

Research Article

Volume 3 Issue 3 - February 2018
DOI: 10.19080/GJORM.2018.03.555611

Glob J Reprod Med

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Psychometric Characteristics of the Theory of Planned Behavior-based Puberty Health Behavior Scale (PHSFA) in Iranian Adolescents



Darabi F¹, Yaseri M², Farahani FK^{3*}, Kaveh MH⁴, Shojaeizadeh D⁵ and Majlessi F⁶

¹Department of Epidemiology and Biostatistics, Tehran University of Medical Sciences, Iran

²Department of Health Education & Promotion, Asadabad School of Medical Sciences, Iran

³Department of Population, Health and Family Planning, National Institute for Population Research, Iran

⁴Department of Health Education and Health Promotion, Shiraz University of Medical Sciences, Iran

⁵Department of Health Education and Health Promotion, Tehran University of Medical Sciences, Iran

⁶Department of Education Health and Promotion Health, Tehran University of Medical Sciences, Iran

Submission: December 12, 2017; **Published:** February 09, 2018

***Corresponding author:** Farideh Khalajabadi Farahani, Department of Population, Health and Family Planning, National Institute for Population Research, Tehran, Iran, Tel: +98-9125357983; Email: faridehfarahani2@gmail.com

Background

Puberty is the prominent evolution during adolescence. This evolutionary change is referred to as a turning point of adolescence.

Objective: This study aimed to evaluate the psychometric characteristics of the theory of planned behavior-based puberty health behavior scale (PHSFA) in Iranian adolescents.

Methods: This methodological study was carried out in Iran in 2016. First, puberty health behavior scale (PHSFA) was developed based on TPB. Then, the validation criteria of this scale were evaluated through content and face validity and were confirmed by an expert panel. Next, the Exploratory Factor Analysis (EFA) ($KMO=0.73$) with varimax rotation were used for construct validity. Also, the Cronbach alpha was calculated, and the test-retest method was used to determine the reliability. For an optimal reduced solution, 42 items and six factors were used. These factors jointly accounted for 65% variance of the outcome variable. The sample size for construct validity was 578 female students aged 12 to 15 years. Finally, data were analyzed using SPSS 23.0 and AMOS 23.0 and the results less than 0.001 were considered to be significant.

Results: The Confirmatory Factor Analysis (CFA) indicated the good fit to the data ($RMSE= 0.053$ 95% CI 0.042- 0.064). EFA was run, and a six-factor model was extracted. The final results confirmed acceptable goodness of fit indices for the six-factor structure of PHQFA. The six subscales explained 65% of the variance and showed significant reliability. The Cronbach's alpha coefficients were (0.79-0.91) for all items, and the test-retest results were satisfactory for all items ($ICC = 0.86-0.94$).

Conclusion: This study illustrates the factor structure of expanded TPB-based puberty health behavior scale. It is necessary to provide valid and reliable questionnaires and apply appropriate interventions to assess puberty health behaviors of adolescents.

Keywords : Psychometric, Factor Analysis, Adolescents, Questionnaire

Abbreviations : WHO: World Health Organization; Fgds: Focus Group Discussions; CVR: Content Validity Ratio; CVI: Content Validity Index; CFI: Comparative Fit Index; NFI: Normed Fit Index; IFI: Incremental Fit Index; RMSEA: Root Mean Square Error Of Approximation; SRMR: Standardized Root Mean Square Residual; ICC: Inter-Class Correlation Coefficient

Background

Puberty refers to a physical stage in the second decade of life by which a child's body becomes an adult body capable of reproduction. The World Health Organization has defined the ages from 10 to 19 as adolescence age [1]. Adolescents comprise a significant proportion of the total population in Iran. In the recent national census in 2011, there were approximately 12

million adolescents aged 10-19 (16.34% of entire population), and 21 million young people aged 10-24 (27% of entire population) which consist nearly less than one-third of the entire country population [1]. Studies in developed countries have shown insufficient knowledge of 65% of adolescents, especially girls, about puberty and sexuality. Despite the high

interest of researchers in puberty health, there are few studies published on the development of appropriate scales regarding health puberty of Iranian youth [2,3]. In Iran, there are few scales available assessing puberty health-related behavior [4]. For example, Rabiepoor [2] and Mohammad-Alizadeh [5] have used scales which assess knowledge of puberty health. Some existing scales are incomplete like the scale developed by Afghari [4] which assesses only puberty health education of 10-14 years-old girls, without validity and reliability.

Compared to boys, girls have less knowledge about puberty health [6], possibly because talking about the sensitive issue of puberty health is more of a taboo for girls. Given the importance of puberty health in adolescents, having precise scales assessing puberty health behavior of adolescents is of the prerequisites of appropriate intervention [4]. Therefore, it is necessary to develop and validate the scale based on behavior change theories of social and behavioral sciences as well as using the uniform scale which enables us to compare the results of different studies. Based on evidence [7], TPB is more acceptable theory than other behavior theories explaining how adolescents engage in the high-risk behaviors [8]. TPB has been used to predict puberty health-related behavior of adolescent females [9]. Based on TPB, there are three determinants of behavior including attitudes, subjective norms, and perceived behavioral control. Some studies have shown that the perceived parental control may improve children's behaviors. Thus, in this study, perceived parental control construct was added to the original theory to strengthen the predictive power of puberty health-related behavior theory. Several pieces of evidence emphasize the effectiveness of TPB constructs for high-risk behaviors among youth [3,10]. There are a few studies [11,12] assessing direct measures of TPB such as attitude, subjective norm, and perceived behavioral control. Hence, to assess sexual and puberty health of adolescents, valid and reliable scales based on behavior change theories of social and behavioral sciences, are needed [8].

Objective

This study aimed to evaluate the psychometric characteristics of the theory of planned behavior-based puberty health behavior scale in Iranian adolescents.

Participants and methods

This methodological study was conducted among Iranian adolescent students through a cross-sectional design in Iran in 2016.

Selection of subjects

The target population of the study was female students (578 students) of Tehran, Iran. The sample size was calculated base of knowledge since it produces the maximum sample size. According to previous studies, the standard deviation of knowledge scores was considered to be between 22.9 and 25.20 to have a power of 90% with an attrition rate of 10% between intervention and control groups [13]. The inclusion criteria were as follows: an adolescent girl, 12 to 16 years, living in Tehran,

and willing to participate in the study. The exclusion criteria were as follows: being absent for more than one session, and lack of participation to the post-test.

The scale development process

A self-administered scale was developed based on TPB constructs. Some parts of this scale were based upon the scale developed by World Health Organization [14]. The WHO scale includes questions about knowledge of reproductive health and its sources, and sexual attitudes and behavior. To complete the items obtained from WHO, we reviewed papers in electronic resources. Of total 317 papers, we investigated 71 of them and found 15 papers specifically related to adolescent reproductive health. Then, we evaluated their contents. Next, we prepared a checklist to assess the quality of our documentation. We investigated study purpose, study method, data collection scale, target group, and the method of variables measurement for every paper. After that, five papers related to the reproductive health of female students were extracted. Some items added to scale and some removed from scale. According to experts, to complete the items obtained from the previous steps, a qualitative study including eight focus group discussions (FGDs) with 40 participants, taking an hour for each FGD, was implemented. Finally, the primary scale was completed.

Demographic, knowledge and attributes questionnaire

Six variables were about demographic information; age, father's education, mother's education, mother's job, father's job, and economic situation (self-reported). Nine items were used to assess puberty health-related knowledge. The response to each question was scored using three categories including true, false, and do not know, one score for true response and zero scores for false and "do not know" responses.

TPB constructs

Eleven items regarding attitude towards puberty health, derived from relevant literature, were employed. Ten items were used to assess the influence of important people (parents, friends, and teachers) on students' opinion about puberty health. Nine items were used to measure the students' perceptions of behavioral control about behaving in a way that preserves their puberty health. Seven items were used to assess perceived parental control. Six items about behavioral intention towards puberty health, derived from relevant literature, were employed. Eight items were used to evaluate puberty health skills. All items were scored on a five-point Likert-type scale (ranging from "strongly disagree" to "strongly agree"). To make the results comparable with other scales, we transformed scores from 0 to 100 with the following formulation:

$$\text{New score} = 100 \times (\text{Score} - \text{minimum possible score}) / (\text{range of scores})$$

In our study, the minimum possible score for each question was one and range of scores was four (=5-1). The total scores for each subscale were calculated by averaging the scores of all questions on that scale, ranging from 0 to 100. Each participant

could obtain the maximum of 100 scores. The scores between 0 to 33.3, 33.4 to 66.7, and 66.7 to 100 were considered respectively as poor, moderate, and good. We also weighed the percentage of correct questions to get the score of knowledge. The psychometric properties of the theory-based puberty health scale were determined to evaluate validity and reliability of the questionnaire. Then, the 51-items scale was prepared and put in six main categories. Subsequently, psychometric tests including face validity, EFA, CFA, internal consistency, and reliability were performed on the scale.

Scale validation

Face and content validity: Content validity and face validity of the 51-items scale was evaluated by a panel of experts. Eleven specialists were faculty members of the school of public health and nursing and midwifery, Shiraz and Yazd Universities of Medical Sciences. They were specialists in the fields of health education and promotion (four women and one man), public health (two women) and psychometrics (two women and two men).

Content validity: Qualitative and quantitative approaches were applied to evaluate the content validity of the questionnaire. First, eleven specialists reviewed the scale to check its grammar, wording, scaling, and item allocation. To calculate the Content Validity Ratio (CVR), twelve other specialists (in the field of health education & promotion) were asked to determine each item on a 3-point Likert scale were 1= essential, 2= useful but not essential, and 3= not essential. Based on Lawshe's table, items that scored more than or equal to 0.54 were kept in the scale. To calculate the Content Validity Index (CVI), eleven additional expert panelists were asked to determine the relevance, clarity, and simplicity of each item using the 4-point Likert scale [15]. For more precision, two separate groups of experts were engaged. In according with Waltz & Baussel items with CVI values more than or equal to 0.79 were accepted.

Face validity: Both qualitative and quantitative methods were applied to face validity. For the qualitative part, ten adolescent girls were recruited using convenience sampling to assess the ambiguity, relevance, and difficulty of each item. For the quantitative part, impact score method was used to recognize the importance of each item. An impact score of 1.5 or more showed that the intended item was appropriate. The revised scale was then given to twelve females, and the score of each question was assessed separately. The five-point Likert scale answers consisted of: very important (score 5), important (score 4), averagely important (score 3), slightly important (score 2), and not important (score 1). The questions that received a score more than 1.5 were retained for subsequent analyses. Eventually, the face validity of the revised scale was evaluated again by four students.

Construct validity

The construct validity was determined via EFA. EFA was investigated using varimax rotation. The Kaiser-Meyer-Olkin

and Bartlett's test of sphericity was used to determine whether the factor analysis sample is appropriate. Eigenvalues above 1 and scree plot were used to determine the number of factors. Factor loadings equal to or more than 0.4 were considered appropriate [16]. Factor analysis was performed to assess the model fitness. Various fit indices such as relative chi-square (χ^2/df), Comparative Fit Index (CFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) were used.

Reliability assessment

Reliability was assessed by Cronbach's alpha coefficient. Test-retest over the course of two weeks for thirty women was performed by the inter-class correlation coefficient (ICC).

Statistical Analysis

CFA was performed by AMOS 23.0 to assess the construct validity of the questionnaire. Data were analyzed using SPSS 23.0 through descriptive statistics (mean, standard deviation, frequency, percentage). The generalized linear mixed model was used to compare the characteristics of participants in two groups while considering the design effect of our sampling. We used EFA with varimax rotation to obtain the dimensions and loads of each question on these dimensions. We calculated intra-cluster correlation and Cronbach's Alpha for intra-scale reliability. All statistical tests were also two-sided, and $P \leq 0.05$ was considered to be statistically significant.

Results

Descriptive statistics

The total number of participants was 578 with a mean age of 14.1 ± 1 . The socioeconomic and demographic characteristics of the studied participants are shown in Table 1.

Table 1: Socio-economic and demographic characteristics of female adolescents (N = 578).

Covariates	Category	Total
Economic situation	Very good	35 (6.1%)
	Good	242(41.9%)
	Average	254(43.9%)
	Weak	47 (8.1%)
Father education	<6	57 (9.9%)
	6-12	366 (63.8%)
	>12	151 (26.3%)
Mother education	<6	72 (12.5%)
	6-12	379 (65.8%)
	>12	125 (21.7%)
Father job	Working	544 (94.1%)
	Unemployed	34 (5.9%)
Mother job	Working	153 (26.5%)
	housewife	425 (73.5%)

Scale validation

The first draft of the 51-items scale (except knowledge and socioeconomic questions) was formed based on TPB.

Content validity

In quantitative content validity assessment, three items with

CVR less than 0.62, CVI less than 0.62, and CVI less than 0.80 were omitted. The mean CVR and the mean CVI were 0.66, and 0.73 respectively. In qualitative content validity assessment, all criteria including grammar, wording, scaling, and item allocation were found to be appropriate (Table 2). As a result, five items were removed from the scale.

Table 2: Number of items, and α of Iranian students' puberty health scale (PHSFA) constructs (N= 578).

Subscale	Number of items	Mean±SD	Range	α (N=578)	ICC(N=578)
Attitudes towards puberty health	11	41.0±9.4	0 to 80	0.85	0.94
Subjective Norm	7	30.0±20.2	0 to 100	0.89	0.92
Behavioral Intention	6	31.4±12.8	0 to 100	0.8	0.91
Perceived parental control	4	43.1±15.1	0 to 7.5	0.91	0.92
Perceived behavioral control	6	32.2±15.1	0 to 92	0.79	0.93
Puberty health behavior	8	42.3±16.1	0 to 100	0.89	0.94
Total	42	39.6±7.9	0 to 100	0.91	0.86

Face validity

In qualitative part, expert panel suggested removing two items due to the lack of harmony between items and their equivalent category and content overlap. In qualitative part, two items had an impact score less than 1.5 and consequently were omitted.

Construct validity results

Construct validity was done by 578 students. In factor analysis, $KMO \leq 0.73$ and Bartlett's test was significant ($p < 0.001$). The sub-groups analysis showed an acceptable homogeneity level. Principal component analysis with varimax rotation identified six factors with eigen values more than 1 and factor loadings equal to or more than 0.4. Two items in this part had

factor loadings less than 0.4 and were omitted. These accounts for 65% of the variance observed. The factor loadings were as follows: factor 1 (perceived behavioral control) 6 items, factor 2 (subjective norm) 7 items, factor 3 (attitudes towards puberty health issue) 11 items, factor 4 (behavioral intention) 6 items, factor 5 (puberty health behavior) 8 items, and factor 6 (perceived parental control) 4 items, (a total of 42 items), (Table 3). The results of CFA of the general model with 42 items in six subscales showed that the model was accepted in its current form (the relative chi-square (χ^2/df) = 1.911<3, $P < 0.001$; RMSEA=0.053>0.08, (95% CI=0.042-0.064); CFI=0.962 >0.9; IFI=0.955>0.9; TLI=0.946>0.9; GFI=0.996>0.9; AGFI=0.995). Therefore, CFA shows the adequacy of the model and the good fit of its structural model for the study population (Table 4) (Figure 1).

Table 3: The results obtained from EFA with Varimax rotation among adolescents aged 12–16 (N = 578)

Factors: 1= Perceived behavioral control, 2= Subjective Norm, 3= Attitude, 4= Behavioral Intention, 5= Behavior, 6= Perceived parental control.

Row Tems	Items	Factors					
		1	2	3	4	5	6
31	Although I like to spend much time underwater in the bathroom or swim in a pool, I can have a standing bath during my menstruation.	0.87					
30	It is easy for me to control changes in my mood such as depression and anxiety during my menstruation.	0.826					
29	Flexibility and ability to communicate effectively with others are easy for me during adolescence.	0.824					
34	I'm sure that I can do more social activities during my adolescence.	0.822					
33	It is easy for me to look after my individual sanitation such as washing after each bowel movement during menstruation.	0.809					
32	I'm sure that I can manage mental and physical signs of adolescence period.	0.771					
16	Most people who are important to me think that I should take shower standing during menstruation.		0.875				

13	My family believes that I should continue my social activities during menstruation.		0.863				
18	My family believes that I should have my social activities during adolescence similar to my other life periods.		0.86				
15	Most people who are important to me think that I should follow a proper diet in puberty.		0.811				
12	The people surrounding me want me to look after my personal sanitation (bathing, changing underwear, etc.) during my puberty in order to prevent any infection.		0.809				
17	Most of my friends and classmates approve my unwillingness in doing my homework due to changes in my mood as well as my depression because of my menstruation.		0.679				
14	Most people who are important to me think that the changes during puberty such as physical and emotional changes prevent me from carrying out social activities such as attending social meetings.		0.665				
15	Proper washing (first wash the vagina and then the anus) after each bowel movement in the toilet in order to prevent from Pelvic Inflammatory Disease is quite an important behavior among women.			0.749			
20	Changing underwear daily in order to prevent from uterine infection is quite an important behavior in women.			0.736			
17	Taking shower standing, especially during periods is quite an important behavior.			0.729			
14	In my opinion, personal hygiene during menstruation (such as washing genitals and anal area after each excretion and defecation) is essential.			0.722			
11	In my opinion, individual health during menstruation prevents the risk of infection.			0.719			
16	In my opinion, puberty decreases the interest in daily activities such as loss of interest in activities within the home.			0.711			
13	In my opinion, oversleeping during puberty results in impatience in doing homework.			0.708			
18	In my opinion, puberty causes a sharp and aggressive behavior in dealing with others.			0.704			
19	In my opinion, menstruation disturbs the everyday life activities.			0.606			
12	In my opinion, menstruation creates difficulties in concentration on some activities such as studying a lesson.			0.563			
21	In my opinion, menstruation decreases the interest in doing school activities.			0.559			
23	I have decided to frequently change my menstrual pad during menstruation.				0.726		
20	I want to follow health issues for puberty period (such as bathing, changing underwear, etc.).				0.706		
24	I have planned to follow health issues for puberty period (such as bathing, changing underwear, etc.).				0.701		
22	I have decided to continue my social activities during menstruation similar to my former normal life activities.				0.679		
19	I'm going to wash after each bowel movement during menstruation.				0.68		
21	I'm going to follow health issues for puberty period (such as bathing, changing underwear, etc.).				0.625		
41	During my puberty, I change my underwear daily.					0.743	
36	I take standing bath, especially during my menstruation.					0.737	
42	I follow puberty period sanitation issues, especially individual sanitation.					0.717	

40	After each bowel movement, I wash uterus area properly from front to back (first washing the vagina and then the anus) in order to be clean and prevent from Pelvic Inflammatory Disease.				0.714	
39	I don't go to sea and pool during my menstruation.				0.709	
38	I avoid drinking drinks which have caffeine (such as strong black tea, espresso...) in order to prevent from pre-menstrual symptoms (e.g., nervousness and menstrual pain, etc.).				0.705	
35	I would use cotton underclothes during puberty.				0.65	
37	During my puberty, I do daily physical activities which reduce my depression and aggression.				0.619	
28	My parents determine how much I should read on the subject of adolescent health.					0.88
26	My parents give me enough training and guidance on the subject of adolescent health.					0.875
27	My parents give me enough training and guidance about menstrual hygiene.					0.846
25	My parents determine how much I should read about menstrual hygiene.					0.821
	Eigenvalue	4.12	1.95	1.68	1.52	1.19
	Explained Variance (%)	22.93	10.83	9.35	8.48	6.61
	Cumulative Variance (%)	22.93	33.76	43.12	51.61	58.23
						65.01

Table 4: Goodness of fit indices for puberty health dimensions (N =578).

Construct	RMSEA	LO90 HI90	χ^2/df	TLI	IFI	NFI	CFI	AGFI	GFI	SRMR
Summary of rules of thumb	<0.5* <0.1**		0.00	>0.8			>0.9			<0.6 <4
Puberty health	0.053	0.042 0.064	1.91181	0.946	0.955	0.955	0.962	0.995	0.996	0.056

Df= Degrees of Freedom, SB Chi-Square = Satorra–Bentler chi-square, Prob = Probability * Good fit **

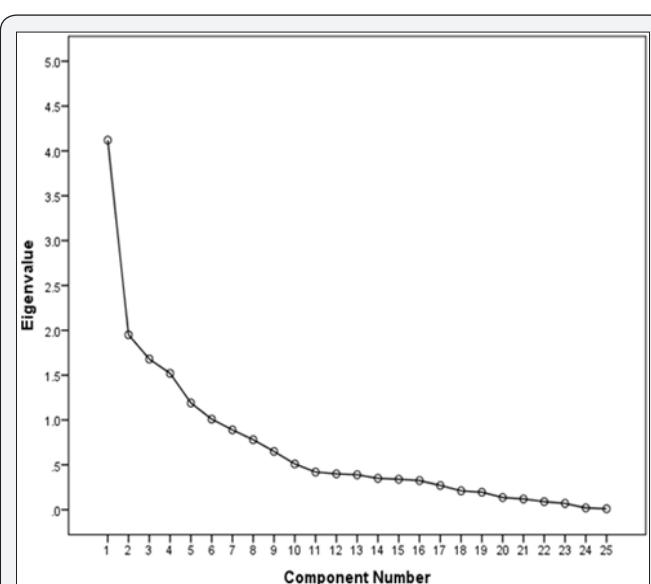


Figure 1: Mediocre fit. Screen Plot.

Reliability results

The overall and domain-specific items showed excellent internal consistency with Cronbach's (alpha) coefficient of 0.92 for the whole scale, ranging from 0.79 to 0.91 for domain

specific. Test-retest reliability results indicated $ICC \geq 0.80$ for all PHSFA domains and total scores suggested PHSFA as a consistent measurement of puberty health over time ($ICC=0.86-0.94$), (Table 2).

Discussion

The results supported validity and reliability of the scale in this sample. The primary scale consisted of 51 items. However, after different parts of psychometric evaluations, the number of items was reduced to 42. The results of content and face validity showed that the items of the scale were comprehensible and related to the Iranian culture. Content validity was assessed by a team of specialists and the results indicated acceptable validity and reliability levels of scale.

In this study, the 42-items scale was classified into six subscales which indicates the existence of six dimensions measuring different aspects of puberty health in students. Changes in the number of factors in the structure of puberty health are consistent with earlier studies [17,18]. EFA with varimax rotation indicated that six subscales including attitude, subjective norm, perceived behavioral control, perceived parental control, behavioral intention, and behavior could be extracted. It seems that a careful selection of items related to puberty health-related behaviors might justify why we obtained

such satisfactory results. The results of the analysis due to the KMO index on this issue emphasize the sufficient sample size and favorable factor analysis.

The six-factor model of the PHQFA in our study explained 65% of the data variance. The results of CFA in same studies on adolescents indicate that the six factors explain 62% of the data variances. Barati et al. [7] study showed consistent results and the theory explained 64% of the variance of puberty health in youth [19]. Similar to previous research, our data show normative patterns. The puberty health scale with 42-items with an appropriate size was used in this study, so it could determine puberty health in six components. The obtained values of CVI and CVR in our study was reasonable. In a related study assessing the reliability and validity of international AIDS scale for Iranian student, the CVR and CVI values more than 0.7 were approved [20].

Reliability results of the PHSFA confirmed the internal consistency of the scale. The test-retest method was also used to evaluate the stability of the scale and the results showed a high ICC between the scores of test and retest, confirming the stability and reliability of the PHSFA. The internal consistency of the PHSFA in this study was paralleled with previous PHQFA research [4,9]. Analysis of the lowest and highest item and item-to-total correlations demonstrated an identical item pattern similar to what reported by Valizadeh et al. [21], and Barati et al. [7]. Another study reported the Cronbach's alpha coefficient of 0.91 which supports the reliability of scale in this population [22].

Strengths

The main strength of this study was the development of a context-bound scale to assess Iranian females beliefs about the puberty health. The PHSFA is a simple, valid, reliable, and context-based scale. We developed and validated the PHQFA based on Iranian socio-cultural context. However, its validity has not been assessed for other cultures. Therefore, further studies are suggested to confirm its validity and applicability to different cultures. Moreover, it is recommended to assess the validity and applicability of the PHSFA in other eastern and Islamic countries. As of today, it has not been developed such theory-based puberty health behavior scale for students. The advantage of the current scale over the previous scales is the evaluation of psychometric aspects of the behavior, while the previous scales only examine domains of knowledge and attitude. Without losing any important dimension on puberty health-related behaviors, the PHSFA is relatively a short and easy scale to use.

Limitations

The present study has some limitations. First, due to the cultural diversity, the scale can't be generalized to people in other geographic locations. Test-retest reliability assessment was done among Iranian students, hence further investigations in other locations, are needed. Another limitation to consider is that the developed scale is only applicable to female adolescents.

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DOI: [10.19080/GJORM.2018.03.555611](https://doi.org/10.19080/GJORM.2018.03.555611)

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