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Original Article

Validation of the Persian version of the Caries Impacts and Experiences Questionnaire for Children (CARIES-QC)

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Abstract

Background: The caries impacts and experiences questionnaire for children, which measures the effects of dental caries on children's quality of life, was designed for the first time in England. The present study aimed to create a localized questionnaire with good validity and reliability on the topic of quality of life related to dental caries for children aged 5 to 16 years in the Persian language from their perspective.

Methods: First, the existing English questionnaire was translated into Persian according to international standards, and then it was filled out by children with active dental caries. Confirmatory factor analysis (CFA) and convergent validity were used to determine construct validity. Ethical approval was granted for the study. SPSS and AMOS software were used for statistical analysis.

Results: One hundred forty-nine children aged 5 to 16 participated in the study. The overall Cronbach's alpha coefficient of this questionnaire was 0.942, which indicates the good coherence of the questions. The intraclass correlation coefficient (ICC) values in each questionnaire field were more than 0.50, and their total value was 0.808, which shows an acceptable correlation and internal stability. The construct validity study results showed the single-factor model's good fit. With the increase in the DMFT/dmft index, the final score of the questionnaires increased significantly, and the quality of life worsened.

Conclusion: The Persian version of the caries impacts and experiences questionnaire for children was valid and reliable. The study results showed that therapeutic intervention significantly reduces the adverse effects of dental caries.

Keywords: Child, Dental caries, Quality of life

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Introduction

Dental caries is still a major global health concern. A recent systematic review shows that approximately 621 million children have untreated dental caries.[1] Despite the global prevalence, few attempts have been made to research children's attitudes towards how dental caries affects their daily lives.[2]

In addition to these functional problems, children with dental caries report many psychosocial issues, including those related to laughing, playing, difficulty sleeping or resting, and emotional-social health. The relationship between clinical findings and quality of life scores related to oral health is weak and contradictory.[3]

To solve these limitations, an assessment of the quality of life related to dental caries examines children in all stages of development and records the changes resulting from the intervention to treat dental caries. Such an evaluation is critical for future clinical trials to investigate the prevention and management of dental caries.

This study was first conducted in England by Dr Fiona Gilchurst,[4] and then it was localized in other languages, such as Dutch,[5] Chines,[6] Arabic,[7] and Turkish.[8] As far as we know, it is being conducted for the first time in Iran in the present study. This study aimed to develop and validate the existing scale for children in the Persian language, which can help evaluate different approaches for dental caries management.

Methods

Study design

This cross-sectional study was conducted at Esfahan Dental School.

Questionnaire design and eligibility criteria for subject selection

The study included children attending Esfahan Dental School (Research code: 3401725, Ethical approval code: IR.MUI.REC.1402.002/REC). Children were selected randomly using a random block of numbers. After the research was explained, the consent of the child's parents

was obtained via informed consent forms. Children aged 5 to 16 years who had dental decay were included in the study. Children with oral diseases (conditions) other than dental caries, such as dental trauma, cleft lip and palate and craniofacial abnormalities and children who could not understand the scale questions even with support were not included in the study.

In order to implement the validated questionnaire, the following formula was used:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 S^2}{d^2} = 154$$

This study was conducted in two stages (before and after treatment): a clinical examination and completing a questionnaire, which required the participation of children and their parents both before and after treatment. The interval between the two questionnaires was 2–6 months.

After the demographic data, including age and gender, were collected, the dmft and DMFT indices, anterior decay, pain, and pulpal involvement were recorded. The researcher evaluated DMFT and dmft using a clinical and radiographic assessment.

Persian translation and cultural adaptation

First, permission was obtained via email from the leading developer of Caries Impacts and Experiences Questionnaire for Children (CARIES-QC) (Dr Fiona Gilchrist) to translate and validate them in Persian. The researchers were committed to sending the results to them. After that, this questionnaire was given to two bilingual experts fluent in English and Persian to score each phrase from 1 to 100 regarding the difficulty and quality of translation.[9,10]

Two indices, the content validity ratio and the content validity index, were used to determine content validity quantitatively. First, to determine the content validity index, 15 dental professionals (experts other than those of the previous stage) were asked to evaluate each item based on a 3-part range (transparency, relevance, and simplicity), each scored from 1 to 4 (1 = irrelevant, 2 = slightly relevant, 3 = very relevant, 4 = completely relevant.[10]

The children's opinions were also asked about the questionnaire design and item clarity.

Construct validity

The factor analysis method was used to determine the construct validity; after examining the internal consistency of the questionnaire items, confirmatory factor analysis (CFA) was conducted using the Analysis of Moment Structures (AMOS) software (BMI, NY, 2020), which examines the internal relationship between the variables.

Reliability

Finally, 30 children filled in the questionnaire to test-retest the CARIES-QC questionnaire. The reliability was calculated through the test-retest method, and the scores of the two stages were compared using the intraclass correlation coefficient (ICC). The internal consistency of the CARIES-QC questionnaire was also estimated using Cronbach's alpha.

Results

Fifteen experts evaluated the validity of the CARIES-QC questionnaire in terms of (1) fluency, clarity, and comprehensibility and (2) being tailored to our society's cultural conditions. From the experts' point of view, all the items acquired percentages equal to or more than 80%. Therefore, they were expressive, understandable, and appropriate for the society's cultural conditions.

Content validity

From the experts' point of view, all the items had CVR above 0.51 and CVI above 0.79. Therefore, all the questionnaire items were approved regarding transparency, relevance, necessity, and simplicity (Table 1).

Construct validity

A hundred forty-nine samples completed the current questionnaire to perform CFA. The goodness of fit index (GFI) was 0.916, which is higher than 0.90 (Table 2).

Furthermore, Table 3 presents non-standardized and standardized factor loadings related to each question. According to this table, all the factor loadings are significantly related to dental caries. The factor analysis model of this questionnaire is presented in Figure 1.

Table 1. Content validity

Item	CVR transparency	CVR relevance	CVR simplicity	CVI
1	0.60	0.60	0.86	0.86
2	0.73	0.73	0.73	0.93
3	0.86	0.86	0.73	1
4	0.73	0.60	0.60	0.93
5	0.60	0.73	0.60	0.93
6	0.60	0.60	0.73	1
7	0.60	0.73	0.73	0.93
8	0.60	0.73	0.60	1
9	0.73	0.73	0.60	0.93
10	0.73	0.86	0.73	1
11	0.86	0.60	0.60	0.93
12	0.60	0.73	0.86	0.93
13	0.86	0.60	0.86	0.93

s-CVI/Ave = 0.95.

Table 2. Model fit indices

Fit indices	Observed values	Minimum acceptable values
Chi-square (CMIN)	24.50	-
Degree of freedom (df)	50	-
CMIN/df	0.500	>3
Comparative fit index (CFI)	0.950	>0.90
Norm fit index (NFI)	0.902	>0.90
Root mean square approximation index (RMSRA)	0.07	<0.08
Tucker-Lewis index (TLI)	0.940	>0.90
Incremental fit index (IFI)	0.956	>0.90
Goodness of fit index (GFI)	0.916	>0.90

Table 3. Standardized factor loadings

Item			Un-standardized estimate	Standardized estimate	SE	CR
I.1	<---	caries1	1.00	0.89		
I.2	<---	caries1	0.83	0.80	0.068	12.22
I.3	<---	caries1	0.99	0.74	0.091	10.81
I.4	<---	caries1	0.92	0.66	0.099	9.23
I.5	<---	caries1	0.56	0.89	0.084	6.72
I.6	<---	caries1	0.46	0.44	0.082	5.56
I.7	<---	caries1	0.33	0.32	0.084	3.88
I.8	<---	caries1	0.79	0.63	0.092	8.56
I.9	<---	caries1	0.63	0.61	0.076	8.28
I.10	<---	caries1	0.61	0.59	0.078	7.84
I.11	<---	caries1	0.76	0.75	0.068	11.08
I.12	<---	caries1	0.35	0.43	0.064	5.43

CR, composite reliability; SE, standard error

Reliability

According to Table 4, each item's Cronbach's alpha coefficient is higher than 0.70. Therefore, this coefficient shows the items' good and desirable consistency (Table 4).

In addition, as shown in Table 4, the ICC values for all items of the CARIES-QC questionnaire are higher than 0.50, and the overall ICC value is 0.808, which shows an acceptable correlation and internal reliability. Thus, this questionnaire's reliability was also confirmed.

Study samples

Table 5 presents the basic and clinical characteristics of 149 children aged 5 to 16. According to this table, 85 (57%) were male, and 64 (43%) were female.

The average quality of life scores based on children's characteristics

Table 5 also presents the mean total scores of the questionnaires based on the children's characteristics. As indicated, there is no significant difference in the final scores of the primary questionnaire between boys and girls ($P>0.05$). However, after the treatment, the mean final score of the questionnaire for the girls, with an average of 3.39 ± 5.92, was significantly higher than that of the boys, with an average of 3.23 ± 4.19 ($P<0.05$). In addition, the mean final score of the questionnaires was higher at younger ages, both before and after the treatment, as the final score of the questionnaires decreased with age ($P<0.001$). Children with a history of pain, pulp involvement, and tooth decay still achieved higher mean final scores both before and after treatment ($P<0.001$).

Frequency of responses to questionnaires before and after the treatment

It is worth mentioning that only children who completed their dental treatment (n=62) filled out the second questionnaire. As shown in Table S1, a significant improvement is seen in each of the questions of the CARIES-QC, so the frequency of "a lot" responses after treatment decreased significantly compared to before treatment, and the frequency of "not at all" responses after treatment significantly increased compared to before treatment.

Comparing the average scores of the final questionnaires by recovery status

As indicated, 51 patients reported lower CARIES-QC scores, 10 reported no change, and one reported higher scores (Table S2).

The analysis of questionnaire scores revealed significant improvement following the treatment. Overall, the mean final score post-treatment (4.92 ± 3.38) was substantially lower than the pre-treatment score (8.42 ± 5.54), with a statistically significant difference ($P<0.001$).

Moreover, the contrast was even more pronounced among participants who reported subjective improvement. In this subgroup, the average post-treatment score (5.51 ± 3.30) showed a marked decrease compared to the pre-treatment score (9.71 ± 5.15), again with high statistical significance ($P<0.001$).

As shown in Table S2, those who felt an improvement in their condition obtained a lower mean final questionnaire score. Those who reported the worsening of their tooth condition also reported that their quality of life had worsened. Those who reported their status without change had relatively little change in their mean scores, indicating the present study's responsiveness.

Discussion

The results of the present study indicated that the questionnaires in the Persian language had appropriate validity and reliability on the impact of caries on the quality of life of children aged 5 to 16. This is the first study in the Persian language that examines the CARIES-QC in the Persian-speaking community. The available translations for this scale are in Chinese,[6] Dutch,[7] Arabic,[8] and Turkish.[9] A single-factor CFA was found to be

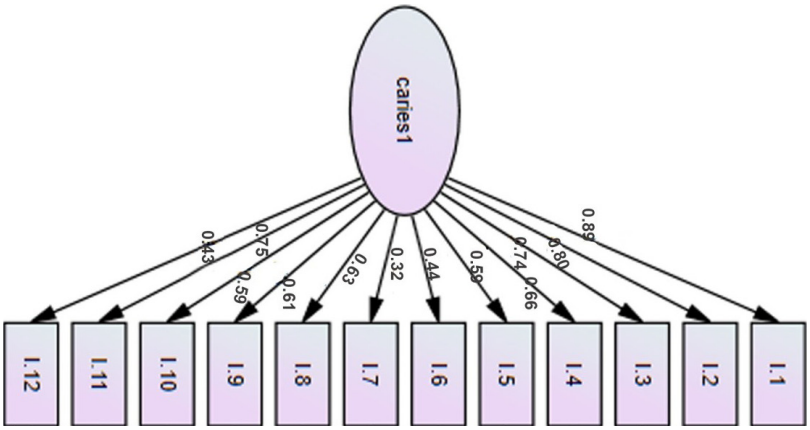

Figure 1. Standardized factor load, one-factor CFA model

Table 4. Reliability

Item	Corrected item-total correlation	Cronbach's alpha if item deleted	ICC	95% CI
1	0.892	0.932	0.683	0.524–0.796
2	0.887	0.933	0.528	0.322–0.686
3	0.857	0.933	0.625	0.447–0.756
4	0.789	0.936	0.655	0.486–0.777
5	0.587	0.941	0.821	0.719–0.888
6	0.672	0.939	0.687	0.520–0.799
7	0.496	0.944	0.728	0.586–0.827
8	0.563	0.942	0.674	0.512–0.790
9	0.716	0.938	0.654	0.485–0.776
10	0.770	0.936	0.702	0.550–0.809
11	0.795	0.935	0.704	0.552–0.810
12	0.478	0.944	0.567	0.386–0.717
Total Cronbach's alpha = 0.942			0.808	0.700–0.880

appropriate for evaluating the validity of the construct and showed a good fit for the model. In the present study, the overall Cronbach's alpha coefficient of this questionnaire was 0.942, which shows the good consistency of the questions and is supported by the results of previous studies. However, it was slightly higher than the original scale and other translations of the questionnaire.[5]

Like previous studies, the present study found that the higher the final index score of the questionnaire, the lower the child's quality of life. Children with a history of pain, pulp involvement, and tooth decay, both before and after treatment, had a higher mean final index score and a lower quality of life.[4]

Compared to the original study,[5] the children in this study had significantly lower dmft indices (only in primary teeth), pulp involvement, history of pain, and lower final index scores.

In the present study, as the age increased, the final index score of the questionnaire decreased significantly in comparison to the original study, which can be due to the cultural, social, and socio-economic differences between different countries. Moreover, most children older than 9 (more than 90%) in the present study had caries in first molars compared to the original study.[5]

Table S2 compares the average final scores of the questionnaires before and after the treatment according to the reported change. In the people who reported an improvement, the average final score on the questionnaire was significantly lower after the treatment than before. Moreover, although 10 of the patients reported unchanged conditions, the average final score of the questionnaire was significantly lower after treatment than before treatment. Similar to the original study's findings, there was a significant difference in the final score indices of the questionnaire in those who reported improvement. However, unlike the original study, the final score index of the questionnaire had decreased in those who reported their conditions were unchanged.

One of the things that improved significantly was "hard to eat some foods." This study's findings indicated that the negative effects of dental caries are important and that there should not be a focus merely on improving function. As a result of the dental intervention, there was a reduction in scores for all items of the questionnaire, especially crying due to toothache and annoying teeth.[7-10]

Ethical considerations

For the children's participation, we obtained consent from them or their parents, and participation in the study was voluntary. We also pointed out that the study would be performed in two stages. All information received remained confidential and was not used elsewhere. In correspondence with the developer of the questionnaire, only the researcher and supervisor were allowed to have the English version of the questionnaire, and the results were sent to the developer. Ethical approval was granted for the study (Decision No. 1402.002).

Strength and Limitations

The participants required recall after treatment, which sometimes took a long time. The valid and reliable format

Table 5. The characteristics of study samples

Parameter		Value	Total score before treatment	*p*-value	Total score after treatment	*P* value
Gender	Boy	85 (57%)	6.90 ± 5.13	0.973	4.19 ± 3.23	0.046
	Girl	64 (43%)	6.87 ± 5.86		5.92 ± 3.39	
Age		9.05 ± 2.86				
	5–8	76 (51.0%)	8.88 ± 5.29	< 0.001	5.48 ± 3.33	< 0.001
	9–12	49 (32.9%)	5.43 ± 5.12		5.09 ± 3.46	
	13–16	24 (16.1%)	3.58 ± 3.34		2.25 ± 2.00	
Pain	Yes	97 (65.1%)	9.74 ± 4.41	< 0.001	6.00 ± 3.05	< 0.001
	No	52 (34.9%)	1.58 ± 2.23		1.81 ± 2.20	
Pulpal involvement	Yes	109 (73.2%)	8.91 ± 4.79	< 0.001	5.51 ± 3.21	< 0.001
	No	40 (26.8%)	1.40 ± 0.39		1.44 ± 0.69	
Anterior caries	Yes	50 (33.6%)	10.44 ± 4.94	< 0.001	6.86 ± 3.67	< 0.001
	No	99 (66.4%)	5.10 ± 4.77		3.85 ± 2.71	
dmft		5.01 ± 3.44 [0–15]				
	d	3.56 ± 3.03				
	m	0.60 ± 1.06				
	f	0.86 ± 1.48				
DMFT		1.82 ± 1.85 [0–6]				
	D	1.34 ± 1.32				
	M	0.03 ± 0.18				
	F	0.42 ± 0.91				

The relevant index is shown in two forms: mean ± (standard deviation) and [maximum-minimum] median.

for the questionnaires should be used in future studies in the country with a larger sample size and in patients with different socio-economic levels. It is also suggested that children treated under general anesthesia be included. Furthermore, with some modifications, this scale can be used in other countries such as Afghanistan, Punjab, Pakistan, Tajikistan, parts of Bahrain, etc.

Conclusion

The validity and reliability of the CARIES-QC questionnaire in Persian were good. Dental intervention for caries significantly reduced the adverse effects of this disease.

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Authors' Contribution

Conceptualization: Firoozeh Nilchian.
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Writing-original draft: Firoozeh Nilchian, Abbas Esmaeeli.
Writing- review & editing: Firoozeh Nilchian, Abbas Esmaeeli.

Competing Interests

The authors have declared that no conflict of interest exists.

Data Availability Statement

Data are available upon email request to f_nilchian@dnt.mui.ac.ir.

Ethical Approval

Ethical approval was obtained from Isfahan University of Medical Sciences (research code: 3401725, ethical approval code: IR.MUI.REC.1402.002/REC).

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Supplementary Files

Supplementary file 1 contains Tables S1-S2.

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