Original Article

Development and Validation of Social Cognitive Theory Based Questionnaire for Physical Activity to Preventing Osteoporosis (PAQ-SCT)

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Abstract

Background: Social cognitive theory is a suitable model that examines many factors associated with physical activity. Despite the importance of this issue, there is no evidence of a specific questionnaire for assessing physical activity in Iranian women.

Objectives: This article reports the development and psychometric evaluation process of a physical activity questionnaire among Iranian women.

Methods: In 2016, this psychometric study was carried out on 400 women aged less than 50 years old from 10 health centers recruited by clustering sampling in Isfahan. After reviewing numerous texts, a questionnaire was developed and necessary reforms, in accordance with the principles of translation and cultural adaptation, were applied in a research committee. Then, content validity confirmed by an expert panel as well as face validity was evaluated in a pilot study. Construct validity was conducted using exploratory and confirmatory factor analysis. Reliability was also measured using Cronbach's alpha coefficient and internal consistency method. Scales used in this study included self-efficacy, outcome expectations, social support, and self-regulation.

Results: Internal consistency was found 0.90. In the exploratory factor analysis, four-factor models with a total variance of 80.9% were identified (P < 0.001). The CFA results (CMIN = 276/874, DF = 166, P < 0.001, CFI = 0.967, RMSEA = 0.061) represent the suitability and acceptability of a model based on social cognitive theory.

Conclusions: Due to good values of validity and reliability, the questionnaire was developed based on social cognitive theory, its use is recommended to assess physical activity in Iranian women.

Keywords: Physical Activity, Questionnaires, Reliability and Validity

1. Background

Osteoporosis is a major health concern in which bones become weak and fragile, leading to enormous physical, psychological, economic, and social consequence (1). More than half of the women over 45 are affected with this disease (2). The most important way to prevent osteoporosis is physical activity. Physical activity causes strengthened bones, maintained balance, reduced falling, and reduced bone fractures (3, 4). Despite evidence regarding the benefits of exercise, studies have shown that the physical activity rate in women is highly undesirable (5, 6). According to the world health organization in 2010, about 27% of women had no physical activity and a total of 35% of them in high-income countries and 24% of them in low-income countries had physical inactivity (7). The prevalence of sedentary in Iranian women is 76.3% (8). Women's

participation in sports activities is affected by personal, environmental, and behavioral factors (9, 10). Several studies have been conducted to examine the factors explaining the physical activity and different questionnaires have been developed, which is briefly mentioned:

Sechrist et al. (11), developed the exercise benefits/barriers scale (EBBS). It includes two parts: exercise benefits (29 items) and exercise barriers (14 items). It was evaluated in 650 adults and its reliability and validity have been proven. Cronbach's alpha was obtained as 0.952 for the whole questionnaire. The Internal correlation coefficient was 0.77. In the exploratory factor analysis (EFA); 9 factors with variance of 64/9% were identified (11). A questionnaire was developed by Steinhardt and Dishman known as outcome expectancies scale (OESE) and it was evaluated on 243 students. It includes two parts: ex-

ercise benefits (12 items) and exercise barriers (14 items). The Cronbach's alpha coefficient for the whole questionnaire was 0.78 (12). the stage of exercise change questionnaire (SECQ) was developed by Marcus. It contains the components of balance of decision-making, barriers, benefits, and self-efficacy and it was examined on 778 men and women. Its Cronbach's alpha coefficient was obtained 0.82 (13, 14). Physical activity-related self-regulation questionnaire (PARS-43) was developed by Petosa. This questionnaire has 43 items used for self-regulation assessment of adults. Its Cronbach's alpha coefficient was obtained as 0.96 (15). Self-efficacy assessment and outcome expectancy questionnaire was developed by Clark and it was examined in 729 patients. Variance of self-efficacy was 31% and variance of outcome expectation was 13% (16). Outcome Expectancies Scale for Exercise (OEE) was developed to measure the outcome expectations by Resnick and it was evaluated in 182 old individuals. It includes two parts: exercise benefits (5 items) and exercise barriers (4 items). Reliability and the validity of this tool have been proven (17). Self-Efficacy for Exercise Scale (SEE) was developed by Resnick. It includes 9 items and it was evaluated in older people. Its internal validity was obtained as 0.92. The confirmatory factor analysis (CFA) was significant and acceptable (18). An exercise barriers' questionnaire was developed by Andajani and it was investigated in a community-based study of 445 women. It includes three parts: Personal barriers (3 items), social barriers (3 items), and environmental barriers (5 items). Cronbach's alpha of the tool was higher than 0.7 (19). Self-efficacy for exercise scale (SSE) was developed by Kroll to assess self-efficacy. It includes 15 items. Cronbach's alpha of the tool was 0.72 - 0/83 and total variance was 53% (20). Multidimensional outcome expectations for exercise scale (MOES) was developed by Wojcicki. It assesses multi-dimensional expectations of exercise in older people. It includes three parts: physical (6 items), social (4 items), and self-assessment (5 items). Its reliability and the validity were confirmed using EFA and CFA (21).

Studied tools explained limited dimensions of factors related to physical activity. In some studies, reliability and validity stages have not been stated clearly and precisely (12) or the number of questions was high (11) and localization of these tools has not been conducted in Iran (11). Therefore, it is necessary to develop an appropriate tool to assess factors explaining the physical activity. Social-cognitive theory of Bandura is a model with a broad approach, examining many factors related to physical activity. Based on this theory: cognitive, environmental and behavioral factors have three-way interrelationships. The individual's behavior is shaped by the perception of the environment. The environment influences the individual's behavior (22).

2. Objectives

The aim of the present study is the development and psychometric assessment of an appropriate questionnaire to assess constructs of Social-cognitive theory in explaining physical activity related to preventing osteoporosis.

3. Materials and Methods

3.1. Design and Sites

This is a psychometric study that was conducted in Isfahan city after gaining ethical approval from the research deputy of Isfahan University of Medical Sciences (Grant NO. 395203) from May to September 2016.

3.2. Participants

In psychometric studies, the sample size per item is 15 (23, 24) considering the number of questionnaire parameters and the possibility of loss, 25%, 400 samples recruited from women aged less than 50 years. At first, the city centers covered by The Health Center in Isfahan were selected randomly, then, 10 centers from 25 urban centers were selected by clustering sampling and sample size was obtained based on the proportional to size sampling for each center. After familiarization with samples and informed consent, questionnaires were completed. The inclusion criteria for this study were informed consent and ability to respond to the questions. The exclusion criteria were the physical and mental disability as well as unwillingness to complete the questionnaires.

3.3. Measurement Instrument

The questionnaire used in this study (PAQ-SCT) consists of three parts as follows:

1. Tools to assess demographic factors: it consists of 10 questions regarding age, education, marital status, employment status, and income level.

2. PAQ-SCT: Tools to assess social cognitive theory constructs related to physical activity and it includes four parts: self-efficiency: (14 items), outcome expectations (9 items), social support (8 items), and self-regulation (8 items). In total, 39 questions were developed. Scoring range of all of the questions is based on a 10-point Likert.

3. Tools to assess physical activity: standard questionnaire of physical activity was used in this regard. The international physical activity questionnaire (IPAQ) was used to determine appropriate levels of physical activity among adults aged 15 to 69 years (25), and its validity and reliability have been reported (26). According to its instruction, people are classified into three groups in terms of physical activity: low activity (0 - 599 MET-min/week) of moderate activity (600 - 3000 MET-min/week) and intense activity (greater than 3000 MET-min/week) (25).

3.3.1. Process of Development of PAQ-SCT and Evaluation of Validity and Reliability

After reviewing the literature and studying questionnaires used in papers and confirming the research team, 38 questionnaires were selected. Then, it was examined and necessary reforms were applied by 5 experts to adapt it linguistically and culturally with target population by observing the translation principles and cultural adaptation with the Persian language (27). Validity and reliability of the questionnaire were determined in three steps: Step 1: developed items (38 items) were evaluated to determine the content validity index (CVI) and content validity ratio (CVR) was evaluated by a panel of 20 health experts. Acceptance criterion for each item was based on CVI higher than 0.79 and CVR (in accordance with the Lawshe's CVR) higher than 0.42 (28). At the stage of examining CVI and CVR, 19 items were deleted: 9 items from the structure of self-efficacy, 4 items from the structure of outcome expectations, and 3 items from the structure of social support and self-regulation. Finally, 20 questions were confirmed. Step 2: In a pilot study, questionnaires were given to 20 women similar to the target population to determine the face validity and impact score was calculated that the impact score of all questions was higher than 1.5 and 20 items were selected (Table 1). Step 3: questionnaires were evaluated in a cross-sectional study in a sample of 400 women.

3.4. Data Analysis

Using statistical SPSS.v20 and Amos Grafic.v23 software, data were analyzed and descriptive tests, Cronbach's alpha coefficient, correlation, variance, EFA, CFA were calculated. EFA was evaluated by using principal component analysis (PCA) to extract the factors and varimax method to rotate the factors. We also used Kaiser-Meyer-Olkin (KMO) measure and Bartlett test to evaluate the sampling adequacy. The best structure was considered to be the one with the eigenvalue greater than 1 and factor loading equal to or greater than 0.4 (29, 30).

The CFA model using the robust maximum likelihood was used to estimate the model parameter. The model was considered acceptable if CMIN/DF was between 1 and 5, CFI (comparative fit index) was greater than 0.8, parsimonious comparative fit index (PCFI) was more than 0.6, Tucker-Lewis Index (TLI) was more than 0.9, root mean squared error of approximation (RMSEA) was < 0.05 good fit or between 0.05 and 0.08 adequate fit (29, 30).

4. Results

The number of participants in the study was 400 people, 40 of them were excluded due to illness, incapacity, or

Table 1. Items of the Development and Psychometric of a PAQ-SCT for Iranian Women

Items Subject	Items of Questionnaire
se_1	1.I can do exercises such as walking and jogging twice a week
se_2	2.I can do exercise at least an hour a day
se_3	3.I can do exercise, even if I am tired
se_4	4.I can do exercise, even if I am under stress
se_5	5.I can do exercise, even if I have no exercise facilities
oe_1	6.Exercise can increase my energy, vitality and freshness
oe_2	7.Exercise causes fatigue and pain in the muscles
oe_3	8.Exercise reduces the risk of diseases such as osteoporosis and depression
oe_4	9.Exercise is an impediment to perform my everyday tasks
oe_5	10.Exercise is a waste of time
ss_1	11.My family and friends encourage me to do exercise
ss_2	12.My family provides exercise facilities for me
ss_3	13.My family and friends prevent exercising
ss_4	14.My family and friends do exercise with me
ss_5	15.My family and friends are satisfied with my exercise
sr_1	16.I have a regular weekly program for exercise
sr_2	17.I adjust my exercise program in accordance with my life and career
sr_3	18.I write my exercise program in a notebook
sr_4	19.If there is a problem in the implementation of the exercise program, I change it
sr_5	20.I am diligent and consistent in implementing my exercise program

Abbreviations: (oe_1-oe_5); outcome expectations, (se_1-se_5); self-efficacy, (sr_1-sr_5); self –regulation, (ss_1-ss_5); social support.

unwillingness to complete the questionnaires, and finally 360 samples were included. The mean age of participants was 33.67 (mean = 33/67, SD = 8/353), (range = 14 - 50). The main characteristics of participants are shown in Table 2.

The results of the physical activity of participants (mean = 934.33, SD = 1051.598) based on the IPAC questionnaire and MET min/week criterion are shown in Table 3.

4.1. Items Analysis

In total, 20 items were considered in the questionnaire. Items 1 to 5 related to self-efficiency, items 6 to 10 related to outcome expectations, items 11 to 15 related to social support, and items 16 to 20 related to self-regulation. Based on the information contained in Table 4 and as a correlation coefficient of items was higher than 0.3 ($P \leq 0.005$) and the skewness of items was less than 1.96, items were not deleted.

Table 2. Characteristics of Women Who Participated in Study (N = 360)

Groups Variables	Frequency (No.)	Percent (%)
Years of education		
Illiterate	5	1.4
The ability to read and write	13	3.6
Primary school	36	10
Middle & high school	49	13.6
Diploma	145	40.3
Collegiate	112	31.1
Marriage status		
Marriage	314	87.2
Single	36	10
Widow	6	1.7
Divorced	4	1.1
Job status		
Employed	68	18.9
Unemployed	292	81.1
Income status		
Little	38	10.6
Moderate	205	56.9
Good	100	27.8
Excellent	17	4.7

Table 4. Item's Total Statistics of PAQ-SCT about Physical Activity of Women Who Participated in Study

Items Subject	Mean Score of Item	Std. Deviation	Skewness	Total Correlation	Squared Multiple Correlation
se_1	5.41	3.173	0.141	0.635	0.721
se_2	4.89	3.281	0.317	0.644	0.745
se_3	4.03	2.862	0.576	0.630	0.803
se_4	4.33	3.070	0.509	0.600	0.783
se_5	5.38	3.185	0.072	0.618	0.751
oe_1	8.44	2.516	-10.659	0.476	0.811
oe_2	7.34	2.383	-10.091	0.394	0.724
oe_3	8.42	2.606	-10.695	0.382	0.814
oe_4	7.07	2.386	-0.915	0.447	0.703
oe_5	7.46	2.533	-10.126	0.407	0.723
ss_1	6.51	3.086	-0.309	0.571	0.748
ss_2	5.57	3.166	0.015	0.589	0.739
ss_3	6.58	2.872	-0.218	0.523	0.676
ss_4	5.08	2.904	0.123	0.635	0.743
ss_5	5.91	3.047	-0.104	0.653	0.704
sr_1	4.09	3.267	0.727	0.746	0.800
sr_2	4.68	3.337	0.435	0.684	0.765
sr_3	2.89	2.831	1.415	0.505	0.513
sr_4	4.20	3.268	0.616	0.609	0.654
sr_5	3.97	3.174	0.738	0.688	0.755

Abbreviations: (oe_1-oe_5); outcome expectations, (se_1-se_5); self-efficacy, (sr_1-sr_5); self –regulation, (ss_1-ss_5); social support.

4.2. Reliability

The internal consistency and split-half method were used in order to examine the reliability of the scale. Cronbach's alpha of the whole questionnaire was 0.919 that reflects the suitability of translation and internal consistency of the questionnaire. The internal consistency of the separate factors was also good and ranged from 0.925 to 0.946 (Table 5).

4.3. Factor Analysis

For statistical analysis, the samples (n = 360) were randomly divided into two. EFA was performed on a calibration sample (n1 = 180) and the CFA was performed on a validation sample (n2 = 180).

Table 3. The Results of the Physical Activity of Women Who Participated in Study (N = 360)

Total Physical Activity	Frequency (No.)	Percent (%)
Low	168	46.7
Intermediate	178	49.4
High	14	3.9

4.3.1. EFA

KMO index value (Kaiser-Meyer-Olkin index) was equal to 0.917, indicating the adequacy of the sample and Bartlett's sphericity test results were (Bartlett's x^2 = 4139, df = 120, P < 0.001), which indicates the factor analysis is appropriate to analyze the data. EFA was performed by Promax method, cutoff point = 0.4, and eigenvalues = 1, and a four-factor model with total variance of 80.9% was detected (Table 5).

4.3.2. CFA

The CFA results showed that the measurement model has a good fit with the assumed model, and indicators are significant within the acceptable range. CFA results showed that self-regulation is the most important factor in predicting physical activity (Figure 1).
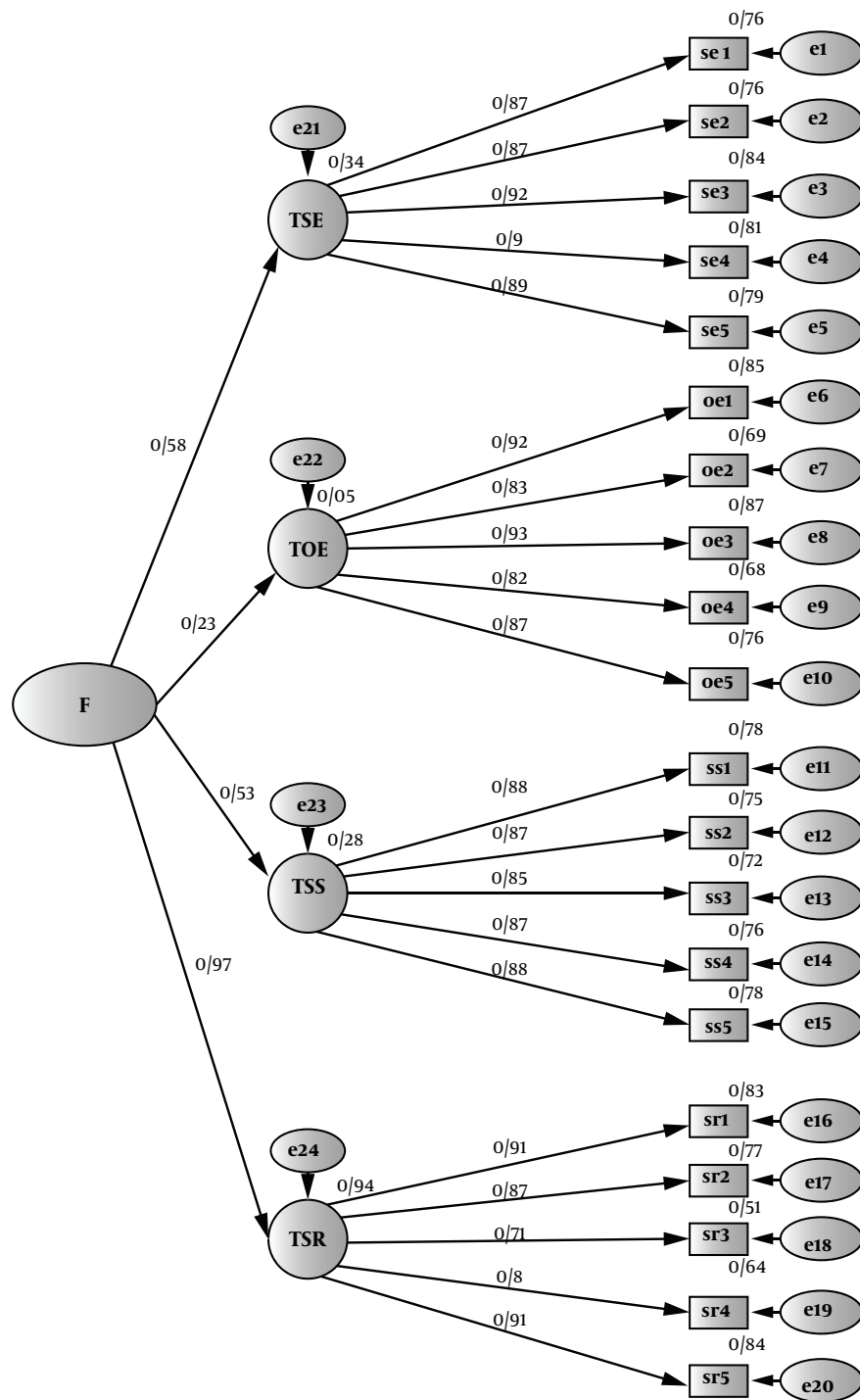
Figure 1. Second-order model (CFA) [CMIN = 276.874, DF = 166, CMIN/DF = 1.668, CFI = 0.946, PCFI = 0.967, TLI = 0.962, RMSEA = 0.061 (LO-HI = 0.048 - 0.074)]

5. Discussion

Analyzing and explaining health-related behaviors and related factors require appropriate instruments for measurement. One of these tools is the questionnaires, which is particularly important in science, health education (31, 32). Several questionnaires have been developed and used

Table 5. Results of Exploratory Factor Analysis Extracted Factors for Items of a PAQ-SCT of Women Who Participated in Study[a]

Items Subject	Self-Efficacy	Outcome Expectations	Social Support	Self-Regulation
se_1	0.855	...	...	...
se_2	0.856	...	...	...
se_3	0.885	...	...	...
se_4	0.886	...	...	...
se_5	0.882	...	...	...
oe_1	...	0.908	...	...
oe_2	...	0.893	...	...
oe_3	...	0.925	...	...
oe_4	...	0.871	...	...
oe_5	...	0.889	...	...
ss_1	...	...	0.891	...
ss_2	...	...	0.877	...
ss_3	...	...	0.863	...
ss_4	...	...	0.859	...
ss_5	...	...	0.819	...
sr_1	...	...	...	0.794
sr_2	...	...	...	0.830
sr_3	...	...	...	0.782
sr_4	...	...	...	0.836
sr_5	...	...	...	0.848
Percentage of variance	39.782	18.092	13.726	9.302
Cronbach's alpha	0.946	0.945	0.938	0.925

Abbreviations: (oe_1-oe_5); outcome expectations, (se_1-se_5); self-efficacy, (sr_1-sr_5); self –regulation, (ss_1-ss_5); social support.
[a] ... Not applicable: is less than 0.3

so far to measure social cognitive theory constructs to explain physical activity. The results showed the questionnaire developed in this study for psychometric evaluation of social cognitive theory constructs related to physical activity in women has acceptable reliability and validity. The strength of this study is an appropriate number of samples (n = 360) to the target group. The developed questionnaire is based on a theory in which four important constructs of social cognitive theory were used, while in most studies, one or two constructs of one model has been examined (20, 21). In this study, we tried to fully state the validity and reliability of tools stages clearly and completely. Reliability and validity of questionnaires and psychometric evaluation procedures have not been clearly and completely stated, and they reported only the results of previous papers (33, 34). One of the main features of a questionnaire is its compliance with cultural, linguistic, and local conditions of the target population. Accordingly, this study examined questionnaires in terms of observing the translation principles and cultural adaptability with the Persian language in a committee consisting of 5 experts. This issue is usually overlooked in other studies (35, 36). To validate the questionnaire and to assess CVI and CVR in this study, the views of 20 experts from the fields of health education were used. This could increase the scientific validity of the questionnaire, while views of less number of experts have been used in most studied related to physical activity (20, 37). The results of studies conducted by Ievers-Landis and Rovniak have identified social cognitive theory as an appropriate model to explain physical activity (33, 38). Cronbach's alpha of the PAQ-SCT was equal to 0.919 (0.925 - 0.949), which was very appropriate (39). The results of this study are in line with the results of other studies, that consider Cronbach's alpha reliability, higher than 0.7 as sign of scientific validity of the questionnaire (36, 40). In this study, four scales of social cognitive theory were examined where Cronbach's alpha of all was higher than 0.9 (Table 5). The results of similar studies could confirm the reliability of the questionnaire in this study (36, 41). In this study, self-regulation (R^2 = 0.97) was the most important predictor of physical activity. In studies conducted by Khani Jeyhuni and Wolfe, self-regulation has been introduced as the most important predictor of physical activity (42, 43). Additionally, the Tan study results showed that self-regulation is one of the most important factors in physical activity (44). Consistency of results of this study with mentioned studies shows that four scales developed to measure physical activity have appropriate and acceptable validity and reliability.

Limitations of the study include the large number of questions in the questionnaire, responding to the questions in the form of self-reporting, and short time of the research.

5.1. Conclusion

The present study represents that the reliability and validity of the PAQ-SCT developed to measure physical activity with the application of social cognitive theory is acceptable. Due to cultural and linguistic adaptation and the use of an ecological model to investigate individual, behavioral, and environmental variables, this questionnaire is recommended to assess physical activity, and it is necessary that further psychometric studies be conducted in this regard.

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Footnotes

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