

## ORIGINAL ARTICLE

# Reliability and validity of the Turkish version of the Oral Health Literacy Assessment Task: Pathways between parental oral health literacy and oral health consequences in children

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**Abstract**

**Background:** Parental oral health literacy (OHL) is a determinant of oral health behavior and oral health status of children.

**Aim:** To delineate the pathways between parental OHL and oral health consequences in children and to validate the Turkish version of the Oral Health Literacy Assessment Task (TOHLAT-P).

**Design:** This cross-sectional study was conducted with 315 parent-child dyads. The TOHLAT-P was psychometrically evaluated. Item analysis was performed to determine the reliability of the TOHLAT-P. Construct validity was tested by comparing a commonly used instrument using Pearson's product-moment correlation coefficients. A path model was developed to evaluate associations between parental OHL and oral health consequences in children. The model consisted of five endogenous variables (parental oral health behaviors, children's oral health behaviors, children's dental anxiety, dental caries, and oral health-related quality of life [OHRQoL]) and one exogenous variable (parental OHL). A path analysis was used to test the compatibility of the conceptual model, with a statistical significance of  $p < .001$ .

**Results:** There was a statistically significant association between parental oral health behaviors and children's oral health behaviors, and between dental caries and OHRQoL. The variable most directly affected by parental OHL was parental oral health behaviors, whereas the variable most indirectly affected by parental OHL was children's oral health behaviors.

**Conclusions:** The path analysis revealed significant associations between parental and children's oral health behaviors, and between dental caries and OHRQoL. Understanding these pathways is necessary to establish strategies to improve children's oral health. The TOHLAT-P will be useful for future assessments of Turkish children.

**KEYWORDS**

children, oral health, oral health literacy, oral health-related quality of life

## 1 | INTRODUCTION

Oral health literacy (OHL) is a determinant of oral health behavior and status.<sup>1-3</sup> It is defined as an individual's capacity to learn, understand, and evaluate basic oral health information and services needed to make sound health decisions.<sup>3</sup> OHL also incorporates the ability to grasp the causes of poor or good oral health, adopt appropriate oral health behaviors, and communicate effectively with dentists.<sup>2</sup>

Parental sociodemographic characteristics, which include education level, health insurance status, and income level, and parental oral health behaviors, which include the frequency of toothbrushing and attending dental visits, the length of time since the last dental visit, negative dental experiences, and training about oral hygiene, have direct and indirect effects on their children's oral health behaviors and oral health status.<sup>4-9</sup> OHL, which has recently gained interest as an important factor, forms the basis for the development and shaping of all these parental oral health behaviors.<sup>2,4,10</sup> Preschool children whose parents have a low level of OHL have a higher prevalence rate of dental caries, increased levels of dental plaque, and an increased need for dental visits. OHL plays a role in shaping concomitant individual factors, such as dental anxiety and oral health-related quality of life (OHRQoL) in preschool children.<sup>8,9</sup> A previous study<sup>10</sup> has reported that lower OHL has been associated with increased dental anxiety. A recent model<sup>11</sup> shows the vicious cycle of dental anxiety, suggesting that people with high dental anxiety are more likely to delay treatment, leading to more extensive dental problems and symptomatic visitation patterns that feed back into maintaining the existing dental anxiety and worsening OHRQoL.

Many scales have been developed to assess OHL worldwide.<sup>1,12</sup> In these scales, different aspects of individuals' OHL, such as word recognition, reading comprehension and pronunciation, and filling in the blanks, are evaluated.<sup>4</sup> The currently available scales, however, assess only one aspect of functional OHL (word recognition). It is controversial whether the commonly used OHL scales presented in the literature effectively capture various aspects of the nature and etiology of OHL. They also have several disadvantages, such as their impracticality given their length, their focus on word recognition that only addresses the reading capacity aspect of OHL, and the overwhelming absence of rigorous study regarding their construct validity.<sup>1,13,14</sup> A comprehensive tool should be able to provide an in-depth assessment of OHL through including its various and more complex aspects, such as oral health knowledge, reading comprehension, and

### Why this paper is important to paediatric dentists

- In this study, a conceptual model presenting the pathways between parental OHL and oral health consequences in children was developed and validated.
- Coupled with parental oral health education, understanding these pathways may be an important part of improving community oral health.
- For this study, the Turkish version of the Oral Health Literacy Assessment Task (TOHLAT-P) was developed, and evidence of its validity and reliability for assessing OHL in the Turkish community is provided.

numeracy skills. It is important to consider OHL and to use tools that measure other aspects of functional OHL that include more than just word recognition. To overcome these limitations, Wong et al.<sup>14</sup> developed the Hong Kong Oral Health Literacy Assessment Task for Paediatric Dentistry (HKOHLAT-P), which is designed to evaluate various aspects of OHL (oral health knowledge, reading comprehension, and numeracy). The HKOHLAT-P has been shown to have good reliability and validity. There is, however, no Turkish version of the HKOHLAT-P currently available.

The comprehensive assessment of OHL in Turkey is a new field with remarkable research potential that has attracted limited interest to date. In particular, there is a need for a Turkish tool that measures parental OHL. Therefore, it is crucial to validate a more robust instrument for the Turkish context.

A comprehensive framework that delineates associations between OHL and parental and children's oral health behaviors and oral health consequences can help policymakers, dental professionals, and the community. In this way, programs to effectively increase the OHL of both parents and their children, and strategies to improve children's oral and community health can be designed. It is also necessary to understand what factors mediate oral health outcomes in children. Using this framework, this study had the following aims: (a) to adapt the HKOHLAT-P for use in Turkey by performing the validity and reliability testing and a cross-cultural adaptation for the Turkish population; (b) to examine the pathways between parental OHL and oral health consequences in children; and (c) to determine which parental and individual variables are associated with parental OHL.

## 2 | MATERIALS AND METHODS

### 2.1 | Study design

This study applied a cross-sectional and relational design that was conducted in accordance with the Declaration of Helsinki (2013) and received approval from the local ethics committee (ID: 2020-01/03). Participants were 3- to 6-year-olds and their parents who had been referred to the Department of Pediatric Dentistry, Sivas Cumhuriyet University, between July and December 2020 voluntarily and through convenience sampling. The inclusion criteria were as follows: (a) systemically and mentally healthy children and parents, (b) children with no disability that would affect their cooperation during the dental examination (Frankl's behavior scale score 1 or 2), and (c) parents with the ability to read and speak Turkish and complete questionnaires. Systemically or mentally disabled and extremely uncooperative children were excluded. The sample size for the path analysis was calculated by assuming a desired power ( $1 - \beta$  error of probability) of 0.90, a significance level of .05, a confidence interval of 95%, and an effect size of 0.10. The sample size calculated was 308. In order to account for possible exclusions and dropouts, the sample size was increased to 350 parent-child dyads. With regard to the sample size of reliability and validity of the Turkish version of the HKOHLAT-P, it has been suggested that a minimum sample size of 300 or more participants is good for scale development.<sup>15</sup> Thus, the same sample was used in the path analysis and to determine reliability and validity of the Turkish version of the HKOHLAT-P.

The children and their parents were initially evaluated by an investigator for eligibility. Parent-child dyads who met the inclusion criteria were provided with information regarding the study and were recruited to participate. Written informed consent was obtained from all guardians. In the first session, noninvasive preventive dental procedures were performed by the primary investigator, after which another appointment was made for the patients. At the beginning of the second session, an experienced and trained dental assistant who was not involved in the study had the participants complete the data collection forms in the waiting room.

### 2.2 | Conceptual model

The conceptual model was developed in various stages. First, the search terms "oral health literacy," "oral health literacy and oral health behavior," "oral health literacy and caries," "oral health literacy and dental anxiety," and "oral health literacy and oral health-related quality of life" were searched in the PubMed, SCOPUS, and

Web of Knowledge databases. The search was restricted to peer-reviewed English publications only. Along with the examination and classification of the articles, a draft of the conceptual model was created based on the final data. In order to perform face validity, the draft of the model was presented to three lecturers from the departments of paediatric dentistry, psychiatry, and biostatistics for expert opinion. These experts were asked to comment on the relevance of the endogenous and exogenous variables included in the conceptual model and the pathways linking them. The experts suggested including a way to show the direct impact of children's dental anxiety on children's oral health behaviors. The conceptual model was thus revised and finalized and included five endogenous variables (parental oral health behaviors, children's oral health behaviors, dental anxiety, dental caries, and OHRQoL) and one exogenous variable (parental OHL) (Figure 1).

### 2.3 | Measurements

The following scales and forms were used for data collection: (a) the sociodemographic and oral health form, (b) the Turkish version of the Oral Health Literacy Assessment Task (TOHLAT-P), (c) the Rapid Estimation of Adult Literacy in Dentistry 30 (REALD-30), (d) the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS), (e) the Early Childhood Oral Health Impact Scale (ECOHIS), and (f) the Oral Health Behavior Form. The sociodemographic characteristics collected included age, sex, parental education level, and the monthly income and health insurance subvariables.

All forms were completed by the parents.

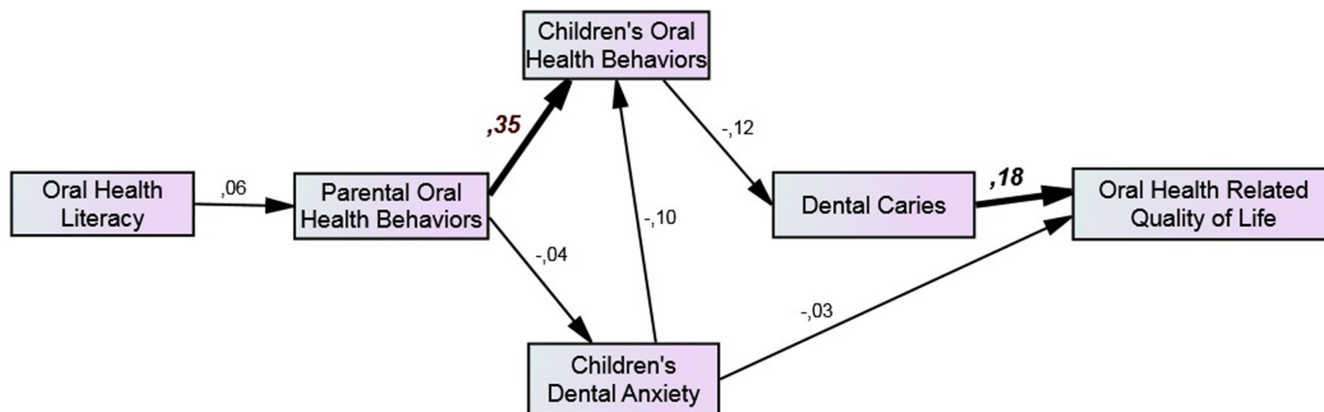
#### 2.3.1 | Exogenous variables

##### *Oral health literacy*

The TOHLAT-P was used to assess OHL. The original HKOHLAT-P was created by researchers from Hong Kong University and was developed based on items from previous measurements along with a review of health materials, including oral health leaflets, brochures, videos, and materials from radio and TV.

##### *Translation and adaptation*

The adaptation of the scale into Turkish was carried out in various stages according to the forward-and-back-translation procedure. In order to ensure the internal validity of the scale, the English form of the scale was first translated into Turkish by two different experts. These translations were then evaluated by researchers and three specialist dentists. The Turkish form was thus prepared



**FIGURE 1** Path diagram and fit index values of the conceptual model ( $n = 315$ ). Standardized beta coefficients are shown above the arrows. Thick arrows and bold-italic parameters show statistical significance ( $p < .001$ ). The fit index values were as follows:  $\chi^2 = 9.354$ ; degrees of freedom ( $df$ ) = 9;  $\chi^2/df = 1.169$ ;  $p < .001$ ; root mean square error of approximation (RMSEA) = 0.023; the Tucker–Lewis fit index (TLI) = 0.95; standardized root mean square residual (SRMR) = 0.018; goodness-of-fit index (GFI) = 0.99; adjusted goodness-of-fit index (AGFI) = 0.99; comparative fit index (CFI) = 0.99; incremental fit index (IFI) = 0.99.

according to their suggestions and was sent, along with the English original, to two different specialist dentists, after which the Turkish form was revised again according to their suggestions. The prepared Turkish form was translated back into English by an expert with an advanced level of English. The translations submitted by a specialist dentist were then again compared, and the initial version of the translation was developed. Two specialist paediatric dentists were interviewed for the face validity of the Turkish scale, and revisions were thus made to the Turkish form according to their suggestions. Next, focus group discussions were held with 15 patients to assess the clarity of items in the scale, and revisions were again made according to the patients' suggestions. The revised scale was then presented to two lecturers who are experts in the Turkish language for language compatibility. Finally, the 52-item TOHLAT-P scale was finalized for the study group.

The TOHLAT-P uses a set of literacy and numeracy skills to assess three types of knowledge (factual, procedural, and conceptual) and cognitive process dimensions (remembering, understanding, and analyzing) to determine parents' oral health knowledge. It consists of three parts, each of which is discussed below.

The first part of the TOHLAT-P assesses oral health knowledge by showing figures of healthy and decayed primary teeth and asking participants to name the structures indicated by arrows. It consists of four images showing the structure of either normal milk teeth or decayed teeth. Participants are asked to match the structures indicated by arrows in the pictures with the numbers below the pictures.

The second part of the TOHLAT-P consists of reading comprehension and arithmetic tests. There are a total of

four sets of questions, which include a clinical appointment card, a prescription label, post-procedure instructions, and a toothpaste label. Participants are asked to use the information and instructions provided to answer the questions.

The third part of the TOHLAT-P is the comprehension test (fill in the blanks and revise). It consists of three sections with fill-in-the-blank questions and a section where sentences are rearranged. The gap-fill questions relate to complex dentition, tooth extraction, and orthodontic treatments. A forum-based structure was used in the development of the test, which includes questions from parents and answers from physicians. Using the content word deletion method, four possible options are selected for each question and only one is the correct answer. A toothbrushing guide is used for the sentence rearrangement section.

The maximum score for each part of the TOHLAT-P is 12, 26, and 14, respectively. The score ranges from 0 to 52, with high scores representing high literacy levels.

#### *The Rapid Estimation of Adult Literacy in Dentistry 30*

The REALD-30 was originally developed and validated to measure OHL with a word recognition test consisting of 30 dental words arranged in order of increasing difficulty according to average word length, the number of syllables, and difficult sound combinations. This assessment tool has previously been validated in Turkish. In this study, the REALD-30 was conducted by a single researcher (EO) to record the correct pronunciation score of the words that participants were asked to read aloud, and a point is given for each word that is pronounced correctly. The score ranges from 0 to 30, with 0 being the lowest and 30 being the highest literacy level.



### 2.3.2 | Endogenous variables

#### *Parental oral health behavior form*

A previously validated oral health form in Turkish was used to assess oral health behaviors. This questionnaire is used to assess the parental oral health behaviors with questions that measure the frequency of toothbrushing and dental visits, the length of time since the last dental visit, negative dental experiences, and exposure to training about oral hygiene. For each question, “1” represents the most negative response, and positive responses receive higher scores. Total scores can range from 5 to 14. Higher scores indicate better oral health behaviors.

#### *Children's oral health behavior form*

This variable was measured using a previously validated form, with questions meant to assess the frequency of toothbrushing and dental visits, the length of time since the last dental visit, negative dental experiences, and frequency and timing of consumption of cariogenic foods. For each question, “1” is the most negative response, and positive responses receive higher scores. Total scores can range from 5 to 16. Higher scores indicate better oral health behaviors.

#### *Children's dental anxiety*

The Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) consists of 15 questions, and its validity and reliability in Turkish have previously been assessed.<sup>16</sup> The parents answered the questions on the scale by choosing one of the five options (1 = “I'm not afraid” to 5 = “I'm scared”). The score ranges from 15 to 75, with higher scores indicating a higher level of anxiety.

#### *Oral health-related quality of life*

The ECOHIS, which consists of 13 questions, was completed by the parents. The first section, the Child Impact Scale (CIS), has 9 questions that evaluate effects of dental problems and treatments on the daily activities of children such as eating, drinking, and communication. The second part is the Family Impact Scale (FIS), which measures the effect of dental problems and treatments on family members. The answer categories for each question are evaluated on a 5-point Likert scale indicating how often an event occurs over the child's lifetime: 0 = never, 1 = almost never, 2 = occasionally, 3 = often, 4 = very often, and 5 = I do not know. After all of the responses with “5” were omitted, the total score was calculated. The score ranges from 0 to 52, with higher scores representing better OHRQoL. Its validity and reliability in Turkish have previously been assessed.<sup>6</sup>

#### *Dental caries*

Examinations on children's oral and dental were conducted under standard reflector light in a dental

examination room. A standard examination was conducted, and clinical measurements were recorded. A trained and experienced clinical researcher (EO) administered the measurement tools and undertook the measurement procedures. Decayed and filled tooth (dft) indices were used for the evaluation of dental caries using the World Health Organization (WHO) criteria.<sup>17</sup> Since the study participants were aged between 3 and 6 years, only the dft data were calculated. Parents were not in the examination room during the examination.

### 2.4 | A priori hypotheses

There were four a priori hypotheses as follows: (i) Higher OHL is associated with better parental oral health behaviors; (ii) better parental oral health behaviors are associated with better oral health behaviors and lower dental anxiety in children; (iii) lower dental anxiety in children is associated with better oral health behaviors and better OHRQoL in children; (iv) better oral health behaviors in children are associated with fewer dental caries; and (v) fewer dental caries is associated with better OHRQoL.

### 2.5 | Statistical analysis

SPSS and AMOS (IBM SPSS Statistics for Windows, version 22.0) were used to analyze the data. The descriptive analysis included demographic characteristics, participant responses to questionnaires, and the computation of scale scores. The normality of distributions was tested using skewness and kurtosis values. Although means and standard deviations were calculated for continuous variables, frequencies were calculated for categorical variables. Kruskal–Wallis and Mann–Whitney *U* tests were used to examine the differences among the independent groups. The homogeneity of variance was assessed using Levene's test.

Item analysis was performed to determine the reliability of the TOHLAT-P. Item analysis and discrimination between participants in the lower 27% and upper 27% were examined. The KR-20 reliability coefficient of the scale and the item difficulty and item discrimination indices of each item were calculated. Construct validity was tested by comparing a commonly used instrument, REALD-30, using Pearson's product–moment correlation coefficients.

A path analysis was conducted to test the validity of the conceptual model. The following indices were calculated to test the fit of the path analysis and confirmatory factor analysis (CFA) models: root mean square error of approximation (RMSEA); normed fit index (NFI); adjusted goodness-of-fit index (AGFI); incremental fit index (IFI);

standardized root mean square residual (SRMR); chi-squared statistic ( $\chi^2$ ); degrees of freedom ( $df$ ); and  $\chi^2/df$ . It has been suggested that a  $\chi^2/df$  ratio  $\leq 3$  signifies a good fit. The recommended cutoff values that indicate a good fit are as follows: (a)  $\chi^2 p > .05$ ; (b) GFI, IFI, and TLI  $> 0.95$ ; (c) CFI and AGFI  $> 0.90$ ; and (d) RMSEA and SRMR  $< 0.08$ .<sup>18</sup>

### 3 | RESULTS

A total of 350 participants completed the questionnaires. Thirty-five participants were excluded from the study due to incompletely filling out the forms. Finally, 315 participants were included in the analysis. The mean age of the children was  $4.6 \pm 0.8$  years. Of the participants, 53% ( $n = 168$ ) were male and 47% ( $n = 147$ ) were female.

#### 3.1 | Reliability and validity of the TOHLAT-P

Table 1 presents the findings of the item analysis of the TOHLAT-P, including item difficulty and item discrimination values for each item. The KR-20 coefficient of the 52-item TOHLAT-P was 0.97. Since this value was greater than 0.80, the scale was determined to be reliable. The mean item difficulty was 0.46, which is considered moderate. Since the discrimination index value of each item was higher than 0.20, no item needed to be removed from the scale. The mean discrimination index of the scale was 0.49, indicating appropriate discrimination among the participants.

Table 2 presents Pearson's  $r$  correlations between the TOHLAT-P and its three components and the REALD-30. Pearson's  $r$  correlations between the full TOHLAT-P scale score and each item of the three components of the scale were .75, .91, and .77 for Part 1, Part 2, and Part 3, respectively. Pearson's  $r$  correlations were all statistically significant ( $p < .01$ ). Part 3 of the TOHLAT-P, which was meant to assess recognition and labeling, however, showed weaker associations than that of other components. The TOHLAT-P and the REALD-30 had a high correlation ( $r = .79$ ). Part 2 (numeracy/literacy) had the highest correlation with the REALD-30 ( $r = .71$ ), whereas Part 1 (recognizing and labeling) had the lowest correlation with the REALD-30 ( $r = .59$ ).

#### 3.2 | Path analysis

The path diagram and standardized beta coefficients of the path model are shown in Figure 1. According to the path analysis, the following results were obtained: (a) As

parental oral health behaviors increased, children's oral health behaviors improved ( $\beta = .35$ ;  $p < .001$ ); (b) an increasing number of caries were associated with a decrease in the OHRQoL ( $\beta = .18$ ;  $p < .001$ ); (c) as the parental OHL level increased, parental oral health behaviors improved ( $\beta = .06$ ;  $p > .001$ ); (d) as parental oral health behaviors improved, the level of child dental anxiety decreased ( $\beta = -.04$ ;  $p > .001$ ); (e) as the level of child dental anxiety increased, children's oral health behaviors worsened ( $\beta = -.10$ ;  $p > .001$ ); (f) as the level of child dental anxiety increased, the OHRQoL decreased ( $\beta = .03$ ;  $p > .001$ ); and (g) as children's oral health behaviors improved, the number of caries decreased ( $\beta = -.12$ ;  $p > .001$ ).

Table 3 presents the direct, indirect, and total effects of the tested variables in the path model of the TOHLAT-P and other endogenous variables. The path analysis revealed the following findings: (a) Parental oral health behaviors were directly impacted by parental OHL, with increasing levels of parental OHL positively affecting parental oral health behaviors; (b) children's oral health behaviors were the most indirectly affected by parental OHL, with increasing levels of parental OHL positively affecting children's oral health behaviors; (c) the variables that were most affected by the level of parental OHL were parental and children's oral health behaviors. With regard to the direct effects among the other variables, children's oral health behaviors were most directly affected by parental oral health behaviors, with a positive relationship between the variables. With regard to indirect interactions between the other variables, the number of dental caries was most indirectly affected by parental oral health behaviors, with a negative relationship between the variables.

Tables 4 and 5 show the distribution of TOHLAT-P scores and associations between the measured parental and child variables, respectively. Regarding the parental variables, education level, monthly income, health insurance status, frequency of toothbrushing, the length of time since the last dental visit, and training about oral hygiene were significantly associated with OHL. Regarding the child variables, time of consumption of cariogenic food, the length of time since the last dental visit, and negative dental experiences were significantly associated with OHL.

### 4 | DISCUSSION

To the best of our knowledge, this is the first study to present a new conceptual model of the many individual and parental behaviors and oral health outcomes associated with OHL. In this conceptual model, associations between the tested variables and the mediating effects of individual

TABLE 1 Outcomes of the item analysis of the TOHLAT-P

Dimension	Item no.	Item-total correlations	t Values (upper-lower 27%)	Item difficulty	Item discrimination
Part 1					
Recognizing and labelling	1	0.502	7.186*	0.411	0.466
	2	0.688	12.685*	0.511	0.688
	3	0.664	11.059*	0.388	0.622
	4	0.516	7.944*	0.522	0.511
	5	0.569	9.741*	0.600	0.577
	6	0.715	13.603*	0.544	0.711
	7	0.620	9.628*	0.316	0.544
	8	0.671	12.300*	0.494	0.677
	9	0.471	6.690*	0.372	0.433
	10	0.441	6.340*	0.155	0.311
	11	0.535	8.423*	0.477	0.533
	12	0.393	5.798*	0.155	0.288
Part 2					
Comprehension (numeracy/literacy)	13	0.442	6.382*	0.716	0.388
	14	0.381	5.323*	0.427	0.366
	15	0.463	6.828*	0.494	0.455
	16	0.472	6.599*	0.605	0.433
	17	0.651	12.129*	0.433	0.666
	18	0.678	12.502*	0.611	0.666
	19	0.358	4.775*	0.272	0.301
	20	0.356	4.976*	0.127	0.233
	21	0.346	4.659*	0.394	0.322
	22	0.411	6.062*	0.244	0.355
	23	0.541	8.050*	0.772	0.433
	24	0.532	8.604*	0.411	0.533
Part 3					
Comprehension (close/ organizing)	37	0.651	10.968*	0.402	0.623
	38	0.643	10.688*	0.394	0.611
	39	0.306	4.203*	0.472	0.325
	40	0.528	7.789*	0.377	0.488
	41	0.484	7.566*	0.738	0.433
	42	0.281	3.526*	0.811	0.245
	43	0.139	1.962*	0.944	0.667
	44	0.453	6.128*	0.738	0.366
	45	0.473	6.836*	0.311	0.422
	46	0.442	6.455*	0.450	0.433
	47	0.558	8.414*	0.701	0.488
	48	0.418	8.415*	0.661	0.388
49	0.473	8.416*	0.700	0.422	
50	0.438	8.417*	0.511	0.422	
51	0.458	8.418*	0.650	0.433	
52	0.461	8.419*	0.644	0.444	

Abbreviations: TOHLAT-P, Turkish Hong Kong Oral Health Literacy Assessment Task for Paediatric Dentistry.

\*Statistical significance,  $p < .05$ .

TABLE 2 Correlations between the TOHLAT-P and its components and the REALD-30

Measure	1	2	3	4	5
1. TOHLAT-P	—	0.75	0.91	0.77	0.79
2. TOHLAT-P Part 1 (recognizing and labelling)		—	0.49	0.41	0.59
3. TOHLAT-P Part 2 (comprehension [numeracy/literacy])			—	0.58	0.71
4. TOHLAT-P Part 3 (comprehension [cloze/organizing])				—	0.61
5. REALD-30					—

TABLE 3 Outcomes of the path analysis: Direct, indirect, and total effects of the variables of the conceptual model and other endogenous variables

	Oral health literacy	Parental oral health behaviors	Children's dental anxiety	Children's oral health behaviors	Dental caries
Direct effects					
Parental oral health behaviors	0.056	—	—	—	—
Children's dental anxiety	—	−0.042	—	—	—
Children's oral health behaviors	—	0.346	−0.097	—	—
Dental caries	—	—	—	−0.119	—
Oral health-related quality of life	—	—	−0.033	—	0.184
Indirect effects					
Parental oral health behaviors	—	—	—	—	—
Children's dental anxiety	−0.002	—	—	—	—
Children's oral health behaviors	0.020	0.004	—	—	—
Dental caries	−0.002	−0.042	0.012	—	—
Oral health-related quality of life	—	−0.006	0.002	−0.022	—
Total effects					
Parental oral health behaviors	0.056	—	—	—	—
Children's dental anxiety	−0.002	−0.042	—	—	—
Children's oral health behaviors	0.020	0.350	−0.097	—	—
Dental caries	−0.002	−0.042	0.012	−0.119	—
Oral health-related quality of life	—	−0.006	−0.031	−0.022	0.184

and parental variables are presented. This model revealed that OHL has a direct and/or indirect effect on children's oral health status through variables such as parental oral health behaviors, children's oral health behaviors, child dental anxiety, and OHRQoL.

The application of the path analysis is one of the methodological strengths of this study.<sup>19</sup> In addition, the TOHLAT-P was developed in this study by adapting the HKOHLAT-P into Turkish and ensuring its validity and reliability. This scale provides an advantage over other existing scales in the literature, as it includes various sub-factors of OHL, and a benefit of this study is the potential application of the TOHLAT-P in future clinical and/or epidemiological studies.

This study, however, also has several limitations. First, even though the model included many parental and individual variables, it did not include many environmental factors. Another major limitation was its cross-sectional

design, as this type of design cannot be used to determine causality and mediation effects. Longitudinal and interventional studies should investigate the causality. Another limitation was the use of an easily accessible sample of paediatric patients from a single dental center. This study, however, examined relationships between variables rather than prevalence rates, and the strength of our analysis is based on statistical assumptions about the distribution of variables. Another limitation could be the use of self-report measures, as they may be affected by responders' response biases. Validated questionnaires were used to circumvent this limitation.

This study revealed a valid conceptual model that was based on a larger framework of associations between the tested variables. Although previous studies<sup>7,20–23</sup> have reported different variables that are associated with parental OHL, none have tested the validity of a comprehensive model that includes a wide range of variables.



TABLE 4 Distribution of mean, maximum, and minimum TOHLAT-P scores by model variables of parents

Variables	N	%	Mean	SD	Min	Max	p Value
<b>Age</b>							
<30	65	20.6	27.49	9.05	7	47	$p = .062$
31–39	166	52.7	27.59	9.35	6	49	
40–49	71	22.5	28.84	11.15	6	48	
>50	13	4.1	20.77	12.18	4	41	
<b>Relationship to child</b>							
Mother	166	52.7	26.74	9.46	6	49	$p = .210$
Father	132	41.9	28.73	10.27	6	48	
Other	17	5.4	26.65	11.19	4	47	
<b>Education level</b>							
Elementary <sup>A</sup>	45	14.3	20.16	10.03	4	46	$p = .001^*$
Secondary <sup>B</sup>	66	21.0	24.32	7.40	7	41	
High school <sup>b</sup>	102	32.4	26.72	9.37	8	46	
University <sup>C</sup>	89	28.3	33.30	8.28	8	49	
Postgraduate <sup>C</sup>	13	4.1	37.23	7.08	24	48	
<b>Monthly income</b>							
0–1500 TL	34	10.8	23.32	8.57	6	42	$p = .001^*$
1501–3000 TL	115	36.5	24.41	9.10	4	47	
3000–5000 TL	81	25.7	27.77	10.26	6	48	
>5000 <sup>A</sup>	85	27.76	33.36	8.42	8	49	
<b>Health insurance</b>							
None	21	6.7	26.38	9.36	10	47	$p = .377^*$
Green card	12	3.8	23.42	9.94	4	34	
Social security	255	81.0	27.7	10.03	6	49	
Private	27	8.6	29.11	9.20	9	44	
<b>Frequency of toothbrushing</b>							
Never	3	1.0	23.00	7.21	15	29	$p = .001^*$
Rarely <sup>A</sup>	19	6.0	18.84	7.89	6	34	
Occasionally	90	28.6	27.07	9.51	9	48	
Daily	203	64.4	28.68	9.91	4	49	
<b>Frequency of dental visits</b>							
When toothache	182	57.8	26.63	9.55	4	48	$p = .090$
Occasionally	66	21.0	28.59	10.32	7	49	
Once in a year	50	15.9	30.24	9.92	6	47	
Once in 6 months	17	5.4	25.82	11.09	6	44	
<b>The last time dental visit</b>							
Never <sup>A</sup>	13	4.1	19.84	7.28	10	38	$p = .011^*$
In last 5 years	69	21.9	29.08	9.81	4	49	
In last 1 year	137	43.5	28.23	9.53	8	46	
In last 6 months	96	30.5	26.59	10.37	6	47	
<b>Negative dental experience</b>							
Yes	32	10.2	29.28	10.01	6	49	$p = .304$
No	283	89.8	27.38	9.90	4	48	

(Continues)

TABLE 4 (Continued)

Variables	N	%	Mean	SD	Min	Max	p Value
Training about oral hygiene							
Yes <sup>A</sup>	224	71.1	28.93	9.80	4	49	$p = .001^*$
No	91	28.9	24.22	9.43	6	45	
Time spent reading (h in a week)							
None	119	37.8	26.97	8.91	7	47	$p = .328$
<1	123	39.0	27.61	9.73	6	48	
1–3	36	11.4	30.31	12.15	4	49	
>3	37	11.7	26.70	11.11	4	49	

Abbreviations: TOHLAT-P, Turkish Hong Kong Oral Health Literacy Assessment Task for Paediatric Dentistry; SD, standard deviation.

\*Different letter indicates statistical significance, verified by Kruskal–Wallis and Mann–Whitney  $U$  tests ( $p < .05$ ).

Variables	N	%	Mean	SD	Min	Max	p Value
Sex							
Girl	147	46.7	27.44	9.91	6	47	$p = .212$
Boy	168	53.3	27.68	9.95	4	49	
Frequency of consumption of cariogenic food							
Always	12	3.8	26.42	6.35	18	37	$p = .479$
Occasionally	233	74.0	27.97	9.93	4	49	
Never	70	22.2	26.43	10.36	7	47	
Time of consumption of cariogenic food							
Main meal <sup>A</sup>	35	11.1	32.26	10.44	8	49	$p = .004^*$
Snack	138	43.8	27.83	10.09	6	48	
Any time	142	45.1	26.16	9.28	4	47	
Frequency of toothbrushing							
Never	11	3.5	20.82	11.71	6	40	$p = .082$
Rarely	34	10.8	26.53	9.76	8	47	
Occasionally	127	40.3	28.53	9.10	9	48	
Daily	143	45.4	27.48	10.36	4	49	
Frequency of dental visits							
When toothache	198	62.9	27.05	9.77	4	49	$p = .233$
Occasionally	47	14.9	30.21	10.50	6	48	
Once in a year	45	14.3	26.76	10.47	6	46	
Once in 6 months	25	7.9	28.20	8.51	7	42	
The last dental visit							
Never	60	19.2	26.83	10.22	8	48	$p = .043^*$
In last 5 years <sup>A</sup>	16	5.1	32.81	9.99	20	49	
In last 1 year	83	26.3	25.82	9.82	4	46	
In last 6 months	156	49.5	28.25	9.68	6	48	
Negative dental experience							
Yes <sup>A</sup>	16	5.1	33.28	7.92	20	46	$p = .016^*$
No	299	94.9	27.26	9.93	4	49	

TABLE 5 Distribution of mean, maximum, and minimum TOHLAT-P scores by model variables of children

\*Same letters indicate statistical significance. Verified by Kruskal–Wallis and Mann–Whitney  $U$  tests ( $p < .05$ ).

Oral health literacy levels are often associated with social dimensions, such as education and income level.<sup>12</sup> The findings of this study revealed that parental education level and total family income were directly associated with parental OHL. Participants with higher education are likely more able to find and understand oral health information and make informed decisions about oral health issues.<sup>24</sup> Many previous studies<sup>9,20,24</sup> have reported the effect of higher education on OHL levels and have established a significant relationship between these variables. This may be related to the fact that parents with higher income levels have easier access to education and information. Vann et al.<sup>9</sup> found a statistically significant relationship between oral health knowledge and OHL level, providing further support for the findings of this study.

Children are dependent on their parents/caregivers not only for accessing health care but also for matters related to their health, including maintaining positive health behaviors.<sup>5</sup> Since children see their parents as role models and copy their behaviors, parental OHL and oral health behaviors affect their child's oral health behaviors and the number of dental caries. A previous study<sup>25</sup> showed a direct relationship between the brushing habits of mothers and their children. This relationship may suggest that parents who are more health-conscious have better oral hygiene habits, and thus, their children will have better oral health behaviors and fewer caries. Therefore, the relationship between parental oral health behaviors and children's oral health behaviors was examined in this study. Our findings revealed a direct and statistically significant relationship between parental and children's oral health behaviors. This study also found that the frequency of parental toothbrushing was statistically significantly associated with OHL. Additionally, a previous systematic review determined that parents with low health literacy had less health knowledge and their children had more negative health behaviors.<sup>26</sup>

It is the responsibility of parents of preschool children to take advantage of dental treatment services for their children, and therefore, children whose parents do not go to the dentist regularly may be at risk.<sup>5</sup> In this study, parents of children who had had a dental visit in the previous 5 years were found to have statistically significantly higher OHL levels. Shin et al.<sup>27</sup> also found a statistically significantly higher probability that children of parents with a high OHL level had seen a dentist in the previous year. By contrast, another previous study<sup>28</sup> reported no association between parental OHL level and the child's history of dental visits.

In most of the studies investigating the relationship between OHL and dental caries, a higher incidence of dental caries was found in children of parents and caregivers with low OHL levels.<sup>4,9,10,27,28</sup> Similarly, in this study, a negative significant relationship was found between TOHLAT-P scores and children's dft scores. Likewise, Khodadadi

et al.<sup>20</sup> correlated parents' low OHL levels with a higher number of dental caries and fewer dental fillings in children. One possible explanation for this trend is that parents with low OHL levels have less knowledge about how to prevent dental caries in their children or have more difficulty understanding instructions regarding oral health. This result highlights the need for paediatric dentists to be aware of parental OHL levels, as it may affect the child's susceptibility to dental caries.

Many studies examining the effect of dental caries on OHRQoL have obtained similar results to this study. Piovesan et al.<sup>29</sup> found that OHRQoL is affected by socioeconomic and dental clinical outcomes. Chaffe et al.<sup>30</sup> reported that dental caries in preschool children is strongly associated with detrimental effects on child and family quality of life.

Although previous studies examining the relationship between parents' reading time and habits and OHL level found,<sup>14,22</sup> no significant difference was found between reading duration and frequency and parental OHL levels in this study.

In conclusion, the Turkish version of the Oral Health Literacy Assessment Task (TOHLAT-P) was developed, and evidence of its validity and reliability for assessing OHL in the Turkish community is provided. This study also developed and validated a model presenting the pathways between parental OHL and oral health consequences in children. Specifically, these findings present an association between parental OHL and children's dental anxiety, oral health behaviors, dental caries, and OHRQoL. Having an adequate understanding of these pathways is necessary to design effective strategies to improve children's oral health behaviors and decrease the number of dental caries. Coupled with parental oral health education, understanding these pathways may be an important part of effectively improving community oral health.

#### AUTHOR CONTRIBUTIONS

B.B and E.O conceived the idea; E.O collected the data; and B.B analyzed the data. All authors wrote and reviewed the manuscript.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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