. The questionnaire was filled out face-to-face with 287 employees at relevant Izmir Bornova Municipality workplaces. Employees who could not be reached on the first visit were visited a second time. Training was provided about how to use a pedometer to the 112 employees who first agreed to use pedometers for a week. Fifteen pedometers were used alternately throughout the data collection period. A sportive brand digital pedometer was used. The participants were told that they must attach the pedometers in an upright manner to their waists, that the pedometers must not touch water, that they must reset them when they wake up in the morning, and that they must note the number of steps when they go to bed each night throughout one-week period. The pedometer data were obtained at the end of one week, and the questionnaire was administered for the retest.

Reliability and validity of the GPAQ

The stages of reliability and validity included, in order, in the form of translation, expert panel (face validity), expert views (content validity), pilot study, retest, concurrent validity, criterion validity, and discriminant validity.

Translation steps

Two academicians, one a sports physician with an advance knowledge of the English language and the other a public health expert very fluent in English and independent of the research, translated the survey from English into Turkish. A panel was held with these experts and the researcher, and advisory faculty member. A third version of translation provided by the WHO Turkey Office was also evaluated during this meeting. The questions, examples of physical activity in the text, and sample cards providing visuals were reviewed and a joint Turkish form was created.

The created Turkish survey was translated back to English by two experts, one independent translator whose native language is English and a faculty member at a Foreign Languages Vocational School whose native language is Turkish. The translated English version was compared to the original version and the necessary changes were made.

Expert panel (face validity)

An expert panel was held with a faculty member from the Department of Public Health, a faculty member from the Department of Sports Medicine, a faculty member from the Faculty of Sports Sciences, and a physical therapist working at the university hospital. The questionnaire was reevaluated for intelligibility and its ability to measure physical activity. Corrections were made based on the recommendations of the experts.

Expert views (content validity)

Views were obtained from a total of 10 experts, including a faculty member at the Department of Sports Medicine, two physical therapists working at the university hospital, a faculty member from the Faculty of Sports Sciences, three faculty members from the Department of Public Health, two pilates instructors, and a dietician, through Google Forms. For each question, a response of "very suitable, quite suitable but small changes are necessary, the item must be changed in a suitable manner, not suitable" was taken. For each question, the answers of "very suitable" and "suitable but small changes are necessary" were collected and divided into the total number of experts. The cut-off of content validity was determined as a question remaining under 80%, and changes were made in one question in accordance with the recommendations.

Pilot study

A pilot study was conducted with 12 municipal employees who were not selected for the sampling with the final state of the questionnaire (Appendix 1). "Cleaning work" was added as an example in this phase because of the feedback taken at the end of the pilot study and unpaid work was included in examples of moderate-intensity activity. This addition was considered necessary to be able to evaluate unpaid cleaning work at home.

Data analysis and evaluation techniques

The quality of the data was checked through a comparison of the data entered with the questionnaires in a 10% random sample from the database and checking the minimum and maximum values of each

variable overall. The scale-type data were presented in mean ± standard deviation (SD) and range (min-max) values.

The correlation coefficients were evaluated according to the following classification:[9]

- 0-0.20= poor
- 0.21-0.40= fair
- 0.41-0.60= moderate/acceptable
- 0.61-0.80= substantial
- 0.81-1.00= near perfect

Categorical data acquired in the GPAQ

Two questions were asked, in the form of "Yes/No", for vigorous- and moderate-intensity activities conducted in the GPAQ. Those who responded "No" to both type of activities at the workplace were accepted as "sedentary at work".

Two questions were asked, in the form of "Yes/No", for vigorous and moderate-intensity activities in leisure activities. Those who responded "No" to the both questions were accepted as "sedentary in leisure activities". These data were presented in descriptive number and percentage.

Physical activity score calculation

According to the GPAQ analysis guidebook, a night's sleep was accepted to last an average of 8 h, and that the maximum period of time during which a person could engage in physical activity is 16 h daily. The lengths of time that exceeded 16 h were not taken into account. In this study, none of the participants reported daily physical activity exceeding 16 h.

Total weekly MET-min: (Minutes engaged in moderate-intensity activity each week × 4 MET) + (Minutes engaged in vigorous-intensity activity each week × 8 MET)

Example:

If one person walks 3 h and plays 1 h of basketball a week:

180 min × 4 + 60 min × 8 = 1200 MET-min is calculated.

Levels below 600 MET-min weekly were accepted as physically inactive.[11]

Reliability evaluations

Kappa analysis was done for categorical variables to evaluate the test-retest reliability. The acceptance percentages for those who responded "Yes" in both tests were calculated. Spearman correlation analysis was conducted for scale-type data, as they did not show normal distribution.

Validity evaluations

The scale was not suitable for factor analysis, since different categories of physical activity (leisure, work, transport) were measured in MET-min.

Concurrent validity

The IPAQ was used to evaluate concurrent validity in the other reliability and validity studies.[9] It is a questionnaire developed to measure physical activity and it was previously tested. The Turkish reliability and validity study was conducted by Öztürk.[12] The variables that could be compared in GPAQ and IPAQ were similar. They were evaluated with the Spearman correlation analysis, as the total physical activity variables did not follow normal distribution.

Criterion validity

In similar studies, a pedometer or accelerometer were used for the objective measurement of physical activity. Respondents tended to exaggerate the intensity and/or duration of activity while completing the questionnaire. Such objective methods may overcome the limitations of the questionnaires. In this study, a pedometer was used for criterion validity. The total duration of physical activity acquired from the GPAQ and the daily number of steps acquired from the pedometer were compared using the Spearman correlation analysis.

Discriminant validity

For discriminant validity, to find out whether the questionnaire could differentiate physical activity levels of different groups, a sociodemographic form containing following variables was used: Age, sex, education level, marital status, number of children, duration of work in years at the municipality, job in the municipality, total monthly working time (h), chronic diseases diagnoses, drugs used continuously, tobacco use history, hobby history, licensed sports history, body mass index (BMI), per capita income. Our hypothesis was that GPAQ could differentiate between different groups.

Ethical issues

Permission from the WHO for the adaptation of the scale

The WHO Noncommunicable Diseases and Mental Health Cluster was applied via email. The surveillance

department was, then, contacted and the permission was obtained. The feasibility of the conduction of the research on municipal employees was consulted, and an approval was obtained. Support was obtained in this process from the WHO Turkey Office, and a version of the GPAQ translated into Turkish and for which no reliability or validity research was performed was acquired. This text was also considered during the translation stage.

Ethics approval

Ethics approval was obtained from Ege University, Faculty of Medicine, Clinical Research Ethics Council (No. 16-5/18; Date: 02.06.2016). The municipality was contacted officially and permission was obtained for the study. The municipal employees agreed to participate in the study, filling out the informed consent form.

RESULTS

Descriptive characteristics of the research group

This study included a total of 287 employees working at Izmir Bornova Municipality. The sociodemographic characteristics of the participants are presented in Table 1. The mean income per capita of the employees was 1,676.43±1,078.16 TRY (range, 216.67 to 5,500 TL).

The mean BMI of the employees was 25.8±4.2 (range, 16.3 to 50.8) kg/m^2. The mean duration of working at the municipality was 9.5±7.3 (range, 1 to 34) years. The mean total working h per month for the employees was 171.7±10.9 (range, 160 to 200) h. Corresponding categorical data are shown in Table 1 along with the categorical responses to the activity types questioned in GPAQ.

The physical activity levels of the employees in MET-min are summarized in Table 2. The levels of physical activity for 80.5% of the employees were over the WHO-recommended weekly 600 MET-mins.

Reliability analyses

Reliability analysis for the presence of physical activity

The test-retest reliability for the categorical variables of GPAQ is shown in Table 3. The kappa statistics for all the categorical variables ranged between 0.74 (substantial relationship for vigorous-intensity activity at work) and 0.87 (near perfect relationship for being sedentary in leisure). The acceptance rate ranged between 92% (for sedentary and moderate-intensity activity at work) and 98% (for vigorous-intensity activity at work).

TABLE 1
Distribution of employees by sociodemographic, health, municipal work characteristics and physical activity status

Features	n	%
Sex		
Female	104	36.2
Age group		
18-34 years	95	33.1
35-44 years	122	42.5
45-63 years	70	24.4
Education level group		
Secondary school and below	69	24.0
High school	92	32.1
University and above	126	43.9
Marital status		
Married	196	68.3
Number of children		
No child	102	35.5
One child	90	31.4
Two children and above	95	33.1
Per capita income at or below the poverty line	107	39.5
Having a chronic disease	104	36.2
Continuously used drug history	79	27.5
Smoking history		
Smoking	140	48.8
Quit	36	12.5
Never smoked	111	38.7
Participants having a hobby	167	58.2
Participants with licensed sports history	74	25.8
Body mass index		
Underweight <18.5	5	1.7
Normal 18.5-24.9	122	42.5
Overweight 25-29.9	123	42.9
Obese ≥30	37	12.9
Duration of work at the municipality		
1-5 years	105	36.6
6-10 years	92	32.1
11 years and above	90	31.4
Working 160 hours a month	127	44.3
Physically active work	90	31.4
GPAQ categorical questions		
Vigorous-intensity activity at work	15	5.2
Moderate-intensity activity at work	166	57.8
Sedentary at work	117	40.8
Walking or cycling in transportation	177	61.7
Vigorous-intensity activity in leisure time	52	18.1
Moderate-intensity activity in leisure time	138	48.1
Sedentary in leisure time	126	43.9

GPAQ: Global Physical Activity Questionnaire.

TABLE 2
Physical activity (MET-min) characteristics of employees

Physical activity status	Mean±SD	Median	Min-Max
Vigorous-intensity activity at work	74.70±860.94	0	0-14,400
Moderate-intensity activity at work	1,220.91±2,091.77	320	0-11,520
Total activity at work	1,295.61±2,322.31	480	0-18,720
Activity at transportation	389.48±451.03	400	0-2,520
Vigorous-intensity activity in leisure time	180.07±634.81	0	0-7,680
Moderate-intensity activity in leisure time	312.82±593.86	0	0-4,200
Total activity in leisure time	492.89±958.58	240	0-11,520
Total vigorous-intensity activity	254.77±1,061.90	0	0-14,400
Total moderate-intensity activity	1,923.21±2,173.99	1,080	0-12,720
Total physical activity	2,177.98±2,483.00	1,360	0-19,680

SD: Standard deviation; Min: Minimum; Max: Maximum.

Reliability analysis for the level of physical activity in MET-min

The test-retest reliability for the measurement-type variables of the GPAQ is shown in Table 4. The Spearman rho correlation coefficients ranged between 0.77 (substantial relationship for vigorous-intensity activity at work) and 0.91 (near perfect relationship for being sedentary during leisure).

Concurrent validity analysis

Concurrent validity correlation coefficient is shown in Table 5. The Spearman rho coefficient between the GPAQ and IPAQ ranges between 0.79 (substantial relationship for total moderate-intensity activity) and 0.85 (near perfect relationship for total vigorous-intensity activity). The highest correlation coefficient was observed for the sedentary period (0.94).

Criterion validity analysis

The correlation coefficient between the GPAQ score in MET-min and the average daily number of steps for criterion validity is shown in Table 5. The correlation coefficient between GPAQ and the pedometer for total physical activity is 0.32 (fair relationship). The correlation coefficient between the sedentary period (sitting, h) and GPAQ was 0.23 (fair relationship).

Discriminant validity

Education level, length of time spent working at the municipality, income per capita, and status of physical active work led to a statistically significant difference at the GPAQ MET-min level. There was no statistically significant difference in the mean MET-min physical activity levels of different sex and age group, marital status, number of children, total working hours of

TABLE 3
Test-retest reliability for existence of physical activity

Activity location (n=112)	Kappa	Acceptance (%)	*p*
Activity at work			
Sedentary	0.82	92.0	<0.001
Vigorous-intensity activity	0.74	98.2	<0.001
Moderate-intensity activity	0.83	92.0	<0.001
Transportation			
Walking or cycling	0.84	92.9	<0.001
Activity in leisure time			
Sedentary	0.87	93.8	<0.001
Vigorous-intensity activity	0.86	96.4	<0.001
Moderate-intensity activity	0.85	92.9	<0.001

TABLE 4
Test-retest reliability for physical activity level (MET-min)

Activity location (n=112)	Spearman's Rho	*p*
Activity at work		
Sedentary	0.77	<0.001
Vigorous-intensity activity	0.90	<0.001
Moderate-intensity activity	0.90	<0.001
Transportation		
Walking or cycling	0.88	<0.001
Activity in leisure time		
Vigorous-intensity activity	0.89	<0.001
Moderate-intensity activity	0.91	<0.001
Total activity in leisure time	0.90	<0.001
Total physical activity	0.86	<0.001

TABLE 5
Validity analyses as compared to IPAQ and pedometer

Concurrent validity between GPAQ and IPAQ

Activity location (n=287)	Spearman's Rho	*p*
Total vigorous-intensity activity	0.85	<0.001
Total moderate-intensity activity	0.79	<0.001
Total physical activity	0.80	<0.001
Sedentary duration	0.94	<0.001

Criterion validity between GPAQ and pedometer

Variable (n=112)	Spearman's Rho	*p*
Total physical activity	0.32	0.001
Sedentary duration	-0.23	0.012

IPAQ: International Physical Activity Questionnaire; GPAQ: Global Physical Activity Questionnaire.

worked monthly, medical history, history of prescribed medications, cigarette use, hobbies, certified sports, and BMI, categories (Table 6).

DISCUSSION

A substantial relationship was found in the test-retest reliability for the overall score and scores of the different domains of the Turkish GPAQ. A substantial relationship in the concurrent validity and a fair relationship in the criterion validity were also found. A substantial relationship in the existence of vigorous-intensity activity at work from the categorical variables was found in the test-retest reliability (0.74), and a near perfect relationship was found in the others (0.82-0.87). Reliability might have been lower for vigorous-intensity activities, as fewer employees reported engagement in vigorous-intensity physical activity at work and these vigorous-intensity activities at work might vary from week to week. The high kappa values can be explained with the education levels of the municipal workers and their employment status being better than that of the general public and also employees doing routine and defined work. Lower kappa values ranging from 0.67 to 0.73 were reported in the GPAQ reliability and validity studies of nine countries, which could be linked to the fact that the research was conducted in nine different countries and the characteristics of physical activity could be different among the countries. While reviewing individual countries, the kappa values ranged between 0.34 and 1.00.[9]

The physical activity kappa values ranged between 0.50 and 0.62 in a GPAQ reliability and validity study conducted on individuals working and studying at the medical school of a university in France.[13] The kappa value was found to be 0.33 in the section the interviewer administered in the reliability and validity study for the versions the participants and interviewer administered for the GPAQ administered to employees and students at a university in Singapore.[14] The kappa values in these studies might have been lower compared to our study, as the levels of physical activity of the students and academics might vary.

A substantial relationship was found in the MET-min of vigorous-intensity activities (0.77) and a near perfect relationship was found for the other types of physical activities (0.88-0.91). The correlation coefficients might have been higher, since the educational level and employment status of the municipal workers were relatively higher than the public. The correlation coefficients ranged between 0.67 and 0.81 in the analysis in which data from nine countries were combined. While reviewing individual countries' results, the values for the correlation coefficients ranged between 0.40 and 1.00 for the measurement-type variables.[9] The correlation coefficient range could be greater, as this research was conducted in many countries. The municipal workers in our study could be considered as having the same culture and they work at the same institution. Therefore, the correlation coefficients might be found to be higher and the range to be narrower.

The Spearman rho coefficients for the measurement-type variables vary between 0.52 and 0.89 in the French reliability and validity study

TABLE 6
MET-min physical activity levels of different sub-groups and their comparisons

	n	Mean±SD	Median	Min-Max	*p*
Sex*					0.476
Female	104	1,771.50±1,098.98	1440	0-5,440	
Male	183	2439.67±2,969.22	1200	0-19,680	
Age group**					0.360
18-34	95	1,783.37±1,778.09	1320	0-10,960	
35-44	122	2,491.80±3,107.68	1340	0-19,680	
45-63	70	2,166.57±1,981.64	1440	0-10,000	
Education level**					**<0.001**
Secondary school and below	69	4,154.49±3,552.34	3120	0-19,680	
High school	92	1,800.87±2,104.11	1040	0-13,800	
University and above	126	1,370.95±1,050.16	1200	0-5,760	
Marital status*					0.409
Married	196	2,407.76±2,796.85	1440	0-19,680	
Single	91	1,683.08±1,511.23	1320	0-10,960	
Number of children**					0.341
No child	102	1,686.27±1,599.38	1280	0-10,960	
One child	90	2,127.11±2,140.67	1360	0-12,720	
Two children and above	95	2,754.11±3,327.70	1440	0-19,680	
Duration of employment at municipality**					**0.035**
1-5 years	105	1,599.43±1,671.32	1280	0-13,800	
6-10 years	92	2,740.22±3,180.96	1480	0-19,680	
11 years and above	90	2,278.22±2,339.49	1440	0-10,000	
Working hours in a month*					0.095
160 hours	127	1,770.87±1,887.83	1280	0-10,000	
Over 160 hours	160	2,501.13±2,833.68	1540	0-19,680	
Disease history*					0.840
Yes	104	2,059.62±2,159.05	1440	0-12,720	
No	183	2,245.25±2,653.13	1280	0-19,680	
Continuously used drug history*					0.510
Yes	79	2,386.58±3,028.45	1440	0-19680	
No	208	2,098.75±2,245.15	1320	0-13800	
Smoking history**					0.874
Smoking	140	2,310.00±2,834.44	1360	0-19,680	
Quit	36	2,390.00±2,436.90	1240	0-9,120	
Never smoked	111	1,942.70±1,974.29	1360	0-12,720	
Hobby history*					0.801
Yes	167	2,034.49±2,135.80	1320	0-12,720	
No	120	2,377.67±2,896.08	1400	0-19,680	
Licensed sport history*					0.376
Yes	74	2,470.54±2,785.35	1440	0-13,800	
No	213	2,076.34±2,367.89	1320	0-19,680	
Body Mass Index Group**					0.254
Underweight and normal***	127	2,304.72±2,308.95	1560	0-10,960	
Overweight	123	2,037.89±2,642.10	1200	0-19,680	
Obese	37	2,208.65±2,558.59	1440	0-12,720	
Per capita income group*					<0.001
Poverty line and below	107	3,342.99±3,486.62	2400	0-19,680	
Above poverty line	164	1,495.98±1,202.24	1200	0-6,240	
Physical active work status*					**<0.001**
Physical active	90	4,128.89±3,465.86	3240	0-19,680	
Physical inactive	197	1,286.70±998.53	960	0-5,520	

SD: Standard deviation; Min: Minimum; Max: Maximum; * Mann-Whitney U test was conducted because there were extreme MET-min values; ** Kruskal Wallis test was conducted because it did not follow normal distribution; *** Underweight employees were included in the normal group because the number of underweight employees was 5.

for GPAQ, conducted with 68 participants.[13] The Spearman rho coefficients for the measurement-type variables vary between 0.52 and 0.82 in the section administered by the interviewer in the reliability and validity study in the versions implemented by the participant and interviewer for the GPAQ conducted with 56 participants.[14] The reliability coefficients vary between 0.44 and 0.77 for the measurement-type data in the validity study for the GPAQ conducted in 62 Saudi males.[15] The correlation values might be low due to the low number of participants.

The test-retest Spearman rho coefficients were 0.50-0.69 for the IPAQ short form in the IPAQ Turkish reliability and validity study conducted on university students. They ranged between 0.55 and 0.99 for the IPAQ long form.[12] Although university students are more educated and younger, their correlation coefficients might have been lower than GPAQ, as the IPAQ asks specifically about the past week and as a person's level of physical activity can vary from week to week.

For concurrent validity, when the weekly MET-min values of IPAQ were compared with GPAQ, the correlation coefficients varied between 0.79 and 0.85. In the nine-country study, the correlation coefficients were between 0.45 and 0.57 in the countries-combined analysis GPAQ. The correlation coefficients ranged between 0.29 and 0.92 for individual countries.[9] The correlation coefficients might have a wider range due to the conduction of the research in many countries. The correlation coefficients might be found to be higher and the range to be narrower, as the municipal workers in our study are culturally more homogenous, they work at the same institution, and have a higher level of education, compared to the community.

The highest correlation coefficient between IPAQ and GPAQ was found for the sedentary period (0.94), since the question that asks about sedentary length in the IPAQ is the same as in the GPAQ. However, the correlation coefficient for the sedentary period was found to be 0.65 in the analysis combining nine countries' data. Among individual country results , the correlation coefficients ranged between 0.45 and 0.98 for sedentary duration.[9] Our findings are consistent with this research.

The Spearman rho coefficients for the GPAQ ranged between 0.53 and 0.81, compared to the IPAQ in the French reliability and validity study.[13] The correlation coefficients might be low, as the number of participants was 92. The Spearman rho coefficients for the GPAQ ranged between 0.44-0.46, compared to the IPAQ in the reliability and validity study conducted on 43 nurses in Malaysia.[16] The correlation coefficients might have emerged to be lower, as the number of participants was low, the working order of nurses might vary from week to week, and the IPAQ inquiries about the previous week, while the GPAQ asks about an average week.

The correlation between regarded total physical activity and daily average number of steps using a pedometer for criterion validity is at the level of a fair relationship (r_s=0.32). The correlation coefficient for the pedometer was similarly 0.31 in the analysis of the data combined from nine countries for the GPAQ. For the analysis of each individual country, the correlation coefficients ranged between 0.23 and 0.35 for pedometer.[9] The correlation coefficients might be low, as the pedometer was able to perceive the best walking and running motions, but was unable to perceive other types of physical activity.

A study researching the correlation between GPAQ and pedometers in desk employees in Thailand found no significant relationship between weekly MET-min and the pedometer (Spearman rho=0.08, p=0.15),[17] probably due to the fact that participants were a sedentary group. The Spearman rho coefficient between the daily average number of steps in the reliability and validity study conducted for the GPAQ in Malaysia and the weekly MET-min was 0.30 (p=0.002).[16] The findings are consistent with our research.

The Turkish version of the GPAQ, which is already in use in many countries by the WHO and which has fewer limitations, compared to the IPAQ, was adapted, evaluated in many different aspects, and found to be reliable and valid.

The GPAQ is a questionnaire comprising both categorical and measurement-type questions. Transit, leisure, and work activities are calculated as MET-min per week with counting- and measurement-type variables, and the total level of physical activity is determined from the type of MET-min per week with the total. Therefore, it was not possible to calculate the Cronbach alpha coefficient used in typical Likert scales. The scale was also not suitable for factor analysis due its nature explained. A receiver operating characteristic (ROC) curve was unable to be drawn, since there was no gold-standard method in evaluating physical activity in a Yes/No or adequate/inadequate dichotomous manner, and no cut-off point or, based

on this, sensitivity and specificity could not be determined. This can be accepted as a limitation, as the accuracy of the given responses could not be certain. There are possibilities of the levels of physical activities between those who agreed and did not agree to participate being different, of potential incompetence in complying with the use of the pedometer, and of a possible motivational effect by the use of to engage in physical activity.

In conclusion, the results from the test-retest reliability for the GPAQ were good. The concurrent validity of the GPAQ was found to be good. Criterion validity was at an fair level. The GPAQ was able to differentiate statistically significantly between education level, duration of work at the municipality, income per capita, and status of physical active work in discriminant validity. An international questionnaire was adapted with this study to be used to measure physical activity in Turkey. Based on these findings, the Turkish version of the GPAQ is reliable and valid. Its recommendation and use by the WHO makes the questionnaire more important. Questioning about activities performed in various areas and an average week rather than the previous week makes the questionnaire superior compared to past questionnaires. The WHO's international use of the GPAQ to scan for risk around the world is an advantage for comparison between countries.

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Appendix-1

Türkçe Küresel Fiziksel Aktivite Anketi (The Global Physical Activity Questionnaire; GPAQ)

Fiziksel Aktivite

Şimdi size sıradan bir haftada farklı tipte fiziksel aktiviteler yaparken (hareket ederken) harcadığınız zamanı soracağım. Lütfen bu sorulara kendinizin fiziksel olarak aktif bir insan olduğunu düşünmeseniz de yanıt verin.

Önce iş yaparken harcadığınız zamanı düşünün. İş olarak şunları düşünün: Yapmak zorunda olduğunuz ücretli ya da ücretsiz işler, ders çalışma/eğitim, ev işleri, gıda/ekin hasatı, beslenmek için balık tutma ya da ava çıkma, iş arama vb. *[Gerekirse başka örnekler ekleyiniz].* Aşağıdaki soruları yanıtlarken "yüksek şiddetli aktiviteler" ağır fiziksel çaba gerektiren, solunum veya kalp atım hızında büyük artışlara yol açan aktivitelerdir; "orta şiddetli aktiviteler" orta derecede fiziksel çaba gerektiren, solunum veya kalp atım hızında küçük artışlara yol açan aktivitelerdir.

	Sorular	Yanıtlar	Kod
İşteki Aktivite			
1	İşiniz aralıksız en az 10 dakika süreyle solunum ve kalp atım hızında büyük artışlara yol açan *[ağır yük taşıma/kaldırma, kazı/inşaat işleri gibi]* yüksek şiddetli aktivite içerir mi? *[ÖRNEKLER EKLEYİNİZ] (KARTLARI GÖSTERİNİZ)*	Evet 1 Hayır 2 *Hayır ise P4'e geçiniz*	P1
2	Sıradan bir haftanın kaç gününde işinizin parçası olarak yüksek şiddetli aktiviteler yaparsınız?	Gün sayısı ⌊__⌋	P2
3	Sıradan bir günde işinizde ne kadar süre yüksek şiddetli aktivite yaparsınız?	Saat : dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ sa. dk.	P3 (a-b)
4	İşiniz aralıksız en az 10 dakika süreyle solunum veya kalp atım hızında küçük artışlara neden olan hızlı yürüme *[veya hafif yükler taşıma, temizlik yapma]* gibi orta şiddetli aktivite içeriyor mu? *[ÖRNEKLER EKLEYİNİZ] (KARTLARI GÖSTERİNİZ)*	Evet 1 Hayır 2 *Hayır ise P7'ye geçiniz*	P4
5	Sıradan bir haftanın kaç gününde işinizin parçası olarak orta şiddetli aktiviteler yaparsınız?	Gün sayısı ⌊__⌋	P5
6	Sıradan bir günde işinizde ne kadar süre orta şiddetli aktivite yaparsınız?	Saat : dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ sa. dk.	P6 (a-b)
Ulaşım			
Sıradaki sorulara az önce belirtmiş olduğunuz işteki fiziksel aktiviteler dahil değildir. Şimdi size bir yerden bir yere giderken genelde kullandığınız yöntemi sormak istiyorum. Örneğin işe, alışverişe, markete, ibadete giderken. *[Gerekirse başka örnekler ekleyiniz].*			
7	Bir yerden bir yere giderken aralıksız en az 10 dakika süreyle yürür ya da (*pedal çevirerek*) bisiklete biner misiniz?	Evet 1 Hayır 2 *Hayır ise P10'a geçiniz*	P7
8	Sıradan bir haftanın kaç gününde bir yerden bir yere giderken aralıksız en az 10 dakika süreyle yürür ya da bisiklete binersiniz?	Gün sayısı ⌊__⌋	P8
9	Sıradan bir günde bir yerden bir yere giderken ne kadar süre yürür ya da bisiklete binersiniz?	Saat : dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ sa. dk.	P9 (a-b)
Eğlence ve Boş Zaman Etkinlikleri			
Bundan sonraki sorulara belirtmiş olduğunuz iş ve ulaşım aktivitelerinizi dahil etmeyin. Şimdi size spor, fitness ve boş zaman/eğlence etkinlikleri hakkında sorular sormak istiyorum. *[Uygun terimler ekleyiniz].*			
10	Aralıksız en az 10 dakika süreyle solunum ve kalp atım hızında büyük artışlara yol açan yüksek şiddetli spor, fitness ve boş zaman etkinliklerinden *[koşu veya futbol vb.]* herhangi birini yapar mısınız? *[ÖRNEKLER EKLEYİNİZ] (KARTLARI GÖSTERİNİZ)*	Evet 1 Hayır 2 *Hayır ise P13'e geçiniz*	P10
11	Sıradan bir haftanın kaç gününde yüksek şiddetli spor, fitness ve boş zaman etkinliği yaparsınız?	Gün sayısı ⌊__⌋	P11
12	Sıradan bir günde ne kadar süre yüksek şiddetli spor, fitness ve boş zaman etkinlikleri yaparsınız?	Saat : dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ sa. dk.	P12 (a-b)

Appendix-1

Devamı (Continued)

Fiziksel Aktivite (Eğlence ve Boş Zaman Etkinlikleri)			
Sorular		**Yanıtlar**	**Kod**
13	Aralıksız en az 10 dakika süreyle solunum ve kalp atım hızında küçük artışlara neden olan hızlı yürüyüş *[bisiklete binme, yüzme, voleybol]* gibi orta şiddetli spor, fitness ve boş zaman etkinliklerinden herhangi birini yapar mısınız? *[ÖRNEKLER EKLEYİNİZ] (KARTLARI GÖSTERİNİZ)*	Evet 1 Hayır 2 *Hayır ise P16'ya geçiniz*	P13
14	Sıradan bir haftanın kaç gününde orta şiddetli spor, fitness ve boş zaman etkinlikleri yaparsınız?	Gün sayısı ⌊__⌋	P14
15	Sıradan bir günde ne kadar süre orta şiddetli spor, fitness ve boş zaman etkinlikleri yaparsınız?	Saat : dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ sa. dk.	P15 (a-b)
Sedanter Davranış			
Aşağıdaki soru işte, evde, ulaşımda veya arkadaşlarla oturma ya da uzanma/yaslanma hakkındadır (masada oturma, arkadaşlarla oturma, arabada, otobüste, trende seyahat etme, okuma, iskambil oynama veya televizyon izleme), fakat uyurken geçirilen zamanı dahil etmeyiniz. *[ÖRNEKLER EKLEYİNİZ]*			
16	Sıradan bir günde oturarak ya da uzanarak/yaslanarak genellikle ne kadar zaman geçirirsiniz?	Saat : dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ sa. dk.	P16 (a-b)