

# Oral health-related quality of life of preschool-aged Turkish children with congenital heart disease

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## Abstract

**Background.** Dental caries and poor oral hygiene can affect the quality of life (QoL) of patients with congenital heart disease (CHD). Information about the oral health-related quality of life (OHRQoL) of Turkish preschool children with CHD is scarce.

**Objectives.** The aim of the present study was to assess the OHRQoL, and the presence of caries, plaque and gingivitis in Turkish preschool children with CHD as compared to children without CHD (control group).

**Material and methods.** Children aged 3–6 years with CHD ( $n = 75$ ) and a control group ( $n = 75$ ) were included in the study. Examinations were conducted using the plaque index (PI), the gingival index (GI) and the World Health Organization (WHO) caries diagnostic criteria. The Early Childhood Oral Health Impact Scale (ECHOIS) questionnaire was completed by the children's families.

**Results.** The amount of caries and plaque, as well as the number of missing teeth were higher in children with CHD. The OHRQoL was lower in children with CHD. However, the differences between the 2 groups were not statistically significant ( $p > 0.05$ ). The number of filled teeth was significantly higher in the control group ( $p < 0.05$ ).

**Conclusions.** According to the findings of the present study, the high amount of caries and plaque in both groups demonstrates that caries continues to be a major public health problem. Although there was no significant difference in terms of QoL scale scores between the 2 groups, the study showed that OHRQoL was lower in children with CHD.

**Keywords:** dental caries, congenital heart disease, ECHOIS, oral health-related quality of life

## Cite as

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## Introduction

Congenital heart disease (CHD) is caused by congenital structural or functional anomalies in the cardiovascular system. Advances in diagnostics, neonatal care and surgical management have increased the survival rates in children with CHD.<sup>1</sup> With this increase in survival comes an increased burden of complexity when managing these children's oral health and disease. The maintenance of optimal oral health in children with CHD is of utmost importance.<sup>2</sup>

Oral and dental health is one of the most important factors affecting the quality of life (QoL) of preschool-aged children.<sup>3</sup> Untreated dental caries results in diminished QoL.<sup>4</sup> Previous studies have found that the prevalence of caries, including untreated caries, is higher in children with CHD than in healthy children.<sup>5–8</sup> Conversely, there are also studies indicating that the prevalence of dental caries is not higher in children with CHD.<sup>9,10</sup> Other studies have found that children with CHD also more often present with severe gingival disease and have more accumulated plaque.<sup>5,11</sup> It is known that dental caries, especially when untreated, results in nutritional difficulties, an insufficient chewing function, speech disorders, and esthetic problems. These factors can lead to numerous physical and psychosocial issues in children, such as pain, infection, the loss of self-confidence, the loss of concentration, learning difficulties, and school absenteeism.<sup>12</sup> Dental caries and its consequences can affect the QoL of children with CHD.<sup>13</sup>

The oral health surveys conducted in Turkey have determined that caries is a serious public health problem in preschool-aged children. In those studies, the clinical and microbiological aspects of caries have been investigated.<sup>14–16</sup> To the best of our knowledge, the psychosocial effects of caries on children with CHD have not been studied. In the present study, we evaluated the oral health-related quality of life (OHRQoL) of children with CHD aged 3–6 years as compared to healthy control children in Turkey.

## Material and methods

### Study design and sampling

The study protocol was approved by the institutional Ethics Committee at the Faculty of Dentistry of Selcuk University, Konya, Turkey (approval No. 2018/03). The study enrolled 75 children aged 3–6 years, diagnosed with CHD in the Department of Pediatric Cardiology of Selcuk University Hospital, Turkey, and 75 healthy children (control group without CHD) of similar age who reported to the Department of Pediatric Dentistry of Selcuk University Hospital. The dental examinations of both groups were

performed in the Department of Pediatric Dentistry. The study was conducted over a period of 4 months, from April 2018 to July 2018. The power value for 150 individuals was determined to be 99.817%, using the G\*Power program, v. 3.1.9.7 (<https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower>). Informed consent forms were signed by the parents of all children. The inclusion criteria were as follows: children aged 3–6 years; complete primary dentition; and no other systemic diseases, syndromes or mental illnesses.

### Oral examinations

Data collection was based on the clinical examinations of the teeth and gingiva. The detailed oral examinations of the children included in the study were conducted with a dental mirror and a dental probe. The examination results were recorded in accordance with the dmft index. The dmft/DMFT index (for primary and permanent dentition, respectively) provides information about tooth decay. The total number of decayed (d), missing due to caries (m) and filled (f) teeth in the examined individuals was divided by the total number of the examined individuals, and the dmft value for the group was obtained.

The plaque index (PI) and gingival index (GI) measurements used in the evaluation of periodontal health were taken from the mesial, distal, buccal, and palatal surfaces of each primary tooth, and were recorded accordingly.

The plaque index, developed by Silness and Løe,<sup>acc.17</sup> was used to determine the amount of supragingival microbial dental plaque. The teeth were isolated with cotton pads and air-dried. Microbial dental plaque on the 4 surfaces, in the region near the edge of the gingiva, was examined visually and with a periodontal probe. The PI values between 0 and 3 were obtained for each surface.

The GI values were obtained after evaluating the gums around all primary teeth in the mouth according to color, consistency, edema, and bleeding during probing. In the GI calculation, each of the 4 gingival regions was scored from 0 to 3 according to the GI criteria.

The PI and GI values with regard to the circumference of each tooth were calculated by dividing the obtained score by 4. To obtain the PI and GI values for each individual, the values calculated for each tooth were added and the sum was divided by the number of teeth scored.<sup>17</sup>

### Quality of life (QoL) questionnaire

The assessment of the QoL of each child was carried out using the Early Childhood Oral Health Impact Scale (ECOHIS), the validity and reliability of which has been proven. The ECOHIS questionnaire was completed by the children's parents. This scale consists of a questionnaire section with 13 questions and 6 answer options for each question presented to the parents of the children.

The first 9 questions constitute the Child Impact Section (CIS), which evaluates the direct effects of dental problems and dental treatment on the child's daily activities, such as eating, drinking and communicating. The 2<sup>nd</sup> part (4 questions) is the Family Impact Section (FIS), which determines to what extent the child's dental problems and dental treatment affect their family members.<sup>3</sup>

There are 4 areas evaluated in the 9-question section that refer to the impact on the child. One question covers the child's symptoms, 4 questions cover the child's functioning, 2 questions cover the child's psychology, and 2 questions cover the child's self-confidence and social interaction. In the section consisting of 4 questions that refer to the impact on the child's family, 2 areas are evaluated. Two questions cover the family's distress and anxiety, and 2 questions cover the functioning of the family. Answer options are presented according to a Likert scale: 'never' = 0; 'rarely' = 1; 'sometimes' = 2; 'often' = 3; 'very often' = 4; and 'don't know' = 5. The question scores are added to determine the total score of the section. The higher the score, the more dental health problems occur and the worse OHRQoL is observed.<sup>3</sup>

## Statistical analysis

The data was expressed as mean (*M*) and standard deviation (*SD*). The Kolmogorov–Smirnov normality test and Levene's test were used to examine the homogeneity of variances. While examining the differences between the 2 groups, the independent samples *t* test or the Mann–Whitney *U* test was used. The bivariate associations of continuous variables were assessed using Pearson's correlation coefficient. The results were considered significant at  $p < 0.05$ . Statistical analysis was performed using the IBM SPSS Statistics for Windows software, v. 21.0 (IBM Corp., Armonk, USA).

## Results

The average age of children with CHD was  $4.4 \pm 1.2$  years, while the average age of children in the control group was  $4.2 \pm 0.9$  years. The 2 groups were similar with respect to age and gender ( $p > 0.05$ ).

## Comparison of the dmft values

The mean dmft values for both study groups are presented in Table 1. The number of decayed, missing due to caries and filled teeth was counted for all participants. The mean number of decayed teeth in children with CHD was 4.93, which was similar to 4.53 in the control group ( $p > 0.05$ ). The mean number of missing teeth was 0.32 in the CHD group, whereas it was 0.19 in the control group. The mean number of filled teeth in children with CHD was 0.20, while it was 0.64 in the control group. There

Table 1. Comparison of the number of decayed (d), missing due to caries (m) and filled (f) teeth, and the total dmft values between children with congenital heart disease (CHD) and the control group

Variable	CHD group <i>n</i> = 75	Control group <i>n</i> = 75	<i>p</i> -value
d	4.933 ± 4.303	4.533 ± 3.116	0.515
m	0.320 ± 1.198	0.186 ± 0.537	0.384
f	0.200 ± 0.753	0.640 ± 1.530	0.031*
dmft	5.453 ± 4.366	5.360 ± 3.182	0.881

Data presented as mean ± standard deviation (*M* ± *SD*).

\* statistically significant ( $p < 0.05$ ).

were no statistically significant differences between the 2 groups with regard to the number of carious and missing teeth. However, the number of filled teeth was significantly higher in the control group as compared to the CHD group.

## Comparison of the PI and GI values

While the mean PI value was found to be 1.15 in children with CHD, it was 1.14 in the control group. With regard to the mean GI value, it was 0.98 and 1.05 in the CHD and control groups, respectively. When the 2 groups were compared in terms of PI and GI values, although the mean PI value was higher in children with CHD than in the control group, the differences in both indices were not statistically significant ( $p > 0.05$ ) (Table 2).

## Description of ECOHIS

The ECOHIS subscores and general scores depicting QoL are shown in Table 3.

The child subdimension overall score represents the total score for the answers given to the first 9 questions in the questionnaire. When children with CHD and the control group were compared in terms of child subdimension overall scores, although the score was higher in children with CHD, the difference was not statistically significant ( $p > 0.05$ ). Quality of life was negatively affected to a greater extent in children with CHD than in the control group, but the difference was not statistically significant ( $p > 0.05$ ).

The 2 groups were also compared in terms of family distress and anxiety, as well as family functioning. The family concern subscore type was represented by the total score for the answers given to questions 10 and 11 on the scale.

Table 2. Comparison of the plaque index (PI) and gingival index (GI) values between children with congenital heart disease (CHD) and the control group

Variable	CHD group <i>n</i> = 75	Control group <i>n</i> = 75	<i>p</i> -value
PI	1.152 ± 0.384	1.139 ± 0.259	0.625
GI	0.979 ± 0.323	1.048 ± 0.303	0.185

Data presented as *M* ± *SD*.

**Table 3.** Comparison of the Early Childhood Oral Health Impact Scale (ECOHIS) subscores and general scores in children with congenital heart disease (CHD) and in the control group

Scale subdimension	Evaluated area	Scale scores		<i>p</i> -value
		CHD group <i>n</i> = 75	control group <i>n</i> = 75	
Child subdimension	the child's symptoms	1.040 ±1.190	1.040 ±0.921	0.569
	the child's functioning	2.253 ±2.515	1.813 ±1.821	0.712
	the child's psychology	1.226 ±1.681	1.053 ±1.261	0.989
	the child's self-image	0.480 ±1.004	0.400 ±0.788	0.877
	overall score	4.999 ±5.499	4.306 ±3.701	0.866
Family subdimension	parental distress and anxiety	1.680 ±2.411	1.746 ±1.717	0.127
	family functioning	0.786 ±1.535	0.973 ±1.173	0.027*
	overall score	2.466 ±3.584	2.719 ±2.322	0.033*
Total score		7.465 ±8.558	7.025 ±5.104	0.275

Data presented as *M* ±*SD*. \* statistically significant (*p* < 0.05).

The score was higher in the control group, but this difference was not statistically significant (*p* > 0.05). The family functioning subscore type was represented by the total score for the answers given to questions 12 and 13 on the scale. The score was significantly higher in the control group (*p* = 0.027). The family subdimension overall score was represented by the total score for the answers given to the last 4 questions in the questionnaire. The family subdimension overall score was significantly higher in the control group (*p* = 0.033). The families of the control group individuals were more concerned about their children's oral health; therefore, their QoL was reduced.

Finally, children with CHD and the control group were compared in terms of general scores for the whole scale.

**Table 4.** Correlation between the scale scores and the dmft, plaque index (PI) and gingival index (GI) values in children with congenital heart disease (CHD)

Variable	Correlation	Child subdimension overall score	Family subdimension overall score	Total score
dmft	correlation coefficient	0.671	0.695	0.723
	<i>p</i> -value	<0.0001*	<0.0001*	<0.0001*
PI	correlation coefficient	0.221	0.376	0.300
	<i>p</i> -value	0.056	0.001*	0.009*
GI	correlation coefficient	0.239	0.440	0.338
	<i>p</i> -value	0.039*	<0.0001*	0.003*

\* statistically significant (*p* < 0.05).

The scale total score was represented by the total score for the answers given to all questions. The scale total score was higher in children with CHD than in the control group, but the difference was not statistically significant (*p* > 0.05). Although OHRQoL was lower in children with CHD, the difference was not statistically significant (*p* > 0.05). There was a significant correlation between the scale total score for children with CHD and their dmft, PI and GI values (Table 4).

## Discussion

Congenital heart disease is one of the most common developmental anomalies in children. The disease is serious, as it can cause infective endocarditis in children. The keys to protecting these patients from infective endocarditis are proper oral health education and effective preventive strategies.<sup>8</sup>

Some studies have shown that even in European countries, with better access to dental health services, children with CHD present with a higher rate of caries, despite great preventive efforts.<sup>18,19</sup> Conversely, numerous other studies have found that there is no statistically significant difference in the dmft values between children with CHD and the control group.<sup>9,10,13,20</sup> Da Fonseca et al. did not find any statistically significant difference between the 2 groups.<sup>13</sup> They attributed this to some limitations of their study. One limitation was that radiographs were not used to diagnose caries. Another limitation was that the results might have been different if the sample size had been increased.<sup>13</sup> Talebi et al. showed that although there was no difference between the 2 groups in terms of dmft values, dental health was poor in both groups.<sup>21</sup> This finding underscores the importance of developing preventive strategies in children with CHD in the first years of their lives.

In this study, there was a high rate of caries observed in both groups, but there was no statistically significant difference between the 2 groups, which is similar to the findings of Da Fonseca et al.<sup>13</sup> and Talebi et al.<sup>21</sup> The reason why no statistically significant difference between the 2 groups was found and why the dmft values were higher than in other studies conducted across the country might be the small sample size.<sup>14–16</sup> Thus, the sample size is one of the limitations of the present study. If the sample size had been larger, the results might have been statistically significant.

According to the results of the QoL questionnaire, the family distress and anxiety subscores were lower in the CHD group. This study demonstrated that families did not have enough information about oral and dental health. We think that the dmft values may have been higher in children whose families had insufficient information. However, the level of knowledge on oral and dental health, as well as the socioeconomic status of the families were not evaluated in the present study.

One study reported that the parents of children with CHD did not take much care over dental treatment, and even avoided treatment due to the underlying medical problem.<sup>10</sup> This finding is supported by another study, which reported that 19% of children with CHD had never visited a dentist.<sup>9</sup> In our study, the number of filled teeth in the control group was significantly higher than in children with CHD. This suggests that the families of children with CHD may have avoided dental treatment, since they focused on the underlying medical problem. This study also confirms the high rate of tooth extraction in children with CHD. In previous studies, children with CHD had a higher amount of caries than the control group.<sup>5–8</sup> On the other hand, a few studies found that the difference between the groups was not statistically significant.<sup>9,10</sup> When all these studies were evaluated, the common and consistent result was the excessive amount of untreated caries in children with CHD. This result was also revealed in our study, which is consistent with the literature.<sup>7–10,19</sup>

The reason why PI is significantly higher during the period of primary dentition is probably the poor tooth brushing ability noted in children under the age of 8.<sup>22</sup> Therefore, it is important to reduce the amount of plaque and improve oral health in this age group. It is also critical to raise the awareness of families about the importance of teaching children the habit of tooth brushing by providing children with oral hygiene education. In this study, while the PI values in children with CHD were higher than in the control group, the difference was not statistically significant. Our findings are consistent with those reported by Hallett et al.<sup>7</sup> and Franco et al.<sup>9</sup> In previous studies, the higher PI and GI values demonstrated that oral hygiene and gum health were poor.<sup>7,23</sup> In our study, there was no statistically significant difference between the 2 groups in terms of GI values; however, the mean GI value was found to be slightly lower in children with CHD. The reduced GI value in children with CHD as compared to the control group suggests that the examiner may have examined the teeth and gums gently in an unconscious attempt to avoid causing any gingival bleeding in children with CHD.

This study demonstrated that the OHRQoL of children with CHD was poorer when compared to the control group, but this difference was not statistically significant. This result is different from other studies. Da Fonseca et al.<sup>13</sup> and Amirabad et al.<sup>18</sup> found that the QoL of children with CHD was significantly lower as compared to the control group. In our study, children with CHD had lower OHRQoL in specific areas, such as functioning, psychology, and self-confidence and social interaction. The child functioning subdimension referred to the child's difficulty with drinking hot and cold liquids, eating certain foods, and speaking due to caries, as well as their poor kindergarten attendance due to caries. In the child's psychology subdimension, the extent of the child's frustration or anxiety, and the child's difficulty with sleeping were scored. The self-confidence and

social interaction subdimension referred to how often the child was afraid to smile, laugh and speak. In our study, we observed that the family concern and family functioning subdimension scores in the CHD group were lower than those of the control group. The family distress and anxiety section scored to what extent the family members were disturbed by the child's caries and how guilty they felt. Low family distress and anxiety subscale scores might be due to the families not caring about dental problems and dental treatment, as they were focused on CHD.

When the scale scores were evaluated in this study, in general, we found that children with CHD were affected by the consequences of caries. However, as the families did not have sufficient information about the importance of oral and dental health, we think that the children and their families were not concerned about dental problems, and consequently the children were not brought to dental treatment and follow-ups. In the families of the children from the control group, the family subdimension scores were higher as compared to the CHD group. Therefore, the families of the control group were more concerned about dental problems and dental treatment. The higher number of filled teeth in the control group supports this finding. Da Fonseca et al.<sup>13</sup> found that the parents of children with CHD felt more guilty about their children's oral health than the parents whose children were in the control group.<sup>13</sup> Such results were not reflected in our study. We think that the parents of children with CHD in the Turkish community do not know much about oral hygiene and its relationship to heart health, and thus they are not concerned about these problems. During consultations with parents and other family members, both pediatric cardiologists and dentists should work together to provide more detailed information in order to raise awareness. Another limitation of our study might be the absence of a system that would measure whether the families understood the survey questions correctly. Responses from the parents of young children might have skewed the data due to the children's inability to communicate certain aspects of OHRQoL.

Our study revealed that the high amount of caries, the excessive number of extracted teeth and the high dmft value negatively affected the OHRQoL of children with CHD. There were statistically significant relationships between the dmft and GI values and the child subdimension score. Our findings are consistent with a study by Amirabad et al.<sup>18</sup> These researchers also stated that high dmft values negatively affected QoL. The presence of untreated caries can impact children's social lives, as well as their mental and physical development, by causing pain, infection and swelling.<sup>18</sup> Again, in our study, a statistically significant positive correlation was found between the amount of caries, the dmft, PI and GI values and the total scale score in children with CHD. This indicates that an increased amount of caries and decreased oral hygiene in children with CHD negatively affect their OHRQoL.

## Conclusions

The findings of this study clearly demonstrate that the amount of caries and plaque was high in both healthy children and children with CHD. This can be especially dangerous for children with CHD. The high dmft values in both groups show that caries continues to be a major public health problem. The number of filled teeth was significantly higher in the control group. Although there was no significant difference in terms of QoL scale scores between the 2 groups, we found that OHRQoL was lower in children with CHD. Our findings provide important baseline data that pediatric dentists can use to plan appropriate preventive dental strategies for children with CHD. This study may raise awareness among pediatric dentists and other health professionals.

## Ethics approval and consent to participate

The study protocol was approved by the institutional Ethics Committee at the Faculty of Dentistry of Selcuk University, Konya, Turkey (approval No. 2018/03). Informed consent forms were signed by the parents of all the children participating in the study.

## Data availability


The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.


## Consent for publication

Not applicable.

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