

# Development of a scale for measuring university students' attitudes toward oral health

## Purpose

Valid and reliable scales which have been developed for assessing individuals' attitudes toward oral health and are based on multiple theoretical views are limited in number in the literature. Hence, there is a need for more scale development studies for further evaluation of the psychometric properties of the oral and dental health attitudes of students. The aim of this study was to develop a scale for measuring college undergraduates' attitudes toward oral and dental health.

## Materials and Methods

A sample of 770 college undergraduates (241 male, 529 female) enrolled in various academic programs of three universities in Turkey participated in this study. We collected data from two separate samples. The data obtained from sample 1 (n = 470) were used for Exploratory Factor Analysis (EFA) and the data from sample 2 (n = 300) were utilized for undertaking Confirmatory Factor Analysis (CFA). To test the construct validity, EFA, CFA, convergent validity, and measurement invariance were used, respectively.

## Results

In the first stage, EFA was conducted on a 48-item scale. EFA results showed that the final version of the Oral Health Attitude Scale (OHA-S) had a six-factor structure: sensitivity, importance, avoidance of harmful elements, tendency towards products and activities, awareness, and social impact. To confirm this structure, CFA was used. CFA results showed good model fit indexes. The final version of the scale consisted of 41 items with six factors. Moreover, Cronbach's alpha and Spearman-Brown Split-Half coefficients showed a good level of reliability. Moreover, t-scores were statistically significant for 27% of the lower and upper groups.

## Conclusion

The developed scale was found to be a potential tool for measuring and evaluating university students' attitudes toward oral and dental health.

**Keywords:** Attitude, oral and dental health, scale development, university

## Introduction

Oral and dental problems, which are among the most common issues worldwide, are critical concerns that affect the overall health of individuals (1). These diseases which create a serious economic burden on individuals reduce the quality of their lives (2). Oral diseases can cause serious health problems. The most prominent factors associated with oral and dental diseases are hygiene, tobacco use, alcohol, nutritional status, and stress. Oral hygiene is the most important of these factors in terms of preventing oral diseases (3). The general condition and quality of life of the individuals are adversely affected by poor oral hygiene (4). As a result of this situation, the deterioration of the balance in the oral environment causes dental caries (2). Dental caries have been reported globally as one

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of the most common oral diseases affecting all age groups (2) and the quality of life of individuals (5). Therefore, dental caries are an important problem that should be taken into account because they cause time and financial losses (6).

Individuals with oral and dental fear typically have poorer oral hygiene and a higher incidence of oral diseases. As a result, they avoid visiting the dentist and tend to have longer intervals between dental visits (7). In a previous study, it was stated that individuals with dental anxiety or dental fear had more decayed and missing teeth which prevented them from going to the dentist (8). Good oral health plays an essential role in the individuals' functions such as speaking, smiling, and making creative contributions to society which are impactful in the general well-being of the individual (9). In addition to clinician-related factors, (10) cognitive, affective, and behavioral characteristics of the individuals are also effective in preventing oral and dental diseases (11). Attitude, which emphasizes the combination of these features, is directly related to positive or negative tendencies toward oral and dental health. Specifically, attitude is one of the important determinants in explaining human behavior (12). It is described as a mental posture (13) or psychological tendencies (14) toward a specific object, person, issue, event, or institution. Attitude gives information about the tendencies of individuals about how to behave in a certain situation. It can lead to positive or negative tendencies in their behavior (15). Some attitude theories, including ABC Model (16), Planned Behavior Model (14), Broaden-and-Build Theory of Positive (17), and Health Belief Model (18) provide evidence for its conceptual frameworks suggesting that attitude can result in behavioral changes. A prevalent tripartite model of attitude highlights that it consists of three components (14,15): cognitive component (values, knowledge, beliefs, and thoughts), affective component (emotional or feeling segment of attitudes), and behavioral component (person's tendencies and intentions for behavioral reaction). The formation of attitude depends on the result of the interaction, combination, and organization of these three factors.

The development of positive attitudes toward oral and dental health in individuals is crucial to improving general health at the macro level and ensuring oral health and hygiene at the micro level (19). In a previous study, an instrument was developed to evaluate the patients' oral health attitudes and their tooth brushing habits (20). Importantly, the most common instruments used to measure individuals' attitudes, beliefs, and thoughts are Likert-type scales (21). Since attitudes are tendencies that individuals can learn and acquire later, it is possible to direct their tendencies by determining their existing tendencies. Although early ages make up the critical developmental period for the development of health literacy, it is important to change and guide individuals' stereotypical tendencies toward oral and dental health at later ages. Moreover, it is a necessity for them to develop these beliefs and attitudes in a more conscious way in order to set an example for other individuals at a young age.

In light of this information, valid and reliable instruments are necessary for identifying individuals' attitudes toward oral and dental health. A previous study highlighted the scarcity of instruments for university students or adults (22). Kirtiloglu and Yavuz stated that self-preventive oral behavior among Turkish non-dental university students was at a low-

er level compared to industrialized countries (23). Moreover, the results of another study indicated that increased oral health education was necessary for and could be effective in improving oral health in Turkey (24). While several studies have reported on oral hygiene habits among children, adolescents, adults, and university students, there is a scarcity of research focusing on non-dental university students (23,25). Although several instruments have been developed for assessing attitudes toward oral and dental health, valid and reliable scales based on multiple theoretical views are limited in the literature. Hence, there is a need for more scale development studies for further evaluation of the psychometric properties of oral and dental health attitudes of students. Therefore, the aim of this study was to develop a scale for measuring college undergraduates' attitudes toward oral and dental health.

## Material and Methods

### *Ethical approval*

The study was approved by the institutional board of Bartın University Ethics Committee (Protocol No: 2023-SBB-0120) and informed consent was taken from each of the participants.

### *Study sample*

A total of 770 college undergraduates (241 male and 529 female) enrolled in various academic programs at three universities in Turkey participated in the current study. All of the participants gave their voluntary consent to take part in the study. Data were collected from two samples. The first sample was composed of 470 students (346 females, 124 males) between 18 and 27 years ( $M = 20.18$ ,  $SD = 1.18$ ) while the second sample was comprised of 300 students (183 females, 117 males) between 18 and 28 years ( $M = 20.86$ ,  $SD = 1.5$ ). Convenience sampling was used to select the participants. It is preferable and feasible for implementation when there are limitations in time, cost, and labor (26). These students were enrolled in various academic programs (such as education, engineering, humanities, sports, and medicine) at Usak University ( $n = 302$ ), Bolu Abant İzzet Baysal University ( $n = 255$ ), and Bartın University ( $n = 213$ ) located in Turkey.

### *Sample size estimation*

To estimate the sample size, G\*Power software (version 3.1) was used by taking into consideration the assumption of detecting large effect size and setting up a two-tailed hypothesis. The analysis results showed that a minimum of 565 participants are required for this study ( $\alpha = 0.05$ ;  $\beta = 0.95$ ).

### *Developing the scale*

We adopted Boateng *et al.*'s (27) three phases and nine steps as a guide in scale development and reporting: (i) item development, (ii) scale development, and (iii) scale evaluation. Although the first phase, item development, includes (1) the identification of the domain(s) and item generation, and (2) the consideration of content validity, the second

phase consists of (3) pre-testing questions, (4) sampling and survey administration, (5) item reduction, and (6) extraction of latent factors. The last phase, scale evaluation, requires (7) the tests of dimensionality, (8) the tests of reliability, and (9) the tests of validity. Firstly, to determine the conceptual structure, literature review was conducted to determine the existing attitude scales about oral and dental health (18, 20, 28). Then, these scales were analyzed to identify their factor structures.

Initially, the first version of the scale included 52 items consisting of general factors. To provide the face and content validity, 12 experts with Ph.D. degrees from restorative dentistry ( $n = 3$ ), pediatric dentistry ( $n = 2$ ), oral and maxillo-facial radiology ( $n = 1$ ), periodontology ( $n = 1$ ), orthodontics ( $n = 1$ ), measurement and assessment ( $n = 2$ ), and psychology ( $n = 2$ ) evaluated the scale items. They were sent an expert evaluation form in a 4-point Likert-type format about the scale items involving the statements ranging from “irrelevant” (1) to “highly relevant” (4). There was also a section in the form where experts could write their suggestions and evaluations on the items.

Based on their feedback, some items were revised or excluded from the scale (e.g., the item including the statement “A natural appearance of my teeth is important to me” was revised as “The natural and esthetic appearance of my teeth is important to me”). Specifically, the content validity ratio (CVR) was found to be 0.83. In accordance with Ayre and Scally’s criteria, (29) CVR was not less than 0.66 for 12 experts. Factor analysis and item statistics were conducted for the construct validity of the measurement instrument. A pilot application was employed for the extraction of discriminability levels and the identification of items that represent the construct effectively. Moreover, the item-content validity index (I-CVI) was calculated for each item. The number of experts who rated each item as 3 or 4 regarding their relevancy was divided by the total number of experts to calculate

the I-CVI. According to a previous study, (30) I-CVI should not be less than 0.78. The content validity index (S-CVI) was calculated to prove the content validity of the entire scale. Shrotryia and Dhanda (31) recommended that the S-CVI should not be less than 0.80. In this study, it was found to be 0.85. Irrelevant and redundant items were excluded from the draft scale resulting in an initial scale consisting of 48 items. While preparing the scale items, we paid attention to make the items simple and understandable. Items did not contain more than one thought, judgment, or feeling. Moreover, a language expert evaluated the items for spelling and grammar; 8 university students read the scale items for comprehensibility. The initial version of the scale had a 5-point Likert type response format ranging from strongly disagree (1) to strongly agree (5). The middle option (3) was “somewhat agree” instead of “neutral”. It is a commonly used type of Likert scale in the measurement of psychometric constructs (32). The age of the participants has an important place in determining the rating on Likert scales. As the age groups of the participants decrease, there are difficulties in distinguishing multi-level scales (33). For this reason, we preferred this Likert type for university students. Higher scores indicated more positive attitudes toward oral and dental health. Since all items were positive, there were no reverse-scored items in the scale. Figure 1 shows the developmental process of OHA-S.

#### Procedure

Data were collected between March 15, 2023 and April 15, 2023. The scales were administered to 304 students in a paper-pencil format and 466 students in an online format via Microsoft Forms link by using a QR code. There was no missing data in the completed forms. All the non-dental university students willing to participate in the study were considered in the inclusion criteria. The exclusion criteria includ-

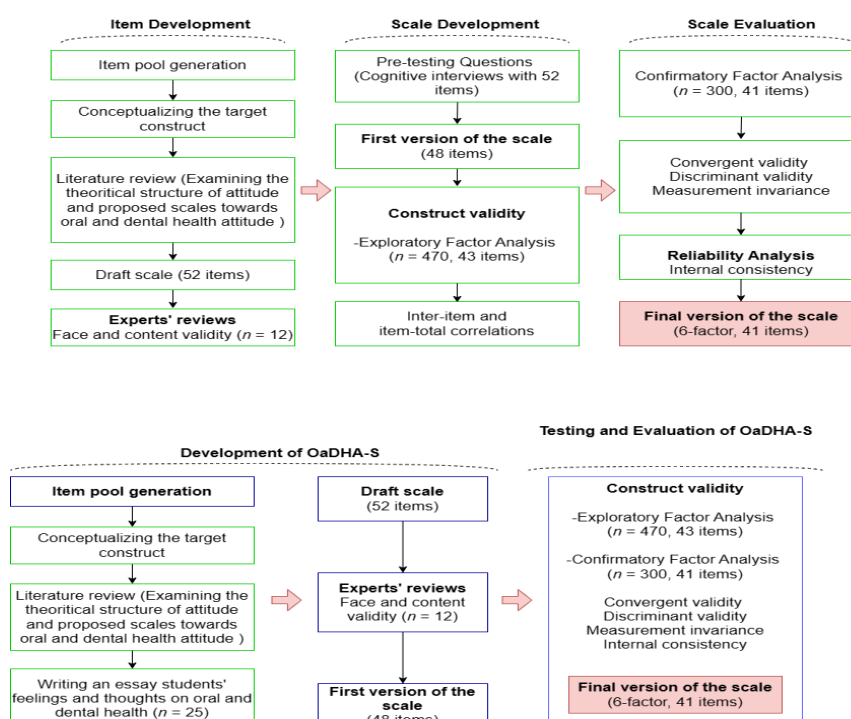


Figure 1. Flowchart of the OHA-S development process.

ed students who did not give consent to participate in the study. Firstly, the participants read the consent form for their voluntary and anonymous participation in the study. Then, they were informed about the purpose of the questionnaire. Completing the scale lasted approximately 10 minutes.

### Data analysis

Construct validity of OHA-S was analyzed with EFA on SPSS V25.0 (IBM, Armonk, NY, USA). Kaiser-Meyer-Olkin (KMO) test for the sample adequacy and Bartlett sphericity statistics for the suitability of the data were run. Although principal component analysis was used as the extraction method, varimax was used as the rotation technique. Structural validity was subsequently tested using the CFA. It was performed using LISREL (v.8.80) with the Robust Maximum Likelihood (R-ML) method by assessing the fit indices which should be lower than 3 for Chi-square/ degree of freedom ( $\chi^2/df$ ) (34), higher than 0.90 for Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI) and Tucker Lewis Index (TLI) (35), and lower than 0.08 for Root-Mean-Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) (36). Cronbach's alpha ( $\alpha$ ) and split-half coefficients (corrected by Spearman-Brown) were calculated for displaying the internal consistency for the overall scale and its each factor. The discrimination of the items of the scale was analyzed based on the lower and upper (27%) groups by using independent samples *t*-test. To check whether the convergent validity was supported, Average Variance Extracted (AVE)  $\geq$  0.50 and Composite Reliability (CR)  $\geq$  0.70 for each factorial structure were computed (37, 38). As a requirement of convergent validity, factor loads for each item must be greater than 0.50 and the level of significance must be less than 0.05 (36). The absence of bias in the responses provided by both female and male participants and the establishment of the validity of the instrument's structure based on gender were examined in terms of measurement invariance. For testing the measurement invariance, multigroup CFA was used. Moreover,  $\Delta CFI$ ,  $\Delta RMSEA$ , and  $\Delta SRMR$  were used to investigate whether the measurement invariance was supported across the two groups of gender. Expected difference less than 0.01 in the  $\Delta CFI$  value supports the less parameterized model (39).

## Results

### Factor structure of OHA-S (EFA Results)

To ensure construct validity, EFA was conducted on the 48 items. Kaiser-Meyer-Olkin (KMO) measure conducted prior to EFA was found to be 0.944 indicating sampling adequacy for this data set and Bartlett's test was statistically significant ( $\chi^2 = 17520.615$   $df = 1128$ ,  $p < 0.001$ ). Six-factor structure of the scale with Eigenvalues above 1 accounted for 51.6% of the total variance. For multifactorial structures, 40% or more of the total variance explained is considered sufficient (40). Items with factor loadings of 0.40 or above were retained in the scale, (41) while 5 items indicating poor factor loadings were removed from it. Factor loadings ranged from 0.43 to 0.75. Subsequently, the factors were named in accordance with the items represented by each structure. The factors

were identified as sensitivity for OH (12 items), importance of OH (6 items), avoidance of harmful elements for OH (7 items), tendency towards products and activities on OH (7 items), awareness of OH (6 items), and social impact (5 items). The item-total correlations were investigated to reveal the consistency of the items in each factor. Results indicated that all item-factor correlations ranging from 0.56 to 0.85 were above the threshold of 0.30 (42). Table 1 shows EFA results including the factor loadings for each factor.

### Confirmative factor analysis (CFA) results

To confirm the proposed six-factor structure of the OHA-S with 43 items, CFA was carried out using a separate sample ( $n = 300$ ). Since the relative multivariate kurtosis value was found to be greater than 1 when the assumption of multivariate normality was examined for the first-order six-factor OHA-S, the R-ML method was used. As the factor loadings of items 7 and 28 were calculated as 0.22 and 0.14 respectively, they were excluded from the analysis. The model fit indexes were checked with 41 items. Since the proposed six sub-factors had high correlations between each other, they were moved up to the second-order level and the model was re-tested. Second-order model represented a good model fit ( $\chi^2/df = 10237.35/813$ ;  $p < 0.001$ ;  $RMSEA = 0.080$ ;  $GFI = 0.90$ ;  $AGFI = 0.90$ ;  $CFI = 0.91$ ;  $NNFI = 0.90$ ). Therefore, the structural model of the scale was accepted and found to be significant ( $p < 0.001$ ) (Figure 2). Although the chi-square value was influenced by the sample size and did not support the model fit,  $RMSEA$ ,  $GFI$ ,  $AGFI$ ,  $CFI$ , and  $NNFI$  values supported the model fit. Finally, the calculated factor loadings varied between 0.30 and 0.80.

### Internal Consistency Reliability of the OHA-S

We used the overall sample to examine the internal consistency of OHA-S. It had good internal consistency ( $\alpha = 0.92$ ). Each of its six sub-factors also had high or acceptable internal consistency as follows: factor1 ( $\alpha = 0.89$ ), factor2 ( $\alpha = 0.85$ ), factor3 ( $\alpha = 0.84$ ), factor4 ( $\alpha = 0.83$ ), factor5 ( $\alpha = 0.80$ ), and factor6 ( $\alpha = 0.77$ ). The coefficient of internal consistency (split-half, corrected by Spearman-Brown) of the overall scale was calculated as 0.91. These values of the factors were computed as 0.86, 0.90, 0.81, 0.82, 0.81, and 0.75, respectively. The findings showed that the split-half coefficients were high or acceptable level. Moreover, the item discrimination was conducted by using the independent samples *t*-test (comparison of 27% lower-upper groups). Analysis results were found to be statistically significant ( $p < 0.001$ ). Hence, *t* values ranged between 23.78 and 34.79 for factor1, 23.41 and 30.96 for factor2, 45.55 and 63.26 for factor3, 49.91 and 68.37 for factor4, 20.62 and 61.224 for factor5, and 50.19 and 69.99 for factor6. These results showed that the items in the scale had acceptable internal consistency and high discrimination in terms of attitudes toward OH.

### Convergent and discriminant validity

AVE and CR values were calculated by examining all factor loading values calculated in the EFA. The findings indicated that the desired limit value was not exceeded ( $AVE_1 = 0.36$ ;  $AVE_2 =$



**Table 1:** Factor loadings for each factor

Item	Factor					
	I	II	III	IV	V	VI
#Item29. I want my teeth to be white.	0.71					
#Item39. I am worried about losing even one of my teeth.	0.70					
#Item34. When I brush my teeth, I feel relaxed.	0.70					
#Item31. I feel good when my teeth or gums are healthy.	0.66					
#Item30. My oral and dental health problems worry me.	0.64					
#Item43. I take care of my toothbrush and change it at least once a year.	0.61					
#Item40. When others smile, I notice whether their teeth have an esthetic appearance or not.	0.59					
#Item21. I take care of my oral and dental health so that there is no bad breath.	0.57					
#Item37. I am worried about discoloration of my teeth.	0.56					
#Item22. I take care to brush my teeth at least twice a day.	0.45					
#Item24. When choosing my toothbrush, I take care of several features such as hardness, softness, and shape of its bristles.	0.43					
#Item20. When my dental and oral treatment is completed, I feel happy.	0.43					
#Item3. I care about my teeth as much as my other organs in my body.		0.74				
#Item4. Oral and dental health is important for a good smile.		0.71				
#Item2. I want to have straight teeth in terms of esthetic.		0.68				
#Item5. I pay attention to my oral and dental care in order not to experience oral and dental problems.		0.66				
#Item1. Oral and dental care is important for general body health.		0.65				
#Item9. The natural and esthetic appearance of my teeth is important to me.		0.62				
#Item36. I avoid damaging foods or beverages causing tooth erosion.			0.75			
#Item14. I avoid excessive consumption of foods or beverages that cause discoloration on my teeth.			0.72			
#Item33. I avoid sugary foods due to their damage to my teeth.			0.71			
#Item23. I avoid extremely hot/cold foods or beverages due to their damage to my teeth.			0.71			
#Item8. I try to avoid foods or beverages that cause dental caries.			0.64			
#Item27. I take care to consume foods that strengthen my teeth.			0.60			
#Item26. I take care not to smoke to protect my oral and dental health.			0.46			
#Item6. New products related to oral and dental health attract my attention.				0.69		
#Item10. I am interested in the promotion or advertisement of products on oral and dental health.				0.68		
#Item44. Programs, news, and events related to oral and dental health in the media attract my attention.				0.60		
#Item11. I purchase my toothpaste by checking its ingredients.				0.57		
#Item35. I am willing to participate in seminars and trainings on oral and dental health.				0.55		
#Item7*. I try to be an example to those around me by paying attention to my oral and dental health.				0.50		
#Item18. I periodically use mouthwash for my oral and dental health.				0.44		
#Item16. Dental floss use helps me maintain my oral and dental health.					0.66	
#Item17. Teeth scaling is periodically necessary for gingival health.					0.61	
#Item25. Besides brushing my teeth, I am willing to use dental floss regularly.					0.60	
#Item45. I am willing to go to the dentist regularly for oral and dental health check-up.					0.52	
#Item46. I avoid breaking hard-shelled foods with my teeth.					0.49	

#Item47. I am willing to learn the necessary information to protect my oral and dental health.	0.43
#Item42. I feel jealous when someone's teeth are prettier than my teeth.	0.64
#Item19. I care about what other people think of my teeth.	0.59
#Item48. Even if it's a joke, it makes me very sad when my teeth made fun of my teeth.	0.55
#Item41. I am pleased to show my teeth to other people when I smile.	0.54
#Item28'. Good oral and dental health strengthens communication and socialization with people.	0.47

Note: \* After CFA, these items were removed from the scale

Factor I="Sensitivity for OH"; Factor II="Importance of OH"; Factor III="Avoidance of Harmful Elements for OH"; Factor IV="Tendency towards Products and Activities on OH"; Factor V="Awareness of OH"; Factor VI="Social Impact".

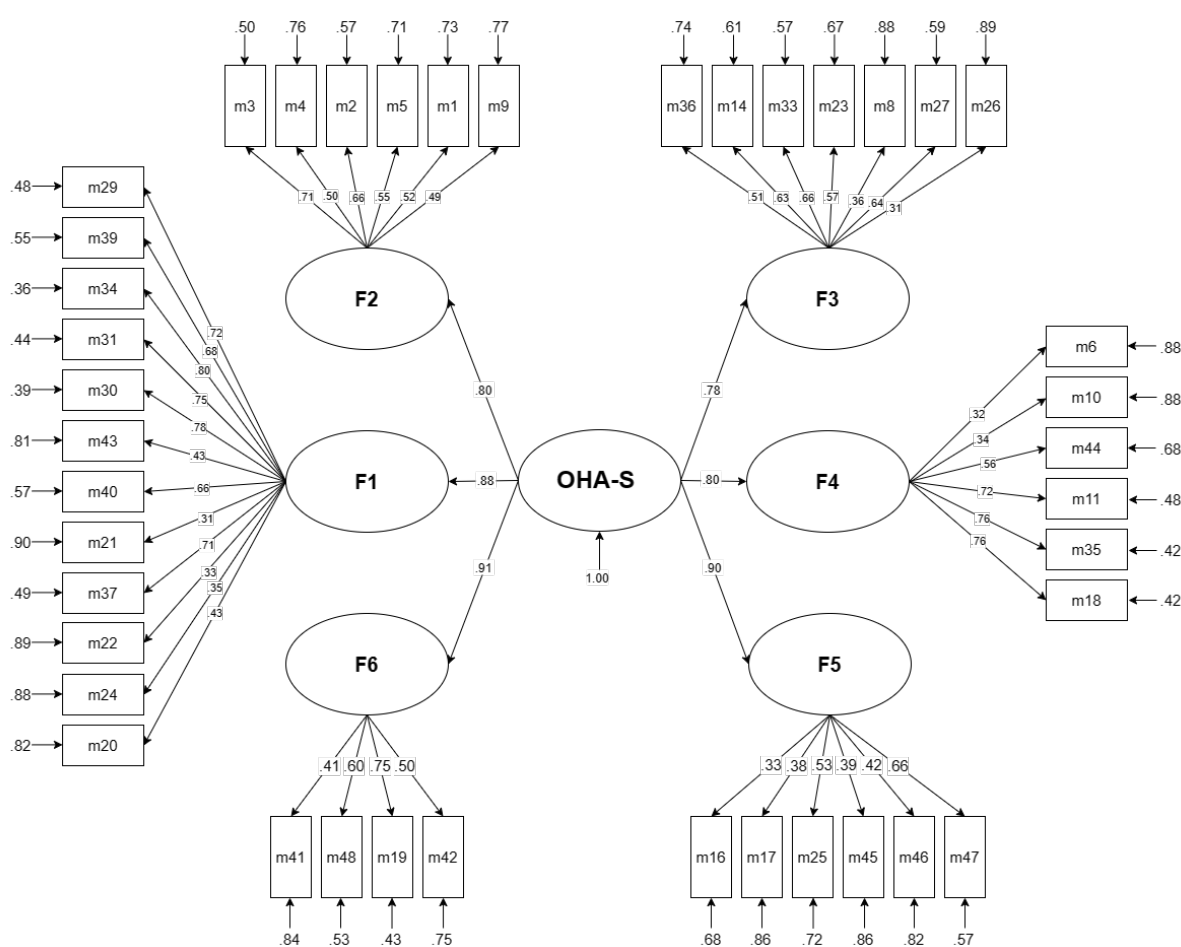


Figure 2. Path diagram for second-order CFA.

0.47;  $AVE_3 = 0.44$ ;  $AVE_4 = 0.34$ ;  $AVE_5 = 0.32$ ;  $AVE_6 = 0.32$ ). Moreover, CR values for all sub-factors exceeded the benchmark value and the composite reliability appeared to be high ( $CR_1 = 0.87$ ;  $CR_2 = 0.84$ ;  $CR_3 = 0.85$ ;  $CR_4 = 0.78$ ;  $CR_5 = 0.73$ ;  $CR_6 = 0.70$ ). When examined as a whole (CR-AVE), it was determined that the convergent validity value was mainly provided by CR. To carry out the discriminant analysis, we examined the correlations between all sub-factors and calculated partial AVE square root values. By using these partial correlation coefficients, we compared the square root values of the partial AVE. All partial coefficients were not bigger than the square root values of AVE.

#### Measurement invariance

As the evidence of construct validity, measurement invariance was discussed according to different demographic char-

acteristics of the developed measurement tool and the meaning/response status of the items. Measurement invariance was examined with multigroup DFA to determine whether the fit of the model differed in terms of the gender variable (241 male, 529 female). For the model, the model fit results for configural invariance, metric invariance, and scalar invariance were examined. It was determined that figural and metric invariances were provided for the established model, but scalar invariance for the model was not achieved. It was observed that the difference values of the fit indices examined in the multigroup CFA could not be obtained with scalar invariance ( $\Delta GFI (<) 0.01$ ,  $\Delta SRMR (>) 0.01$ ,  $\Delta CFI (>) 0.01$ , (Table 2).

After examining the measurement invariance, cut-off scores were determined according to the scale levels to ensure the usability of the scale and to make sense of the scores. Cut-off scores were examined with cluster analysis because a score

**Table 2:** Examination of measurement invariance with Multigroup-CFA results

Measurement Invariance	$\chi^2$	df	RMSEA	GFI	CFI	SRMR
Configural invariance	10123.35*	1575	0.08	0.91	0.90	0.041
Metric invariance	10220.28*	1629	0.08	0.91	0.90	0.045
Scaler invariance	10231.14*	1625	0.08	0.90	0.85	0.056
Metric - Configural	96.93	54	0.08	0	0	0.004
Scaler - Configural	107.79	50	0.08	-0.01	0.05	0.015
Scaler - Metric	10.86	4	0.08	-0.01	0.05	0.011

\* $p < .001$ , Acceptable fit indices: RMSEA  $\leq 0.08$ ; GFI  $\geq 0.90$ ; CFI  $\geq 0.90$ ; SRMR  $\leq 0.08$  (34–36)

**Table 3:** Levels and score ranges of OHA-S

Levels	Score ranges
Very low	41-101
Low	102-144
Improvable	145-160
High	161-184
Very high	185-205

range was not previously specified as a criterion. The score ranges of the five levels were determined. The lowest score of the scale is 41 and the highest score is 205. There are no reverse items. After the cluster analysis, the levels were named as “very low”, “low”, “improvable”, “high” and “very high”. Table 3 shows these levels and score ranges. When Table 3 is examined, the scores between 41-101 points are at a very low level for OHA-S, scores between 102-144 points are at a low level, scores between 145-160 points are at an improvable level, scores between 161-184 points are at a high level, and scores between 185-205 points are at a very high level. It was converted into a standard score at a high level.

## Discussion

The current study sought to develop a scale for measuring college undergraduates’ attitudes toward OH. It provided more evidence for the validity and reliability of the OHA-S and indicated acceptable psychometric features including OH knowledge. The items were initially created based on the review of the literature and the essays about students’ feelings and thoughts. The draft scale consisted of 52 items, all scored on a 5-point Likert-type scale ranging from “strongly disagree-1” to “strongly agree-5”. Based on the experts’ feedback, the initial scale consisted of 48 items.

Good oral health is considered an important factor contributing to an individual’s overall health status (43). There is a growing worldwide awareness of the fact that comprehensive health services should also include oral health (44). Oral health is not only about an individual’s smile and esthetics but it has also been noted for its social impact on the individuals by resulting in low self-confidence and negatively affecting their quality of life in various ways (45). Dental caries and complications can significantly reduce human life quality and create a major economic burden by triggering systemic diseases (46). Adequate oral hygiene helps to increase individuals’ self-esteem, making their quality of life better.

Individuals’ oral and dental health concern depends on their awareness of it and strongly influences their oral health status (47). A previous study indicated that a good oral health knowledge level helps to develop a positive attitude towards oral health (48). Several studies focused on oral health knowledge, attitude, and behavior (28) how much individuals pay attention to oral health care and how much individuals invest in oral health care (oral health values) (49), and, lastly, patients’ oral and dental health attitudes and their tooth brushing behaviors (20). Although dental students were included in some studies (50, 51), students participating in our study were from different academic programs, not from the dentistry program. Unlike other studies, this study focused on attitude and sub-factors of attitude towards OH. In the first stage, OHA-S had 48 items. To ensure the structure validity of the scale, EFA was used. As a result of the EFA, it was grouped into six factors with 43 items.

The first factor, sensitivity for OH, included susceptible reactions and feelings such as getting worried, conscientiousness, and feeling good about OH. The second factor, the importance of OH, was related to paying attention to OH and considering it important for general health and physical appearance. The third factor was named avoidance of harmful elements for OH. Essentially, avoidance occurs when individuals develop an attitude that leads them not to exhibit a certain behavior as a result of associating it with an unpleasant situation. In this sense, individuals may avoid certain behaviors for their OH. The fourth factor, tendency toward products and activities on OH, is related to factors such as directing attention to oral and dental health products, their contents, and information about the subject in the media, and selective perception. With the dynamic and directive effect of the attitude, the individual focuses on certain ones among multiple stimuli. The fifth factor, awareness of OH, was related to being aware of the basics of OH such as toothbrushing, literacy, and check-up. The last factor, social impact, refers to the reactions of others about the teeth of the individual or the formation of trends toward oral and dental health by comparison with others. According to Bandura’s Social Cognitive Learning Theory (52), individuals develop new reactive tendencies by observing the reactions of others cognitively. This indicates that the beliefs underlying attitudes are socially constructed. The results provided evidence for the widely accepted contents of cognitive, affective, and behavioral components (53, 54). Cut-off scores for standard score ranges were created. The cluster analysis results showed that the attitude level was divided into five intervals as “very low”, “low”, “improvable”, “high”, and “very high”.

To confirm this structure, CFA was used. CFA results indicated that the scale had an acceptable model fit and the factor loadings of two items were also calculated lower than 0.30. After these items were removed from the scale, we proposed a scale with 41 items (Appendix-A) (Turkish version; Appendix-B) (English version; Appendix-C) grouped under the aforementioned six factors (sensitivity, importance, avoidance of harmful elements, tendency towards products and activities, awareness, and social impact) (Appendix-B and Appendix-C show a rearranged version of the item rankings in the scale). While the lowest score from the overall scale was 41, the highest score was 205. OHA-S had high internal consistency. Moreover, the overall scale and its sub-factors had good internal consistency, convergent validity, and discriminant validity. In this study, the development process of OHA-S, though not being the first scale developed (22), was comprehensive and, from a multi-view perspective of attitude, it is one of the few scales developed to assess the attitudes toward OH and to understand underlying behavior and intentions in this direction.

There are several limitations of the current study. First, the sample was comprised of college undergraduates and the obtained data was specific to one country. Cultural differences could limit the generalizability of the results. With further validation and use, further studies should be performed on larger samples in different countries or for cross-culture comparisons. Second, predictive validity and test-retest reliability verifications were not performed in this study. Third, further research should be conducted on specific populations such as adults and the elderly. While further studies are needed, the development of a more contemporary assessment tool for OHA may provide opportunities for comprehensive epidemiological research and future intervention.

## Conclusion

The OHA-S had good indexes of content validity, construct validity, and internal consistency. Psychometric characteristics of the OHA-S that were reported in the current study indicated that it is a potential tool for measuring and assessing college undergraduates' attitudes toward OH. There is a need for research using tools such as OHA-S to determine the oral and dental health needs of individuals and the effects of dental problems on their attitudes. Further research should be performed to strengthen the scale characteristics.

**Türkçe özet:** Üniversite Öğrencilerinin Ağız Sağlığına Yönelik Tutumlarının Belirlenmesi için Ölçek Geliştirilmesi. Amaç: İlgili literatürde ağız sağlığına yönelik tutumu değerlendirmek için geliştirilen, çoklu teorik görüşlere dayanan geçerli ve güvenilir ölçekler sınırlı sayıdadır. Bu nedenle, öğrencilerin ağız ve diş sağlığına yönelik tutumların psikometrik özelliklerinin incelenmesine yönelik daha çok ölçek geliştirme çalışmasına ihtiyaç vardır. Mevcut araştırmanın amacı, üniversite öğrencilerinin ağız ve diş sağlığına yönelik tutumlarını ölçmek için geçerli ve güvenilir bir ölçek aracı geliştirmektir. Gereç ve Yöntem: Araştırmaya Türkiye'deki üç üniversitenin çeşitli akademik programlarına kayıtlı 770 üniversite öğrencisi (241 erkek, 529 kadın) katılmıştır. Araştırmanın verileri iki ayrı örneklemden toplanmıştır. İlk örneklemden (n = 470) elde edilen veriler Açıklayıcı Faktör Analizi (AFA) için, ikinci örneklemden (n = 300) elde edilen veriler ise Doğrulayıcı Faktör Analizi (DFA) için kullanıldı. Ölçeğin yapı geçerliliğini test etmek için sırasıyla AFA, DFA, yakınsak geçerlilik ve ölçme değişmezliği kullanılmıştır. Bulgular: İlk aşamada, 48 maddelik ölçek üzerinde AFA yapılmıştır. AFA sonuçları, Ağız Sağlığı Tutum Ölçeğinin (AST-Ö) altı

faktörlü bir yapıya sahip olduğunu göstermiştir: duyarlılık, önem, zararlı unsurlardan kaçınma, ürün ve faaliyetlere eğilim, farkındalık ve sosyal etki. Ölçeğin AFA sonucunda ortaya çıkan yapısını doğrulamak için DFA gerçekleştirilmiştir. DFA sonucunda elde edilen uyum indekslerinin kabul edilebilir olduğu görülmüştür. Ölçeğin son hali, altı faktörlü 41 maddeden oluşmaktadır. Ayrıca Cronbach's alpha ve Spearman-Brown Split Half (yarıya bölme) değerleri iyi düzeyde güvenilirliğe sahip olduğunu göstermiştir. Ayrıca %27 alt-üst gruplar için t puanları istatistiksel olarak anlamlıdır. Sonuç: Geliştirilen ölçeğin üniversite öğrencilerinin ağız ve diş sağlığına yönelik tutumlarını ölçmek ve değerlendirmek için potansiyel bir araç olduğu görülmüştür. Anahtar Kelimeler: Tutum, ağız ve diş sağlığı, ölçek geliştirme, üniversite

**Ethics Committee Approval:** The study was approved by the institutional board of Bartın University Ethics Committee (Protocol No: 2023-SBB-0120) and informed consent was taken from each of the participants.

**Informed Consent:** Participants provided informed consent.

**Peer-review:** Externally peer-reviewed.

**Author contributions:** MF, CM, MF participated in designing the study. MF, CM, MF participated in generating the data for the study. MF, CM, MF participated in gathering the data for the study. CM, MF participated in the analysis of the data. MF, MF wrote the majority of the original draft of the paper. MF, CM, MF participated in writing the paper. MF, CM, MF has had access to all of the raw data of the study. MF, CM, MF has reviewed the pertinent raw data on which the results and conclusions of this study are based. MF, CM, MF have approved the final version of this paper. MF, CM, MF guarantees that all individuals who meet the Journal's authorship criteria are included as authors of this paper.

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## APPENDIX

## Appendix A. Turkish version of Oral Health Attitude Scale

## Factor-1: Sensitivity/Duyarlılık (12 items)

- Dişlerimin beyaz olmasını arzu ederim.
- Dişlerimden birini bile kaybetmek beni endişelendirir.
- Dişlerimi fırçalamak beni rahatlatır.
- Dişlerimin/dişetlerimin sağlıklı olması beni mutlu hissettirir.
- Ağız ve diş sağlığı problemlerim beni endişelendirir.
- Diş fırçamı yılda en az bir kez değiştirmeye özen gösteririm.
- Başkaları gülümsediğinde onların dişlerinin estetik görünümü dikkatimi çeker.
- Ağız kokusu olmaması için ağız ve diş sağlığıma özen gösteririm.
- Dişlerimde renklenme olması beni endişelendirir.
- Dişlerimi günde en az iki kez fırçalamaya dikkat ederim.
- Diş fırçamın seçiminde fırça kıllarının sertlik, yumuşaklık ve şekil gibi özelliklerine dikkat ederim.
- Ağız ve diş tedavim tamamlandığında mutlu hissederim.

## Factor-2: Importance/Önem (6 items)

- Dişlerimi vücudumdaki diğer organlarım kadar önemserim.
- İyi bir gülümseme için ağız ve diş sağlığı önemlidir.
- Estetik açıdan dişlerimin düzgün dizilimde olmasını arzu ederim.
- Ağız ve diş sorunları yaşamamak için ağız ve diş bakımına dikkat ederim.
- Ağız ve diş bakımı genel vücut sağlığı için önemlidir.
- Dişlerimin doğal ve estetik görünümü benim için önemlidir.

## Factor-3: Avoidance of harmful elements/Zararlı unsurlardan kaçınma (7 items)

- Dişlerimi aşındıran yiyecek veya içeceklerden uzak dururum.
- Dişlerimde renklenmeye neden olan yiyecek veya içecekleri aşırı tüketmekten kaçınırım.
- Şekerli gıdalardan uzak dururum, çünkü dişlerime zarar vereceğini düşünürüm.
- Aşırı sıcak/soğuk yiyecek veya içeceklerden uzak dururum, çünkü dişlerime zarar vereceğini düşünürüm.
- Diş çürümesine neden olan yiyecek veya içeceklerden uzak durmaya çalışırım.
- Dişlerimi güçlendiren besinleri tüketmeye dikkat ederim.
- Ağız ve diş sağlığı korumak için sigara içmemeye özen gösteririm.

## Factor-4: Tendency towards products and activities/Ürün ve faaliyetlere eğilim (6 items)

- Ağız ve diş sağlığı ile ilgili yeni çıkan ürünler dikkatimi çeker.
- Ağız ve diş sağlığı ile ilgili ürünlerin tanıtım veya reklamları ilgimi çeker.
- Medyada ağız ve diş sağlığı ile ilgili program, haber, etkinlik vs. ilgimi çeker.
- Diş macunumun içeriğini kontrol ederek seçerim.
- Ağız ve diş sağlığına yönelik eğitim ve seminerlere katılmada istekliyim.
- Ağız ve diş sağlığı için belirli zamanlarda ağız gargarası kullanırım.

## Factor-5: Awareness/Farkındalık (6 items)

- Diş ipi kullanmak ağız ve diş sağlığı korumaya yardımcı olur.
- Dişeti sağlığı için belirli zamanlarda diş taşı temizliği yaptırmak gereklidir.
- Dişlerimi fırçalamanın yanında diş ipini de düzenli kullanmada istekliyim.
- Ağız ve diş sağlığı kontrolü için düzenli periyotlarda diş hekimine gitmede istekliyim.
- Sert kabuklu yiyecekleri dişlerimle kırmaktan kaçınırım.
- Ağız ve diş sağlığı korumak için gerekli bilgileri öğrenmede istekliyim.

## Factor-6: Social impact/Sosyal etki (4 items)

- Başkalarının dişlerinin benim dişlerimden daha güzel olmasını kıskanırım.
- Başkalarının dişlerim hakkında ne düşündüğünü önemserim.
- Şaka da olsa, dişlerimle dalga geçilmesi beni üzer.
- Gülümsediğimde dişlerimi başkalarına göstermek hoşuma gider.

## Appendix B. Ağız Sağlığı Tutum Ölçeği (AST-Ö)

	Kesinlikle Katılmıyorum	Katılmıyorum	Kısmen Katılmıyorum	Katılmıyorum	Kesinlikle Katılmıyorum
1-Dişlerimin beyaz olmasını arzu ederim.					
2-Dişlerimi aşındıran yiyecek veya içeceklerden uzak dururum.					
3-Dişlerimi vücudumdaki diğer organlarım kadar önemserim.					
4-Diş ipi kullanmak ağız ve diş sağlığımı korumaya yardımcı olur.					
5-Dişlerimden birini bile kaybetmek beni endişelendirir.					
6-Ağız ve diş sağlığı ile ilgili yeni çıkan ürünler dikkatimi çeker.					
7-İyi bir gülümseme için ağız ve diş sağlığı önemlidir.					
8-Başkalarının dişlerim hakkında ne düşündüğünü önemserim.					
9-Dişlerimi fırçalamak beni rahatlatır.					
10-Şaka da olsa, dişlerimle dalga geçilmesi beni üzer.					
11-Dişlerimde renklenmeye neden olan yiyecek veya içecekleri aşırı tüketmekten kaçınırım.					
12-Gülümsediğimde dişlerimi başkalarına göstermek hoşuma gider.					
13-Dişlerimin/dişetlerimin sağlıklı olması beni mutlu hissettirir.					
14-Dişeti sağlığı için belirli zamanlarda diş taşı temizliği yaptırmak gereklidir.					
15-Diş fırçamın seçiminde fırça kıllarının sertlik, yumuşaklık ve şekil gibi özelliklerine dikkat ederim.					
16-Estetik açıdan dişlerimin düzgün dizilimde olmasını arzu ederim.					
17-Ağız ve diş sağlığı problemlerim beni endişelendirir.					
18-Şekerli gıdalardan uzak dururum, çünkü dişlerime zarar vereceğini düşünürüm.					
19-Ağız ve diş sağlığı ile ilgili ürünlerin tanıtım veya reklamları ilgimi çeker.					
20-Ağız ve diş sorunları yaşamamak için ağız ve diş bakımına dikkat ederim.					
21-Diş fırçamı yılda en az bir kez değiştirmeye özen gösteririm.					
22-Dişlerimi fırçalamanın yanında diş ipini de düzenli kullanmada istekliyim.					
23-Aşırı sıcak/soğuk yiyecek veya içeceklerden uzak dururum, çünkü dişlerime zarar vereceğini düşünürüm.					
24-Medyada ağız ve diş sağlığı ile ilgili program, haber, etkinlik vs. ilgimi çeker.					
25-Başkaları gülümsediğinde onların dişlerinin estetik görünümü dikkatimi çeker.					
26-Başkalarının dişlerinin benim dişlerimden daha güzel olmasını kıskanırım.					
27-Diş çürümesine neden olan yiyecek veya içeceklerden uzak durmaya çalışırım.					
28-Diş macunumun içeriğini kontrol ederek seçerim.					
29-Ağız kokusu olmaması için ağız ve diş sağlığıma özen gösteririm.					
30-Ağız ve diş sağlığı kontrolü için düzenli periyotlarda diş hekimine gitmede istekliyim.					
31-Ağız ve diş bakımı genel vücut sağlığım için önemlidir.					
32-Ağız ve diş sağlığına yönelik eğitim ve seminerlere katılmada istekliyim.					
33-Dişlerimde renklenme olması beni endişelendirir.					
34-Dişlerimi güçlendiren besinleri tüketmeye dikkat ederim.					
35-Dişlerimin doğal ve estetik görünümü benim için önemlidir.					
36-Sert kabuklu yiyecekleri dişlerimle kırmaktan kaçınırım.					
37-Dişlerimi günde en az iki kez fırçalamaya dikkat ederim.					
38-Ağız ve diş sağlığımı korumak için gerekli bilgileri öğrenmede istekliyim.					
39-Ağız ve diş sağlığımı korumak için sigara içmemeye özen gösteririm.					
40-Ağız ve diş tedavim tamamlandığında mutlu hissederim.					
41-Ağız ve diş sağlığım için belirli zamanlarda ağız gargarası kullanırım.					

**Duyarlılık:** 1,5,9,13,15,17,21,25,29,33,37,40; **Önem:** 3,7,16,20,31,35; **Zararlı unsurlardan kaçınma:** 2,11,18,23,27,34,39; **Ürün ve faaliyetlere eğilim:** 6,19,24,28,32,41; **Farkındalık:** 4,14,22,30,36,38; **Sosyal etki:** 8,10,12,26

## Appendix C. Oral Health Attitude Scale (OHA-S)

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
1-I want my teeth to be white.					
2-I avoid damaging foods or beverages causing tooth erosion.					
3-I care about my teeth as much as my other organs in my body.					
4-Dental floss use helps me maintain my oral and dental health.					
5-I am worried about losing even one of my teeth.					
6-New products related to oral and dental health attract my attention.					
7-Oral and dental health is important for a good smile.					
8-I care about what other people think of my teeth.					
9- When I brush my teeth, I feel relaxed.					
10-Even if it's a joke, it makes me very sad when my teeth made fun of my teeth.					
11-I avoid excessive consumption of foods or beverages that cause discoloration on my teeth.					
12-I am pleased to show my teeth to other people when I smile.					
13-I feel good when my teeth or gums are healthy.					
14-Teeth scaling is periodically necessary for gingival health.					
15-When choosing my toothbrush, I take care of several features such as hardness, softness, and shape of its bristles.					
16-I want to have straight teeth in terms of esthetic.					
17-My oral and dental health problems worry me.					
18-I avoid sugary foods due to their damage to my teeth.					
19-I am interested in the promotion or advertisement of products on oral and dental health.					
20-I pay attention to my oral and dental care in order not to experience oral and dental problems.					
21-I take care of my toothbrush and change it at least once a year.					
22-Besides brushing my teeth, I am willing to use dental floss regularly					
23-I avoid extremely hot/cold foods or beverages due to their damage for my teeth.					
24-Programs, news, and events related to oral and dental health in the media attract my attention.					
25-When others smile, I notice whether their teeth have an esthetic appearance or not.					
26-I feel jealous when someone's teeth are prettier than my teeth.					
27-I try to avoid foods or beverages that cause dental caries.					
28-I purchase my toothpaste by checking its ingredients.					
29-I take care of my oral and dental health so that there is no bad breath.					
30-I am willing to go to the dentist regularly for oral and dental health check-up.					
31-Oral and dental care is important for general body health.					
32-I am willing to participate in seminars and trainings on oral and dental health.					
33-I am worried about discoloration of my teeth.					
34- I take care to consume foods that strengthen my teeth.					
35-The natural and esthetic appearance of my teeth is important to me.					
36-I avoid breaking hard-shelled foods with my teeth.					
37-I take care to brush my teeth at least twice a day.					
38-I am willing to learn the necessary information to protect my oral and dental health.					
39-I take care not to smoke to protect my oral and dental health.					
40-When my dental and oral treatment is completed, I feel happy.					
41-I periodically use mouthwash for my oral and dental health.					

**Sensitivity:** 1,5,9,13,15,17,21,25,29,33,37,40; **Importance:** 3,7,16,20,31,35; **Avoidance of harmful elements:** 2,11,18,23,27,34,39; **Tendency toward products and activities:** 6,19,24,28,32,41; **Awareness:** 4,14,22,30,36,38; **Social impact:** 8,10,12,26