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RESEARCH ARTICLE

Psychometric Properties of the Turkish Oral Health Behavior Questionnaire for Adolescents Based on the Health Belief Model

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ABSTRACT

Objective: To identify oral and dental health behaviors as critical life skills for adolescents. This study examined the Turkish psychometric properties of the "Health Belief Model-Based Oral Health Behavior Questionnaire for Adolescents" (OHBQAHBM).
Methods: This was a methodological study. The study sample consisted of 335 adolescents aged 13–18 years. The Sociodemographic Information Form and OHBQAHBM were used to gather data. The data analysis and evaluation were performed using factor analysis, Cronbach's alpha, and item-total score correlation.
Results: Thirty-five items were recorded on the main scale, and the other items were recorded on six subscales. The six subscales had a variance of 50.4%. The Turkish Cronbach's alpha coefficient was 0.880. Because of confirmatory factor analysis, the model fit index results were recorded as follows: 0.048 as the RMSEA, 0.861 as the goodness-of-fit index, and 0.924 as the comparative fit index.
Conclusions: The measurement tool was valid and reliable for evaluating adolescents' oral and dental health behaviors based on their health belief model.

Keywords: Health belief model, oral health behavior, adolescent health, scale validity, reliability

INTRODUCTION

Adolescence, the pivotal stage from childhood to adulthood, is a crucial period for establishing health behaviors that often persist into adulthood. This transitional phase is particularly important for health protection and enhancement. The growing emphasis on social appearance during adolescence heightens interest in oral and dental health (ODH) among adolescents. However, they require support and guidance to sustain and enhance their health behaviors they acquire during this period (1-3).

The ODH is an essential indicator of overall health and quality of life (4,5). Poor oral hygiene and dental caries negatively affect physical, mental, and social well-being by causing eating, chewing, and speaking problems and pain (6). In addition, the long duration of dental treatments and high cost create a socioeconomic disadvantage that is challenging for adolescents and their families (7). Therefore, protective behaviors toward ODH reduce long-term health costs (8).

Adolescents believe brushing alone is sufficient to protect against ODH, and they delay regular dental checkups for various reasons(9). Due to dental anxiety and the high cost of dental treatment, adolescents are less likely to attend regular dental checkups (10-12). Therefore, toothbrushing alone is the most common behavior perceived as an individual responsibility for ODH. Regular toothbrushing is associated with the desire to retain white rather than healthy teeth (13). This indicates that adolescents' esthetic concerns outweigh their health. Adolescents should develop dental control behaviors in addition to regular toothbrushing to improve ODH. Many theories are mentioned in the literature as methods of gaining this behavior (14), and one of the most important of these theories is the health belief model (HBM) (15,16).

The HBM provides a holistic view of health behaviors. The framework comprises six main concepts: perceived susceptibility, perceived benefits, perceived severity, perceived barriers, cues to action, and self-efficacy. The model's concepts of the model guide the development of health behavior and the provision of its permanence. Therefore, the HBM is used in behavior development in many areas (17).

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Initiatives based on the HBM to change ODH behaviors have shown very successful results (18-20). Current measurement tools for assessing adolescents' ODH behavior are limited. For this reason, there is a need for measurement tools that can determine the factors that facilitate the emergence of adolescents' attitudes and behaviors toward ODH and identify barriers to maintaining these behaviors. The best way to demonstrate this is to develop a scale based on the six concepts of the HBM. The literature review did not identify a Turkish scale based on the HBM (18-20). The study aim was to investigate the Turkish psychometric properties of the "Oral Health Behavior Questionnaire for Adolescents Based on the Health Belief Model (OHBQAHBM)" (12).

MATERIAL AND METHODS

Study Design and Participant

A methodological, descriptive, and cross-sectional design was used. In methodological type studies, it is examined whether the scales developed in different cultures measure concepts in the same way in the culture to which they want to be adapted. The scale evaluates whether it is valid and reliable in the culture to which it is intended to be adapted. For this purpose, scale translation is performed, content validity is performed, pilot application is carried out, and construct validity is evaluated. All the steps were carried out in this study (21-26). The study sample consisted of healthy adolescents aged 13-18 years. Study data were collected using a "Sociodemographic Information Form" and the "Oral Health Behavior Questionnaire for Adolescents Based on the Health Belief Model" between April and June 2022. The data were collected face-to-face in the classroom environment from students in two public high schools in Izmir, western Turkey. The parents of the adolescents participating in the study were informed about the study, and written informed consent was obtained. In addition, the adolescents participating in the study were given detailed information about the research in the classroom, and their written informed consent was obtained. Validity and reliability analyses were conducted using the responses of students who agreed to participate in the study and completed the questionnaire.

The literature suggests that a sample of 5-10 times the number of items on the scale should be reached to test the validity and reliability of measurement tools. For this reason, it was necessary to include at least 175 adolescents, as there were 35 questions on the measurement tool of the study. In addition, since 27% upper/lower group analysis was used for discrimination analysis in this study, additional sample calculation was based on a t-test in independent groups in the GPOWER program, and the required sample size was determined as 320 adolescents at a significance level of 0.01% and 99% power. A total of 350 adolescents were planned to be included in the study sample to accurately demonstrate the validity and reliability of the scale. Within the scope of our research, 335 students who completed the data forms comprised the research sample (21-26).

Instruments

Adolescent Descriptive Information Form: This form consists of questions about sociodemographic characteristics (such as age, gender, class level, and economic level) and questions evaluating ODH behaviors. Questions about ODH behaviors include the frequency of daily toothbrushing, toothbrush change time, dental floss use, and frequency of dentist visits. The researchers prepared the questions.

Oral Health Behavior Questionnaire for Adolescents Based on the Health Belief Model: This scale was developed by Xiang et al. (12), and its validity and reliability in adolescents were examined. This study consists of 35 items designed in 5-point Likert-type and six sub-dimensions. The total variance explained by the scale was 62.47%. The subdimensions explained variance rate varied between 3.98% and 24.79%. The factor loads ranged from 0.32 to 0.92. In the CFA, the fit indices were >0.90, and the RMSEA was <0.08. The item-total score correlation was 0.47–0.91. Cronbach's alpha coefficient for the six subdimensions of the scale ranged from 0.81 to 0.97. The sub-dimensions and the item distribution of the scale are as follows: "perceived susceptibility sub-dimension" (2 items); "perceived benefits sub-dimension" (7 items); "perceived barriers sub-dimension" (6 items); "cues to action sub-dimension" (3 items); "perceived severity sub-dimension" (7 items); "self-efficacy sub-dimension" (10 items). Scores on the scale ranged from 35 to 175. There are no reverse-scored items. A high score on the scale indicates a high level of health beliefs about ODH. The scale has no cut-off point (12).

Translation of scale

The literature recommends that the most appropriate sentence structures and idioms be used in the target language and that sentences be adapted to the culture (21-24). For this purpose, the scale items in this study were translated into Turkish. The researchers translated the items into Turkish and created a Turkish version of the scale. Turkish was translated into English by a linguist fluent in both Turkish and English.

Content validity of the scale

It is recommended that at least three experts be consulted to determine equivalence with the original scale in translated scales (22). Eight experts were consulted on the Turkish translation of the scale. Two of these experts were dentists, three were faculty members in pediatric nursing, and four were public health nursing faculty members. The original and translated scale forms were submitted to the experts together, and they were asked to score each item between 1 and 4 (1= needs a lot of change, 2= needs little change, 3= appropriate, and 4= very appropriate) to evaluate their suitability. The researchers revised the scale items in line with the experts' suggestions. The item-level content validity index (I-CVI) and the scale-level content validity index (S-CVI) were calculated for each item on the scale and the total scale. A rate of ≥0.80 in I-CVI and S-CVI indicates inter-rater agreement (25-27).

Pilot application

It is recommended that the scale be applied to a group of 20-30 individuals with characteristics similar to those of study participants and who are not included in the sample to analyze the intelligibility of language and expressions (21,22). After the first translation phase, the scale was piloted to a sample of 20

people who were not included and had characteristics similar to those of individuals to whom the scale would be applied. The adolescents in the pilot application found the items intelligible and gave no negative feedback on the scale items. Therefore, the scale was applied to the main sample.

Data analysis

The data analysis used Cronbach's Alpha and McDonald's Omega to determine the scale's internal consistency and subdimensions. Pearson correlation analysis, inter-item correlation, and split-half analysis were used for the item total score analysis of the scale and subdimensions. Experts state that the minimum acceptable Cronbach's alpha value is 0.70 (21-24). The item-total score and item subscale total score correlation coefficients should be at least 0.20 (25-27). Response bias was evaluated using the Hotelling T-square test.

Explanatory and confirmatory factor analysis was used for construct validity. Explanatory factor analysis was performed to determine the item-factor relationship. The adequacy and suitability of data for factor analysis were examined using the Kaiser-Meyer-Olkin (KMO) coefficient and the Barlett Sphericity test. For factor analysis, the Barlett sphericity test value should be $p<0.05$ and that the KMO value should be >0.60. Principal axis factoring and Promax rotation were used to determine the scale's construct validity. Eigenvalues were accepted as ≥1 to choose the most appropriate structure and number of factors (25-27). Experts emphasize that the minimum factor value should be 0.32 (25,26). This study also accepted the minimum factor load of 0.32 to determine which items would be grouped under each factor (25-27).

Confirmatory factor analysis was used to determine whether the items and subdimensions explained the original scale structure. Multicollinearity analysis was performed before confirmatory factor analysis, and it was determined that there was no multicollinearity between items. The Pearson chi-square, degree of freedom, root-mean-square error of approximation (RMSEA), goodness of fit index (GFI), comparative fit index (CFI), and normal fit index (NFI) were examined. It is recommended that the chi-square value divided by the degree of freedom should be <5, RMSEA should be <0.080, and other fit indices should be >0.90 (25-26). The correlation matrix was used for explanatory factor analysis, and the covariance matrix was used for confirmatory factor analysis. The t-test was used for the upper-lower group comparison (27%. The error margin in the data evaluation was set at $p = 0.05$. The SPSS 24.0, AMOS 25.0, and JAMOVI 2.2 software packages were used for statistical analysis.

Ethical consideration

The approval of Dokuz Eylül University Non-Interventional Clinical Research Ethics Committee (IRB: 2022/17-03) and the permission of the Provincial Directorate of National Education in the province where the study was conducted were obtained. The parents of the adolescents participating in the study were informed about the study, and written informed consent was obtained. In addition, the adolescents participating in the study were given detailed information about the research in the classroom, and their written informed consent was obtained.

RESULTS

It was determined that 57.6% (n=193) of the students participating in the study were female, their mean age was 15.43+1,024 (min=13-max=18), 28.4% (n=95) were 9th graders, 36.4% (n=122) were 10th graders, and 10.4% (n=35) were 11th graders. In addition, 42.1% of mothers (n= 141) and 49.9% of fathers (n=167) had an undergraduate degree, 87.8% (n=294) of adolescents had a nuclear family, 79.4% (n=266) had equal income and expenses, 43.3% (n=145) brushed teeth at least twice a day, 20% (n=266) =70) changed their toothbrushes at least every three months, 60.9% (n=204) did not use dental floss, and 28.1% (n=94) went to the dentist regularly.

Validity analyses

Kaiser-Meyer Olkin's (KMO) coefficient was 0.859, and the X^2 value of the Bartlett test was 5743.381 ($p = 0.000$). Because of EFA, the scale consisted of six subdimensions. The first (self-efficacy) explained 20.993% of the total variance, the second (perceived benefits) subdimension 10.509%, the third (perceived severity) subdimension 7.479%, the fourth (perceived barriers) subdimension 4.703%, the fifth (cues to action) subdimension 4.406%, and the sixth (perceived susceptibility) subdimension 2.361%. The six subdimensions explained 50.451% of the total variance. The factor loads of the first sub-dimension varied between 0.692 and 0.826, the second sub-dimension between 0.686 and 0.835, the third sub-dimension between 0.439 and 0.774, the fourth sub-dimension between 0.462 and 0.691, the fifth sub-dimension between 0.459 and 0.826, and the sixth sub-dimension between 0.575 and 0.629 (Table 1).

Table 1. The results of the explanatory factor analysis (n= 168)

Items	Faktor Loads					
	Self-efficacy	Perceived benefits	Perceived severity	Perceived barriers	Cues for action	Perceived susceptibility
I1						0.575
I2						0.629
I3		0.686				
I4		0.835				
I5		0.815				
I6		0.776				
I7		0.700				
I8		0.769				
I9		0.686				
I10				0.489		
I11				0.462		
I12				0.691		
I13				0.483		

The chi-square value of the six-factor model was 940.192, the degree of freedom was 535, and p = 0.000. The X^2/SD division was determined as 1.757. The following fit indices were obtained: RMSEA, 0.048; GFI, 0.861; CFI, 0.924; IFI, 0.925; TLI, 0.916; and NFI, 0.902. As CFA's result, first sub-dimension factor loads were found to vary between 0.70 and 0.80, second sub-dimension between 0.60 and 0.84, third sub-dimension between 0.39 and 0.80, fourth sub-dimension between 0.44 and 0.68, fifth sub-dimension between 0.51 and 0.81, and sixth sub-dimension between 0.62 and 0.64 (Table 2, Figure 1).

Table 1. Continue

Items	Faktor Loads					
	Self-efficacy	Perceived benefits	Perceived severity	Perceived barriers	Cues for action	Perceived susceptibility
I14				0.617		
I15				0.647		
I16					0.459	
I17					0.746	
I18					0.826	
I19			0.607			
I20			0.631			
I21			0.730			
I22			0.774			
I23			0.713			
I24			0.558			
I25			0.439			
I26	0.752					
I27	0.768					
I28	0.736					
I29	0.692					
I30	0.826					
I31	0.732					
I32	0.785					
I33	0.801					
I34	0.735					
I35	0.741					
Variance explained (%)	20.9	10.5	7.4	4.7	4.4	2.3
Totoal Variance explained (%)	50.4					
KMO	0.915					
Bartlett X^2(p)	1002.203 (p<0.001)					

Reliability analyses

Cronbach's alpha coefficient of the total scale was determined as 0.880. The alpha value was determined as 0.930 for the first subdimension of the scale, 0.886 for the second subdimension, 0.795 for the third subdimension, 0.746 for the fourth subdimension, 0.694 for the fifth subdimension, and 0.605 for the sixth subdimension. The McDonald Omega coefficient of the total scale was 0.883, which was found as 0.930 for the first subdimension, 0.892 for the second subdimension, 0.824 for the third subdimension, 0.748 for the fourth subdimension, 0.737 for the fifth subdimension, and 0.615 for the sixth subdimension (Table 3).

Because of the split-half analysis, Cronbach's alpha values of the first and second halves were determined as 0.773 and 0.770, respectively. The correlation between the two halves was found to be 0.872. The Spearman-Brown coefficient was calculated as 0.932, and the Guttman split-half coefficients were 0.932 and 0.931, respectively. The inter-item correlation coefficients of the scale ranged from 0.161 to 0.735 (Table 3).

The Hotelling T-square test was employed to determine whether there was response bias in the scale, and the test

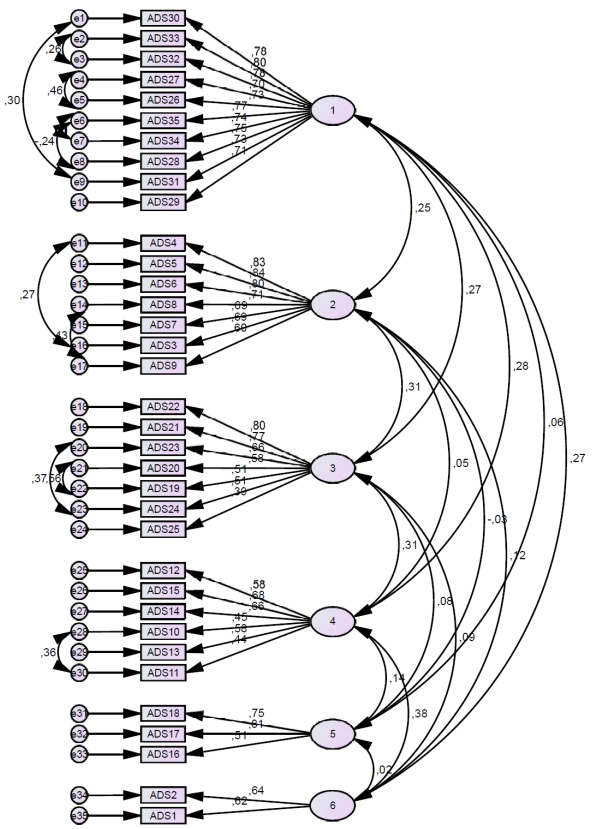

Figure 1: Confirmatory factor analysis.

Table 2. Model fit indices of confirmatory factor analysis (n= 167)

	X^2	DF	X^2/DF	RMSEA	GFI	CFI	IFI	TLI	NFI
Six-factor model	940.192	535	1.757	0.048	0.861	0.924	0.925	0.916	0.902

DF: Degree of Freedom; RMSEA: Root Mean Square Error of Approximation; GFI: Goodness of Fit Index; CFI: Comparative Fit Index; IFI: Incremental Fit Index; NFI: Normed Fit Index; TLI (NNFI): Trucker-Lewis Index.

Table 3. The results of the reliability analysis of the scale (n=335)

			Split-half analysis					
	Cronbach Alpha	McDonald Omege	First Half Cronbach Alpha	Second Half Cronbach Alpha	Spearman Brown	Guttman's split half	Correlation Between the Two Halfs	M± SD (Min-Max)
Total Scale	0.880	0.883	0.773	0.770	0.932	0.931	0.872	135.25+17.62 (79-175)
Self-efficacy	0.930	0.930						31.05+10.62 (10-50)
Perceived benefits	0.886	0.892						25.30+4.74 (6-30)
Perceived severity	0.795	0.824						30.19+4.37 (7-35)
Perceived barriers	0.746	0.748						23.75+4.56 (6-30)
Cues for action	0.694	0.737						12.68+2.69 (3-15)
Perceived susceptibility	0.605	0.615						7.97+1.74 (2-10)

Table 4. Corrected Cronbach's alpha, item-scale total score, and subdimension total score correlations when an item was deleted (n=335)

Items	Cronbach's alpha if item is deleted	Corrected Item-Total Score Correlation *(r)**	Corrected Item-Subscale Score Correlation *(r)**
I1	0.881	0.212	0.444
I2	0.879	0.243	0.444
I3	0.877	0.371	0.637
I4	0.876	0.422	0.777
I5	0.876	0.430	0.778
I6	0.877	0.389	0.732
I7	0.878	0.283	0.649
I8	0.877	0.334	0.726
I9	0.879	0.276	0.616
I10	0.876	0.433	0.438
I11	0.876	0.425	0.433
I12	0.881	0.201	0.507
I13	0.879	0.278	0.455
I14	0.879	0.264	0.530
I15	0.878	0.309	0.547
I16	0.882	0.201	0.437
I17	0.881	0.205	0.606
I18	0.883	0.212	0.553
I19	0.877	0.348	0.547
I20	0.877	0.381	0.580
I21	0.877	0.396	0.620
I22	0.877	0.387	0.651
I23	0.877	0.370	0.629

Table 4. Continue

Items	Cronbach's alpha if item is deleted	Corrected Item-Total Score Correlation *(r)**	Corrected Item-Subscale Score Correlation *(r)**
I24	0.878	0.324	0.482
I25	0.882	0.215	0.345
I26	0.871	0.612	0.731
I27	0.873	0.549	0.714
I28	0.872	0.568	0.696
I29	0.872	0.580	0.676
I30	0.871	0.614	0.776
I31	0.871	0.620	0.726
I32	0.871	0.630	0.747
I33	0.871	0.626	0.763
I34	0.871	0.605	0.714
I35	0.871	0.626	0.719

*** Significant at** p<.001, I =

Table 5. Comparison of the total scale scores of the 27% lower and upper groups

Groups	M+SD	t	p
% 27 Lower Group (n=112)	116.27+10.16	30.304	<0.001
% 27 Upper Group (n=112)	154.61+8.720		

values were found to be 1075.283, F = 28.501, and p = 0.000. The results of the analysis indicated that there was no response bias in the scale (Table 3).

The correlations of the scale items with the total scale score were 0.201–0.630. The correlations of the scale items with the

total subdimension score ranged from 0.345 to 0.766. None of the items significantly increased Cronbach's alpha values when deleted (Table 4).

The mean score of participants in the 27% lower group was 116.27 + 10.16, whereas the mean score of those in the 27% upper group was 154.61 + 8.72. The difference between the mean scores of the 27% upper and lower groups was statistically significant (p<0.001) (Table 5).

DISCUSSION

As a result of this study, it was determined that the adapted scale can be used to measure the oral-dental health behaviors of adolescents in Turkey in a valid and reliable manner. The study determined that the health belief model could be used effectively to measure the oral-dental health behaviors of adolescents.

In this study, whether the adapted scale can measure oral and dental health in a Turkish sample based on the health belief model and the similarity of the content of the original items with Turkish items were evaluated based on expert opinions. Experts stated that the scale preserved its original structure and could measure oral and dental health behaviors in Turkish adolescents based on the health belief model (26,27). The results of the analysis determined that the scale items were sufficient to measure adolescents' oral-dental health behaviors of adolescents.

In this study, EFA was used to evaluate whether the items formed subdimensions similar to those in the original scale. Because of EFA, it was determined that the scale had the same number of subdimensions as the original scale and that the items had the same subdimensions. It was determined that the factor loadings of the items in the scale were high and showed a high level of correlation with their subdimensions. These results demonstrated that the scale could measure the behaviors of adolescents toward oral and dental health accurately and sufficiently (12, 25, 26,28-31). The literature emphasizes that measurements were made using forms developed especially for evaluating oral and dental health. However, sufficient measurements could only be made if the models were based on them. In this study, the fact that the adapted scale was model-based and had a strong item-sub-dimension relationship proved that the scale could make adequate and accurate measurements (32-35). The EFA results revealed that the scale items were sufficient to measure the adolescents' oral and dental health and could be measured accurately without being confused with other concepts. The scale items were also related to oral and dental health.

Because of CFA in this study, it was determined that the structure determined by EFA and the dimensions under which the items were located were appropriate and compatible (26, 29,31). As a result of CFA, it was determined that the scale was sufficient in measuring the oral-dental health behaviors of adolescents in the Turkish sample, and the items adequately represented the subdimensions measuring oral-dental health. As a result of CFA, it was determined that the scale could adequately and accurately measure harmful behaviors toward oral-dental health, perceived wounds of behaviors, and self-efficacy levels, which are indicators for performing the behaviors. It is also suggested in the literature that scales prepared with the appropriate content can detect behaviors toward oral-dental health more accurately and adequately and that models should support these measurement tools. The results of this study provide suggestions for literature and support the literature (32-35).

Whether the scale makes similar measurements at different times and the relationship between the items are evaluated using internal consistency analyses. The most important of these is Cronbach's alpha. In the literature, alpha values are required to be 0.70 and above (28-31). In this study, alpha levels were >0.70 for the entire scale and subdimensions. The other analyses were the split-half and item-total score correlations. In all of these analyses, it was determined that the scale items were highly related to each other; the scale made similar measurements in different situations and had a strong conceptual structure. The literature emphasizes that it is essential for scales to have high internal consistency when measuring oral-dental health behaviors (28-35). It is emphasized that, especially in interventional studies, scales should be able to make accurate and sufficient measurements and should be consistent to define the change correctly (28-35). The reliability results in this study showed that the scale can provide high-level, consistent measurements and that its reliability is high. The high-reliability results in this study demonstrated that the scale could measure the oral-dental health behaviors of adolescents at different time points in a similar manner.

The results obtained in this study showed no response bias, and the measurement results were reliable. This result shows that people are not affected by external factors when answering the scale items and that they answer them according to their opinions. This result reveals that the validity and reliability of the scale are high (26-31).

Our study revealed a notable difference in the mean scores of adolescents between the upper and lower 27% groups.

These results showed that the scale had good discriminatory power and could adequately measure the area and distinguish between the 27% upper and lower groups. Scales with good validity and reliability should distinguish between individuals with positive and negative attitudes. For this purpose, a 27% lower-upper group analysis was performed. In this analysis, individuals with positive attitudes are expected to receive high scores, and individuals with negative attitudes are expected to receive low scores. The scales should be able to distinguish between these two groups and identify significant differences. The difference between the two groups in this study indicates that the scale is an accurate and reliable measurement.

There are a few limitations to this study. First, only adolescents who are voluntary to participate in the study. The second limitation is the use of convenience samples. However, keeping

the sample number high and collecting samples from different regions reduces the

CONCLUSION

The results of the validity and reliability analyses conducted in this study indicate that the Oral Health Behavior Questionnaire for Adolescents Based on the Health Belief Model (OHBQAHBM) is an appropriate measurement tool for the Turkish sample. This scale can evaluate adolescents' attitudes toward ODH based on the HBM. Cross-cultural comparative studies can also be conducted using the scale. With this measurement tool, nurses can identify beliefs, attitudes, and behaviors that negatively affect adolescents' oral and dental health. This scale can be used to create intervention programs to achieve early acquisition of behaviors, such as regular toothbrushing, preventing uncontrolled sugary food consumption, and annual dental checkups. The results of this intervention can be monitored. ODH behaviors can be developed by identifying areas where adolescents are inadequate in terms of these behaviors and applying individual interventions. It was determined that this scale, whose validity and reliability was assessed, evaluated ODH multidimensionally and effectively. Therefore, the validity and reliability of the scale can be evaluated for the 6-12 age group.

Ethics Committee Approval: This study was approved by the ethics committee of Dokuz Eylül University Non-Interventional Clinical Research (IRB: 2022/17-03) and the permission of the Provincial Directorate of National Education.

Informed Consent: Written consent was obtained from the participants.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- İ.B.; Data Acquisition- D.D.K.; Data Analysis/Interpretation- Ş.D., G.K.; Drafting Manuscript- M.B., Ş.D.; Critical Revision of Manuscript- D.D.K.; Final Approval and Accountability- İ.B., D.D.K., M.B., Ş.D.,G.K.

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