

Development and psychometric properties of a self-regulation scale about leisure time physical activity in Iranian male adolescents

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ABSTRACT

Background: Self-regulation is one of the current psychological concepts that have been known as a determinant of leisure time physical activity. Due to cultural and social diversity in different societies and age groups, application of specific questionnaires is essential to perform investigations about physical activities. The aim of this study is development and evaluation of psychometric properties of a self-regulation questionnaire about leisure time physical activity in Iranian male adolescents.

Materials and Methods: This cross-sectional study was conducted in 2013, and data of 603 male students from 12 high schools in Isfahan were collected. A comprehensive literature review and similar questionnaire review were conducted and 25 items were selected or developed to measure self-regulation. Comprehensibility of items was evaluated in a pilot study and an expert panel evaluated face and content validity. Exploratory factors analysis (EFA) was used for evaluation of construct validity and extraction of sub-constructs of self-regulation. Leisure time physical activity was assessed using International Physical Activity Questionnaire (IPAQ).

Results: The mean age of the participants was 16.3 years (SD =1.0) and the range was 15–19 years. Cronbach's α coefficient of the questionnaire in the pilot and main study was 0.84 and 0.90, respectively. EFA resulted in four sub-constructs including "enlistment of social support," "goal setting," "self-construction," and "self-monitoring," which explained 63.6% of the variance of self-regulation.

Conclusions: Results of this investigation provide some support to the validity and reliability of the 16-item questionnaire of self-regulation about leisure time physical activity in the target group.

Key words: Adolescent, exercise, Iran, physical activity, questionnaire, reliability, self-regulation, validity

INTRODUCTION

Despite the fact that physical inactivity has been known as a risk factor for non-communicable, chronic diseases,^[1] reduced participation in physical activities is one of the changes that has occurred recently in lifestyle.^[1-3] This problem is not specific to a particular population, and adolescents are at risk of physical inactivity as well.^[4,5] Based on the Centres for Disease Control and Prevention report, in 2011, only 29% of high school students

in the USA had satisfactory physical activity.^[6] However, the US Department of Health and Human Services recommends that performing at least 60 min of physical activity per day is necessary to maintain and improve adolescents' health. These physical activities must be repeated 3 days or above per week, and include strength exercises to increase the capability of main muscles of the body and limbs and aerobic activities to increase cardiorespiratory capacity.^[7] Contrary to public perceptions, adolescents' physical inactivity is also highly prevalent in developing communities, as in developed communities.^[8] A study published in 2010 demonstrated that over 60% of adolescents in Iran showed lack of adequate physical activity.^[9] Available evidence shows that there is

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an obvious decline in physical activity after childhood and inactivity is likely to become a personal habit continuing in older ages.^[3-5,10] Therefore, the researchers highlight the need to conduct studies aimed to increase the participation of adolescents in regular physical activities and promote community's health.^[2,3]

Physical activity, as with many other behaviors, is influenced by several individual, inter-personal, and environmental determinants.^[11,12] Unsuitable circumstances that prevail currently around humans do not generally support healthy behaviors.^[13,14] The spread of access to digital technologies and the reduced need for physical activities to do daily tasks and for transportation are some of the most important changes in environmental factors related to physical activity. The historical balance between energy intake and expenditure in humans is disrupted in this environment. In such a situation, the importance of intra-personal factors, alongside self-care, reassuring efforts, and protective behaviors, increases further.^[13] Self-regulation is one of these determinants which exerts indirect effects on physical activity at inter-personal and environmental levels, in addition to individual level.^[15]

Despite different definitions have been offered, self-regulation refers to a variety of strategies and behaviors used to adopt and/or maintain the behaviors associated with health.^[16,17] According to Bandura, self-regulation is exerted through a variety of cognitive and behavioral mechanisms such as self-monitoring, goal setting, feedback, self-reward, self-instruction, enlistment of social support, and enables the individual to control individual and environmental health-related factors.^[18] Through maintaining provision of practical guidelines and offering effective feedbacks on behavior and its outcomes, self-regulation enables the individual to have a high control of his/her behavior.^[19]

Many times, exercise and physical activity require disregard of short-term joys to achieve a more valuable benefit in the future. Bearing short-term negative consequences in order to achieve long-term positive outcomes, as one of the known human capacities, is accomplished by self-regulation mechanisms.^[20] Some studies have demonstrated self-regulation as a mediator between self-efficacy construct and physical activity, alongside its direct role in physical activity.^[9,21]

Given the role of self-regulation construct in analysis and moderation of physical activity-related behaviors, availability of an appropriate instrument to measure this psychological construct is particularly important. So, different types of questionnaires have been presented up to now for the assessment of self-regulation about leisure time physical activity.^[20-24] One of the commonly

used instruments to measure physical activity-related self-regulation is the 43-item questionnaire (PASR-43) introduced by Petosa in 1994. This questionnaire, which has been developed to measure self-regulation in middle-aged population, consists of six main sub-constructs. Today, the questionnaires such as PASR-43 have been translated into different languages, including Persian, and are commonly used to measure self-regulation construct.^[9,16]

Although one of the benefits of administering standard questionnaires is to save research resources, the efficiency of each questionnaire is mostly dependent on the social and cultural specifications of the populations which are going to be measured by the questionnaire.^[25] One of the specifications of a good questionnaire is the ability to uniformly assess the individuals of various age groups, gender, and ethnic populations with specific educational level and other demographic characteristics. This characteristic of a questionnaire is referred to as *fairness*. Although fairness of a questionnaire makes the findings of a study in which it has been administered highly generalizable, lack of a quantitative approach for assessing this characteristic and validity's dependency on specifications of the target population have caused failure to address fairness satisfactorily.^[26] As a result, several studies have demonstrated the weakness of common questionnaires in view of fairness. For example, in Umstätt *et al.*'s study conducted in 2009 on the elderly adults, construct validity of Petosa questionnaire was demonstrated as unacceptable.^[22] Similar studies conducted recently have shown the significance of use of specific measurement instruments in populations with different cultural, language, age, and gender characteristics.^[22,27-29] In addition, the passage of time could influence an instrument's capability of measuring psychological constructs in a particular population.^[25]

Despite the significance of using specific instruments to measure the factors related to physical activity, no evidence has yet been obtained regarding a specific instrument to measure self-regulation construct in adolescents in Iran. Therefore, the present study seeks to show the steps of development and psychometric evaluation of a specific 16-item questionnaire to measure self-regulation construct in Iranian male adolescents. This questionnaire is expected to be administered with fewer items than in similar questionnaires to conduct observational and interventional studies.

MATERIALS AND METHODS

Type of study

This study is a cross-sectional, descriptive study conducted in April and May, 2013, in Isfahan, Central Iran. Isfahan was divided into three regions, privileged, semi-privileged, and

sub-privileged, based on relevant studies of socioeconomic status^[30] and the viewpoints of municipal experts and healthcare professionals. Then, four high schools were randomly enrolled from each region. After explaining the research purposes, we gave necessary explanations to the students regarding the confidentiality of data and volunteer participation. The inclusion criteria for the study were: Age 15–19 years, lack of a major health problem preventing regular physical activity, and no membership in professional sports teams. Unwillingness and failure to fill out the questionnaire were considered as the exclusion criteria.

Thus, 650 male adolescents of age 15–19 years, living in Isfahan, participated in the study. But 47 questionnaires were set aside due to failure to fill them out completely. Therefore, data on 603 students were analyzed.

Measurement instrument

The rate of physical activity during leisure time was determined by the long form of *International Physical Activity Questionnaire* (IPAQ). This questionnaire was developed by a group of Italian researchers in 1998 and administered in observational and interventional studies after being translated into various languages, including Persian.^[31,32] Reliability and validity of the Persian version of IPAQ were assessed in several studies. In a study conducted in Tabriz, Iran, content validity index (CVI) and content validity ratio (CVR) of IPAQ were derived and found to be 0.85 and 0.77, respectively. In addition, Cronbach's alpha of this questionnaire in a Persian-speaking population was estimated as 0.7 and Spearman's correlation coefficient was estimated as 0.9 by test–retest. Using this questionnaire, the individuals could be assigned to three groups: Lowly active (less than 600 MET-min/week), moderately active (between 600 and 3000 MET-min/week), and severely active (higher than 3000 MET-min/week).^[33]

The instrument recommended for self-regulation measurement consists of 16 items. This instrument measures the rate of use of self-regulation mechanisms in the past 4 weeks by propositions of “*always*,” “*often*,” “*sometimes*,” “*rarely*,” and “*never*.”

Process of development of measurement instrument and evaluation of validity and reliability

After review of the literature, 25 items were developed to measure self-regulation construct about leisure time physical activity. Some of the items were already used identically in previous studies and translation of these items into Persian was done by translation–back translation method by two health experts who had mastered the language.

The items were examined for face validity and cultural adaptation by five experts of health education to evaluate

qualitatively as per some criteria including compliance with the principles and rules of Persian language, simplicity, comprehensibility, relevance, appropriateness to the construct of interest, and lack of ambiguity.^[34]

CVR of each item was also assessed according to Lawshe method by 10 other experts of health education who formed the expert panel.^[34,35] This panel commented on each item as “*essential*,” “*useful but non-essential*,” and “*non-essential*.”

To determine CVI, simplicity, specificity, and clarity were considered. For simplicity, the options used were “*quite simple*,” “*simple*,” “*relatively simple*,” and “*not simple*.” For specificity, the options were “*highly relevant*,” “*relevant*,” “*moderately relevant*,” and “*irrelevant*.” For clarity, they were “*quite clear*,” “*clear*,” “*relatively clear*,” and “*unclear*.” Comprehensibility of the questionnaire was assessed in a pilot study of 35 members of the target population who were not enrolled in the final study, using the options “*fully comprehensible*,” “*comprehensible*,” “*relatively comprehensible*,” and “*not comprehensible*.” The number of “*fully comprehensible*” and “*comprehensible*” ticked items was divided by 35 to derive comprehensibility coefficient.

To derive reliability coefficient, we administered the questionnaire to 75 members of the target population who were not enrolled in the final study and the internal consistency criterion was used.

Data analysis

After analysis of the items, exploratory factor analysis (EFA) was run to estimate the construct validity of the questionnaire. Since the recommended instrument contained a number of sub-divisions, the *extraction* step was done with the presupposition of *principle components*. Because of the potential correlation among these sub-divisions, the type of rotation of the items was determined promax. The above statistical tests were run using SPSS, version 19.

Ethical considerations

- The study was started after approved by Isfahan University of Medical Sciences and Isfahan Education organization.
- Ethical approval was granted by the deputy of research and technology of Isfahan university of medical sciences
- The purpose and procedures of the study were explained to the participants, and researcher's emphasis on confidentiality of data and voluntary nature of participation.
- Parental informed consent and student dissent were considered as an Inclusion criteria.
- The investigators guaranteed that there were no any conflicts of interest.

RESULTS

Mean age of the participants in the study was 16.3 ± 1.0 (range: 15–19) years.

Determining face validity, CVI, CVR, comprehensibility, and reliability coefficient of the questionnaire

As per the comments of the five-member expert panel, 12 out of total 25 items were revised and changed for phrasing and 6 items were deleted. Also, two new items were added to the previous items. The expert panel believed that addition of these two items enhances the questionnaire's coverage of various dimensions of self-regulation construct and promotes its validity. These items were included as no. 8 and 16 in the final questionnaire. Item no. 8 addresses an individual's effort to find a solution when facing the barriers to physical activity. Item no. 16 reflects an individual's requesting others around to be able to run one's physical activity. Then, CVR of the remaining items was calculated and on using the relevant formula, the CVR of five items did not register the threshold level, and hence, the items were excluded.

Given that 0.79 was considered as the items' CVI acceptability to remain in the questionnaire,^[34] all the remaining items ($n = 16$) were satisfactory with regard to CVI. After administering

the questionnaire in the pilot study, we determined 0.79 as the acceptable comprehensibility and all items met the comprehensibility requirements. Also, the questionnaire's Cronbach's alpha was investigated in a pilot study of 75 members of the target population and was found to be 0.84.

Participation in physical activities

After exclusion of outliers, the mean physical activity was found to be 2324 ± 1437 MET-min/week and the mean physical activity in leisure time was 842 ± 831 MET-min/week. Also, 293 (49%) participants had low activity, 278 (46%) had moderate activity, and 32 (5%) had high activity.

Items analysis

The questionnaire's Cronbach's alpha was found to be 0.90 after 603 participants filled it up. By correlation matrix, all the recommended items had a correlation coefficient of higher than 0.4 with the other items ($P \leq 0.005$). All the items were determined as acceptable and none of them was excluded [Table 1].

Exploratory factor analysis

Kaiser–Meyer–Olkin index was found to be 0.92 and Bartlett's test of sphericity was significant at 95% CI ($\chi^2 = 4139$, $df = 120$, $P = 0.00$). Given the adequacy of

Table 1: Item Total statistic of self-regulation questionnaire about leisure time physical activity in Iranian male adolescents

No.	Subject	Items	Mean score of item	Std. deviation	Total correlation	Squared multiple correlation	α If the item was deleted
1	Thinking about ways to increase physical activity		3.44	1.12	0.61	0.54	0.901
2	Thinking about facilities that are needed for increasing physical activity		3.13	1.13	0.54	0.43	0.903
3	Thinking about obstacles of physical activity		3.32	1.12	0.56	0.40	0.903
4	Thinking about benefits of physical activity		3.54	1.13	0.61	0.49	0.901
5	Designing and program execution of physical activity		2.81	1.31	0.61	0.47	0.901
6	Set goals and definition outcomes for physical activity		2.81	1.24	0.56	0.40	0.903
7	Set appointment with someone else for physical activity		2.87	1.29	0.55	0.38	0.903
8	Seek solution for obstacles of physical activity		2.90	1.14	0.63	0.46	0.901
9	Get help from someone to overcome the barriers of physical activity		2.42	1.21	0.66	0.51	0.899
10	Self-reward after each attempt of physical activity		2.12	1.25	0.46	0.31	0.906
11	Talking with someone else about the goals and techniques of physical activity		2.75	1.21	0.71	0.56	0.898
12	Get help from someone else to designing and program execution of physical activity		2.60	1.26	0.69	0.54	0.898
13	Annotation and recording each attempt of physical activity		1.53	0.97	0.42	0.26	0.907
14	Thinking about the effect of others on my physical activity program		2.80	1.20	0.63	0.49	0.900
15	Asking someone else to remind me about my physical activity program		2.17	1.24	0.53	0.45	0.904
16	Asking someone else to undertake some of tasks so that I could operate my physical activity program		2.10	1.22	0.52	0.40	0.904

sample size and correlation matrix's appropriateness to factor analysis, the data were included in the EFA.

By this test, four main factors were generated, which explained 63.6% of the variance in self-regulation.

The first factor included the items 9, 11, 12, 14, 15, and 16. This factor alone explained 42.3% of the variation in self-regulation total score and the internal consistency coefficient of the items relevant to this factor was estimated as 0.85 by Cronbach's alpha. Out of the relevant items to this factor, item no. 15 yielded the highest (0.737) correlation. This item addressed requesting others around to remind the individual of the time of physical activity. Item no. 11 yielded the lowest (0.607) correlation; it reflected the individual's conversations with others about the ways to develop and implement physical activity and also correlated with item no. 2 (0.408).

The second factor included the items 5, 6, 7, 8, and 11. This factor explained 9.6% of the variation in self-regulation and the Cronbach's alpha of the items relevant to this factor's total items was found to be 0.81. Item no. 6 addressing goal setting and item no. 7 representing schedule development to do physical activity yielded the highest (0.703) correlation with item no. 2. Item no. 11 yielded the lowest (0.408) correlation [Table 2].

The third factor included the items 1, 2, 3, and 4. This factor explained 6.3% of the variation in self-regulation and

the Cronbach's alpha of the items relevant to this factor's total items was found to be 0.82. Item no. 2 addressing the required facilities for physical activity yielded the highest (0.785) correlation with item no. 3. Item no. 4 yielded the lowest (0.650) correlation and it addressed the benefits of physical activity.

The fourth factor included the items 10 and 13. This factor explained 5.2% of the variation in self-regulation. Item no. 13 (0.671) addressed registry of performed physical activity and item no. 10 (0.834) was related to self-reward after each accomplishment in performing physical activity or its constituents. The internal consistency of the items related to this factor was derived as 0.68 by Cronbach's alpha.

DISCUSSION

This study was conducted to evaluate the psychometrics of a 16-item questionnaire specifically developed to measure self-regulation related to leisure time physical activity in Iranian male adolescents. For this, reliability, content validity, and construct validity of this instrument were assessed by a logical and common way.

The questionnaire's reliability was assessed by internal consistency and Cronbach's alpha in two steps. In the pilot study, Cronbach's alpha coefficient was derived as 0.84 and total internal consistency was found to be satisfactory. This index was also estimated as 0.90 after the questionnaires were filled out. This coefficient was reported 0.96 in Yeom

Table 2: Rotated component and structure matrix with PCA and promax rotation for items of self-regulation questionnaire related to leisure time physical activity in Iranian male adolescents

Item no.	Rotated component matrix				Structure matrix				Communalities
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4	
15	0.737	*	*	*	0.760	*	0.301	0.452	0.648
14	0.697	*	*	*	0.774	0.481	0.497	*	0.620
12	0.678	*	*	*	0.790	0.598	0.484	*	0.658
9	0.665	*	*	*	0.775	0.549	0.430	0.360	0.617
16	0.656	*	*	*	0.708	0.328	0.320	0.414	0.532
11	0.607	0.408	*	*	0.752	0.636	0.557	*	0.641
5	*	0.716	*	*	0.418	0.797	0.529	*	0.653
6	*	0.703	*	*	0.387	0.766	0.484	*	0.598
7	*	0.703	*	*	0.478	0.752	0.380	*	0.588
8	*	0.689	*	*	0.490	0.780	0.470	0.314	0.620
2	*	*	0.785	*	0.411	0.416	0.815	*	0.677
1	*	*	0.767	*	0.448	0.569	0.845	*	0.722
3	*	*	0.733	*	0.432	0.457	0.787	*	0.625
4	*	*	0.658	*	0.494	0.584	*	*	0.622
13	*	*	*	0.834	0.402	0.308	*	0.869	0.762
10	*	*	*	0.671	0.492	0.370	*	0.740	0.596

*Less than 0.30

et al.'s study. The findings of the present study are consistent with the reliability coefficient of the 53-item questionnaire introduced by Petosa and calculated by test-retest.^[22] In addition, Cronbach's alpha was found to be 0.85 for enlistment of social support, 0.81 for goal setting and schedule development, 0.82 for self-instruction, and 0.68 for self-monitoring, representing satisfactory consistency of the items associated with any sub-construct of the questionnaire except self-monitoring. In Petosa's study, although the Cronbach's alpha was reported as 0.79 for self-monitoring, this index was found to be 0.62 for one of the measured sub-constructs, i.e. reinforcement. In Petosa's opinion, the emphasis of the items related to a sub-construct on the behavioral mechanisms of self-regulation and failure to address cognitive behaviors could explain the relatively low internal consistency of the items.^[22] Hence, future studies are expected to enhance the internal consistency of this sub-construct by introducing one or two items related to cognitive processes of self-regulation.

To achieve satisfactory face and content validity, we elicited the comments of health experts to determine the CVI and CVR of the 25 recommended items and then unsatisfactory items were excluded. Finally, 16 items remained in accordance with the experts' comments elicited in different steps. The efforts to achieve content validity were initiated since the questionnaire's development. Brons and Gorow have offered literature review and eliciting the comments of experts and the representatives of the target population as the most important measures to achieve content validity for measurement instruments, which should be considered at the step of instrument development.^[36] Therefore, the comments of five health experts outside the research team were elicited after literature review in the present study. These comments helped the researchers consider different dimensions of physical activity-related self-regulation and the contribution of each factor in the final items of the questionnaire at the step of instrument development.

EFA yielded four sub-constructs for the questionnaire. The first factor was mostly correlated with the items 9, 11, 12, 13, 14, 15, and 16, all of which are related to a sub-division of self-regulation construct addressing an individual's effort to garner social and environmental support. Therefore, this factor was named enlistment of social support. The associated items with this factor address thinking about the influence of others around on physical activity schedule, seeking assistance from others around to remind one of the time of physical activity, requesting them to eliminate the existing barriers to performing physical activity, and talking about the purposes and ways of performing physical activities with others. The second factor including the items 5, 6, 7, 8, and 11 exhibited the highest correlation. This

factor, namely goal setting, included the issues concerning setting goal and developing physical activity schedule. The items included in the second factor sub-division address the issues including development of a regular schedule and setting of specific output and behavioral goals for physical activity, planning for performing physical activity schedule along with others, planning for solving current problems, as well as talking about the purposes and methods of performing physical activity with others. Notably, item no. 11 was concurrently correlated with the first and second factors, concerning talking with others about the purposes and ways of performing physical activity schedule. As this item is related to both planning and enlistment of social support, its correlation with both first and second factors could be justified.

The third factor, namely self-instruction, included the items 1, 2, 3, and 4. These items assessed the rate of thinking about physical activity benefits, the ways to increase physical activity, and the facilities of and barriers to performing physical activity. The fourth identified factor was named self-monitoring. This factor was mostly correlated with the items 10 and 13. These two items address the registry of performed physical activities and rewarding self for accomplishment of physical activity performance. However, the questionnaire developed by Petosa has identified six sub-constructs consisting of goal setting, self-monitoring, time management, enlistment of social support, reinforcements, and relapse prevention.^[16,22,37] Fleury introduced the *Index of Self-regulation* in 1998 to measure the self-regulation related to physical activity.^[38] The initial target population of this 9-item questionnaire includes middle-aged adults and only three dimensions, including stimulus control, behavior maintenance, and behavior monitoring, have been considered.

In recent years, some items of this questionnaire were used to develop specific questionnaires to particular target populations and the validity and reliability of the new questionnaires were reported.^[20] The difference in the number of generated sub-constructs between the present study and two other studies could be attributed to the development and selection of the items as per the experts' comments. These items were introduced based on the demographic and cultural specifications of the target community. For example, while Petosa *et al.* have introduced a single sub-construct, namely self-reward, the associated behaviors with self-reward were assigned to the self-monitoring sub-construct. As the associated behaviors with self-reward are a subdivision of self-communication skills, it is also associated with social and cultural specifications of different communities, which could contribute to the number of the items selected by the expert panel to measure self-reward-related behaviors in

Iranian male adolescents.^[39] In addition, the selection of the present questionnaire's items with the assistance of expert panel was made in such a way that led to elimination of relapse prevention and time management sub-constructs. However, these two sub-constructs were already considered in Petosa's questionnaire.

Failure to implement the qualitative extraction of the items using the target population and estimate concurrent and predictive validity could be the most important limitation of the present study. However, use of a considerable number of the target population members ($N = 603$) was a strength of this study. In addition, division of Isfahan into three regions, privileged, semi-privileged, and sub-privileged, and enrollment of participants from all the regions could increase the generalizability of the findings.

CONCLUSION

Although the findings indicated that the 16-item questionnaire used in this study enjoyed satisfactory validity and reliability to measure physical activity-related self-regulation construct in leisure time of male adolescents in Iran, the reassessment of validity and reliability of the new instrument in this population and others, and assessment of concurrent and predictive validity with regard to other main constructs of socio-cognitive theory could be helpful.

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