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ORIGINAL RESEARCH

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Body mass index, oral health status and OHRQoL among special health care needs children and parenting stress: a case-control study in Southern Saudi Arabia

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Abstract

The appropriateness for determining Oral Health Related Quality of Life (OHRQoL) of special children by their caregivers must be thoroughly assessed. The present study was conducted to assess the Oral health related quality of life of children with disability and the stress levels of their parents. Moreover, the study also evaluated the plaque, DMFT (Decayed, missing, filled teeth) and BMI (Body Mass Index) of disabled children (cases) and healthy children (controls). The present case-control study was carried out on 150 parents of disabled children and 30 parents of healthy children (control group) at King Khalid University, Abha, KSA. The Arabic version of the 36-item parenting stress index-short format (PSI-SF) instrument was used for the assessment of parental stress, and the WHOQOL-BREF (World Health Organization Quality of Life Brief Version) Arabic version questionnaire was used for the assessment of quality of life of children. The parents or the caregivers who would be mainly occupied in assisting and rendering care to their children with different disabilities (certified by a pediatrician, aged between 4–14 years), were included in the study. Data were analyzed using statistical software. The total mean value score of the PSI scale of parents of cases was statistically found to be significantly higher compared to the mean scores among parents of controls ($p = 0.004$). The correlation between BMI and plaque & BMI and DMFT+df of cases indicated no statistically significant correlation while a statistically significant correlation between plaque and DMFT+df values in cases was observed. The mean score of the social relationship domain was statistically significantly different across the four levels of parents' educational status. The severity of dental caries, plaque accumulation and education-level of caregivers had a significant impact on the OHRQoL, however, BMI did not show a significant relation with DMFT and plaque scores. The parenting stress was found to be statistically higher among the parents of cases compared to the parents of controls.

Keywords

Body mass index; Dental caries; Quality of life; Disabled children

1. Introduction

Special health care needs (SHCN) is defined by the American Academy of Pediatric Dentistry (AAPD) as any developmental, physical, mental, behavioral, sensory, cognitive or emotional mutilation that needs health care intervention, medical management, and/or use of specialized services, and may cause limitations in doing daily activities or considerable limitations in the major activities of life [1]. Additionally, SHCN children cannot comprehend, presume responsibility for, or assist with preventive oral health measures [2].

Dental caries involving permanent teeth is one of the most common diseases worldwide. Gingivitis, dental caries and periodontitis are seen among one of the eminent groups of the population; children and adolescents [3]. Among different age groups, it has been observed that overweight and obesity are common epidemics. The diseases like periodontal diseases, dental caries and obesity have almost similar features. All are of global significance, having similar risk factors such as behavioral habits like increased consumption of sugar and unhealthy health behavior; same psychosocial conditions like the support of parents and socioeconomic status [4]. All three conditions have a similar multi-factorial framework, and it has been expected that all the conditions show interactions between them. It has been advocated that dental caries and obesity are non-communicable and preventable diseases [5].

A multidimensional framework that shows being comfortable while sleeping, eating, social interactions and self-esteem, reflecting satisfactory oral health is defined as Oral health-related quality of life (OHRQoL) [6]. It has been observed that an increased prevalence rate (77–79%) of dental caries was reported in various studies done in Saudi Arabia among rationally medically-compromised and disabled children [6–10].

Very few studies are available to observe the impact of various socio-demographic features or BMI on the OHRQoL of special children. The appropriateness for determining OHRQoL of special children by their caregivers must be thoroughly assessed. This is especially important in cases of SHCN children when most of them are unable to provide a valid evaluation of their OHRQoL, when the children have problems in communication, or they are dependent on their parents or caregivers for maintaining oral and general health [11].

Various studies have revealed a poorer status of oral health among SHCN children as compared to healthy children [7, 8, 12, 13]. Limited studies have shown a connection between dental caries and obesity among children [14]. The impact of severity of dental caries' on the OHRQoL of special children was not adequately assessed. Thus the present study was conducted to assess the parents' (of healthy and disabled children) quality of life and their stress. Moreover, the study also evaluates the plaque, DMFT+df and BMI of healthy children and those with disability.

2. Materials and method

2.1 Study setting and participants

The present case-control study was carried out among 150 parents of disabled children and 30 parents of healthy children (control group) at King Khalid University, Abha, KSA. The study was conducted from the period from January 2022 to June 2022.

2.2 Data collection and sample selection

The Arabic version of the 36-item parenting stress index-short format (PSI-SF) instrument was used for the assessment of parental stress, and the WHOQOL-BREF Arabic version questionnaire was used for the assessment of quality of life. The Parenting Stress Index-short form (PSI-SF) is a 36-item self-report of parenting stress. It includes three sub-scales: Parental distress (PD), Parent-child dysfunctional Interaction (PCDI) and Difficult Child (DC). Each sub-scale consists of 12-items rated from 1 (strongly disagree) to 5 (strongly agree) with sub-scores ranging from 12 to 60. The total score is calculated by adding three sub-scale score ranging from 36 to 180. Scores of 90 and above indicated the Clinical stress-level [15]. The WHOQOL-BREF is a 26-item instrument consisting of four domains: physical health (7 items), psychological health (6 items), social relationships (3 items), and environmental health (8 items); it also contains QOL and general health items. Each individual item of the WHOQOL-BREF is scored from 1 to 5 on a response scale, which is stipulated as a five-point ordinal scale. The scores are then transformed linearly to a 0–100-scale [16].

The body mass index (BMI) and oral health status were assessed in 150 children with different disabilities aged between 4–14 years (case group) and 30 healthy children (control group). The weight and height of children was measured by standard weighing machine and height-measuring tool. BMI was calculated by the formula: weight (in kgs) divided by square of height (in meters). The oral health condition of children that was investigated was dental caries using DMFT (for permanent teeth) and dmft index (for primary teeth) (The DMFT score of the children was calculated based on the clinical examination findings and the number of decaying (D), filled (F), and missing (M) teeth owing to caries); The Decayed, Filled, and Missing teeth (DMFT) index is the most significant indicator used to measure oral health status [17]. Plaque accumulation on children's teeth was assessed using Silness P and Loe H (1964) Index (PI) [18]. The Examiners were calibrated by the faculty member (expert) during the pilot trial. The inter-examiner Kappa coefficient was found to be moderate (0.78 and 0.79) for DMFT and Plaque scores, respectively and Intra-examiner kappa coefficient was strong (0.89 and 0.87 for DMFT and plaque assessment, respectively. Data was collected using a standard coded form, portable dental chair, artificial light, disposable mouth mirror, and a World Health Organization (WHO) ball-ended dental probe. The Disabled Children's Association and King Khalid University Dental Clinics were the two chosen study-settings. Children whose body mass index could not be measured because of extreme disability, child who could not open his/her mouth due to extreme disability, and uncooperative children were excluded from the study.

The parents or the caregivers who would be mainly occupied in assisting and rendering care to the child, parents of children with different disabilities certified by a pediatrician, aged between 4–14 years, were included in the study. Demographic data such as Parents' age, gender, marital status, current health-status, job-status and educational-level were asked from the participants and recorded.

Consent of participation: Children whose parents/caregivers gave consent to participation were included for the study.

Sample size calculation: The study sample was selected using the judgmental sampling technique. The sample size for the present study was calculated using G*Power 3.1.2 software (Heinrich-HeineUniversität Düsseldorf, Germany) [19] (Free version). Cases and controls were matched by age.

2.3 Data analysis

Data was analyzed using SPSS version 26.0 (IBM Inc., Chicago, IL, USA) software. Descriptive statistics (mean, standard deviation, frequencies and percentages) were used to describe the quantitative and categorical variables. Student's *t*-test for independent samples and one-way analysis of variance followed by Tukey's *post-hoc* test was used to compare the mean values of quantitative outcome variables (scores of PSI scale factors and scores of domains of QOL scale) in relation to the parent's characteristics which had two and more than two categories. Pearson's correlation coefficient was used

to quantify the relationship between the total scores of the PSI scale and the QOL scale. Spearman's correlation was used to quantify the relationship among the pairs of three variables (BMI, plaque, and DMFT+df). A non-parametric test (Mann-Whitney U-test) was used to compare the mean ranks of two variables (plaque and DMFT+df) between cases and controls. A p-value of ≤ 0.05 was used to denote the statistical significance of the results.

3. Results

In this study, children and their parents were used as study subjects. The data of children with 150 cases and 30 controls whose mean age was 7.52 and 8.93 years, 56% and 26.7% were male in cases and controls. The mean values of BMI, plaque and DMFT+df of both cases and controls are given in Table 1.

TABLE 1. Demographic and clinical characteristics of cases & controls (children).

Characteristics	Cases		Controls	
	Mean (Sd.)	No. (%)	Mean (Sd.)	No. (%)
Age in years	7.52 (2.5)		8.93 (2.6)	
Plaque	1.29 (0.72)		1.12 (0.56)	
DMFT+df	5.69 (5.07)		4.67 (0.85)	
BMI	19.14 (8.9)		17.18 (4.3)	
Gender				
Male		84 (56.0)		8 (26.7)
Female		66 (44.0)		22 (73.3)

DMFT: Decayed, missing, filled teeth; BMI: Body Mass Index.

The comparison of mean ranks of plaque and DMFT+df shows no statistical significance between cases and controls (Table 2). The correlation between BMI and plaque & BMI and DMFT+df of cases indicates no statistically significant correlation. But there is a statistically significant correlation between plaque and DMFT+df values in cases. That is, as plaque values increase, the values of DMFT+df also increase in cases which was statistically significant ($p = 0.001$). A similar pattern of no correlation between BMI and plaque & BMI and DMFT+df among controls, but a statistically significant correlation between plaque and DMFT+df values in controls was found. That is, as plaque values increase, the values of DMFT+df also increase in controls (0.048) (Table 3).

The socio-demographic characteristics of parents with 150 cases and 30 controls are given in Table 4. About 61% and 70% of cases and controls were of age $\leq$40 years, and a higher proportion, 84.7% and 100%, were females in cases and controls. Of the 150 cases, 25 (23.3%) were ill, whereas only 3 (10%) controls were reported to be ill (Table 4).

TABLE 2. Comparison of mean ranks of Plaque and DMFT+df between cases and controls by Mann Whitney U test.

Outcome variables	Cases	Controls	p-value
Plaque	92.25	81.77	0.309^{NS}
DMFT+df	87.29	106.55	0.063^{NS}

^{NS}: *Not significant* $p > 0.05$. *DMFT: Decayed, missing, filled teeth.*

The comparison of mean values of three factor scores of the parental Stress Index (PSI) scale, parental distress, parent-child dysfunctional interaction, difficult child, and total score between cases and controls shows statistically significant difference for the two factors (parent-child dysfunctional score and difficult child score) and total score. That is, the mean values of the parent-child dysfunctional interaction score and difficult child score of cases were statistically significantly higher than control scores ($p = 0.005$; $p = 0.001$). Also, the mean value total score of the PSI scale in parents of cases was statistically significantly higher when compared with the mean scores in parents of controls ($p = 0.004$) (Table 5).

The comparison of mean values of the four factors of the Quality of life scale and its total score between cases and controls showed no statistically significant difference. The mean values of the four factors and the total score of the QOL scale were not statistically significantly different across the cases and controls (Table 6).

3.1 Effect of characteristics of parents on the mean scores of three factors and total score of the Parental Stress Index scale

Table 7 compares the mean scores of three factors and the total score of the PSI scale in relation to the characteristics of parents.

3.1.1 Age groups

The mean scores of parental distress score and total score were statistically significantly higher in parents of age group >40 years compared to the mean scores of parents whose age group is $\leq$40 years ($p = 0.044$; $p = 0.046$). And the mean scores of two factors (parent-child dysfunctional interaction & difficult child) were not significantly different across the two age groups of parents when compared statistically.

3.1.2 Gender

The comparison of mean scores of three factors and the total score of the PSI scale in relation to the gender of parents showed no statistically significant difference.

3.1.3 Marital status

The comparison of mean scores of three factors and the total score of the PSI scale in relation to parents' marital status did not show any statistically significant difference.

TABLE 3. Correlation coefficient *r* (*p* value) between (i) BMI and Plaque (ii) BMI and DMFT+df & (iii) Plaque and DMFT+df in cases and controls by Spearman's Correlation.

Outcome variables	Cases		Controls	
	BMI	Plaque	BMI	Plaque
BMI	--	$-0.077\ (0.350^{NS})$	--	$-0.185\ (0.329^{NS})$
Plaque	$-0.077\ (0.350^{NS})$	--	$-0.185\ (0.329^{NS})$	--
DMFT+df	$0.007\ (0.932^{NS})$	0.266 (0.001**)	$-0.239\ (0.204^{NS})$	0.363 (0.048*)

***p-value < 0.01 is highly significant; *p-value < 0.05 is significant; ^{NS}: Not significant p > 0.05. DMFT: Decayed, missing, filled teeth; BMI: Body Mass Index.*

TABLE 4. Frequency distribution N (%) of respondents by their socio-Demographic characteristics of cases & controls (parents).

Characteristics	Cases	Controls
	No. (%)	No. (%)
Age groups (in years)		
≤40	92 (61.3)	21 (70.0)
>40	58 (38.7)	9 (30.0)
Gender		
Male	23 (15.3)	0 (0.0)
Female	127 (84.7)	30 (100.0)
Marital status		
Married	132 (88.0)	23 (76.7)
Divorces & widow	18 (12.0)	7 (23.3)
Educational status		
Primary & less	14 (9.3)	2 (6.7)
Secondary school	22 (14.7)	5 (16.7)
Tertiary school	52 (34.7)	8 (26.7)
University	62 (41.3)	15 (50.0)
Job Status		
No job & retired	46 (30.7)	3 (10.0)
Housewife & student	46 (30.7)	20 (66.7)
Worker & employee	21 (14.0)	4 (13.3)
Professional	22 (14.7)	3 (10.0)
Currently ill		
Yes	35 (23.3)	3 (10.0)
No	115 (76.7)	27 (90.0)

3.1.4 Educational status

There was a statistically significant difference in the mean scores of two factors (parent-child dysfunctional interaction & difficult child) and the total score of the PSI scale across the four levels of educational status of parents ($p < 0.0001$; $p = 0.002$; $p < 0.001$). That is, the mean scores of the two factors and total scores were statistically significantly higher in parents who had secondary school, tertiary school, and university levels than in parents who had primary and lower levels of education. By using *post-hoc* test, it was observed that the mean score of parent-child dysfunction was higher in parents who had secondary school, tertiary school, and university level of education when compared with the mean scores of parents who had primary and less level of education but based on the three levels of education mean scores of this factor not different with each other. And the mean score for the difficult child factor was significantly higher in the parents who had a secondary level, tertiary school level, and university level of education when compared with the mean scores of parents who had primary and less level of education and no difference in the mean scores between the parents with the education of tertiary school level and university level. Also, no difference between the scores of the parents with primary & less level and secondary level of education was found. The *post-hoc* analysis shows that the mean score of the total score of PSI scale is significantly higher in the parents who had secondary level, tertiary school level and university level of education when compared with the mean scores of parents who had primary and less level of education and no difference in the mean scores between the parents with education of tertiary school level and university level, was observed. Also, no difference between the scores of the parents with primary & less level and secondary level of education was noticed.

3.1.5 Job status

The comparison of the mean scores of three factors and the total score of the PSI scale in relation to parents' job status showed no statistically significant difference in the mean scores.

3.1.6 Currently ill

There was a statistically significant difference in the mean scores of three factors (parental distress, parent-child dysfunctional interaction & difficult child) and the total score of the PSI scale between the binary response of parents (yes & no) towards their current illness ($p = 0.010$, $p = 0.041$, $p = 0.030$ & $p = 0.008$). That is, the mean scores of the three factors and total scores were statistically significantly higher in parents who were currently ill compared to those who were not currently ill.

3.2 Effect of characteristics of parents on the mean scores of fours domains of the QOL scale

Table 8 shows the comparison of mean scores of four domains (physical domain, psychological domain, social relationship domain, and environmental domain) scale in relation to the characteristics of parents.

TABLE 5. Comparison of mean (s.d.) values of Parental distress, Parent-child dysfunctional interaction, difficult child scores and total scores between cases and controls by Independent *t*-test.

Factors of PSI	Cases	Controls	*t*-value	*p*-value
Parental distress score	32.23 (9.28)	29.57 (7.82)	1.472	0.143^{NS}
Parent-child dysfunctional interaction score	30.32 (8.60)	25.50 (7.35)	2.867	0.005**
Difficult child score	34.36 (9.64)	28.17 (8.51)	3.271	0.001**
Total score	96.91 (23.77)	83.23 (19.40)	2.959	0.004**

***p-value < 0.01 is highly significant;* ^{NS}*: Not significant p > 0.05.PSI: parenting stress index.*

TABLE 6. Comparison of mean (s.d.) values of 4 domains and total score of Quality of Life between cases and controls by Independent *t*-test.

Factors of QOL	Cases	Controls	*t*-value	*p*-value
Physical domain score	57.95 (14.43)	60.12 (17.10)	−0.728	0.468^{NS}
Psychological domain score	67.47 (16.32)	68.19 (15.10)	−0.224	0.823^{NS}
Social relationship domain score	69.39 (22.99)	70.28 (26.50)	−0.188	0.851^{NS}
Environmental domain score	62.46 (17.30)	68.85 (20.19)	−1.796	0.074^{NS}
Total QOL score	66.93 (14.92)	70.24 (17.99)	−1.071	0.286^{NS}

^{NS}*: Not significant p > 0.05. QOL: Quality of Life.*

TABLE 7. Comparison of mean (s.d.) values three factors and total score of Parental stress Index in relation to the characteristic of cases by Independent *t*-test for two groups and one way ANOVA for more than three groups.

Characteristics	Parental distress score		Parent-child-dysfunctional interaction score		Difficult child score		Total score	
	Mean (Sd.)	*p*-value	Mean (Sd.)	*p*-value	Mean (Sd.)	*p*-value	Mean (Sd.)	*p*-value
Age groups (in years)€								
≤40	31.02 (8.7)	0.044*	29.38 (8.0)	0.092^{NS}	33.43 (8.8)	0.140^{NS}	93.84 (22.4)	0.046*
>40	34.15 (9.8)		31.81 (9.3)		35.83 (10.7)		101.79 (25.2)	
Gender€								
Male	33.35 (8.6)	0.533^{NS}	32.43 (9.4)	0.201^{NS}	36.91 (9.9)	0.169^{NS}	102.69 (25.1)	0.206^{NS}
Female	32.03 (9.4)		29.94 (8.4)		33.90 (9.6)		95.87 (23.5)	
Marital status€								
Married	32.60 (9.3)	0.184^{NS}	30.55 (8.7)	0.370^{NS}	33.97 (9.8)	0.180^{NS}	97.13 (24.5)	0.765^{NS}
Divorces & widow	29.50 (8.5)		28.61 (7.4)		37.22 (8.3)		95.33 (18.0)	
Educational status¥								
Primary & less	35.57 (9.5)	0.122^{NS}	33.07 (8.4)	<0.0001**	29.50 (9.7)	0.002**	98.14 (23.7)	<0.0001**
Secondary school	38.55 (7.8)		39.14 (8.7)		35.77 (10.0)		113.45 (21.0)	
Tertiary school	39.25 (10.4)		41.69 (7.7)		37.69 (9.9)		118.63 (24.7)	
University	41.58 (8.4)		44.52 (7.9)		40.10 (8.3)		126.19 (20.8)	
Job Status¥								
No job & retired	38.50 (8.9)	0.725^{NS}	41.52 (8.7)	0.123^{NS}	36.65 (9.0)	0.784^{NS}	116.67 (22.7)	0.563^{NS}
Housewife & student	40.26 (9.0)		40.69 (8.1)		38.15 (10.2)		119.10 (23.4)	
Worker & employee	40.86 (11.1)		45.76 (8.0)		38.90 (8.9)		125.52 (23.6)	
Professional	40.02 (9.3)		40.86 (9.6)		37.09 (10.2)		117.95 (27.3)	
Currently ill€								
Yes	35.77 (10.7)	0.010*	32.91 (9.2)	0.041*	37.43 (8.9)	0.030*	106.11 (24.7)	0.008**
No	31.15 (8.6)		29.53 (8.3)		33.42 (9.7)		94.11 (22.8)	

€*Independent t-test;* ¥*one-way ANOVA for more than two groups; *p-value < 0.05 is significant; **p-value < 0.01 is highly significant;* ^{NS}*: Not significant p > 0.05.*

TABLE 8. Comparison of mean (s.d.) values four domains of QOL scale in relation to the characteristics of cases.

Characteristics	Physical domain score		Psychological domain score		Social relationship domain score		Environmental domain score	
	Mean (Sd.)	*p*-value	Mean (Sd.)	*p*-value	Mean (Sd.)	*p*-value	Mean (Sd.)	*p*-value
Age groups (in years)€								
≤40	60.40 (13.2)	0.008**	67.39 (16.8)	0.939^{NS}	71.01 (21.9)	0.277^{NS}	62.80 (16.1)	0.758^{NS}
>40	54.06 (15.5)		67.60 (15.5)		66.81 (24.6)		61.91 (19.2)	
Gender€								
Male	63.04 (11.8)	0.066	73.55 (11.3)	0.052^{NS}	71.74 (26.8)	0.596^{NS}	63.99 (16.5)	0.645^{NS}
Female	57.02 (14.7)		66.37 (16.9)		68.96 (22.3)		62.18 (17.4)	
Marital status€								
Married	58.03 (13.6)	0.849^{NS}	67.52 (16.4)	0.925^{NS}	70.26 (21.7)	0.207^{NS}	63.09 (17.2)	0.226^{NS}
Divorces & widow	57.34 (19.7)		67.13 (16.2)		62.96 (31.1)		57.81 (17.9)	
Educational status¥								
Primary & less	52.30 (13.4)	0.350^{NS}	64.58 (15.7)	0.113^{NS}	54.17 (34.7)	0.045^{NS}	58.03 (19.1)	0.164^{NS}
Secondary school	55.84 (14.3)		62.31 (21.4)		66.28 (22.3)		56.53 (18.9)	
Tertiary school	58.86 (14.6)		71.47 (14.6)		72.60 (20.5)		62.86 (16.9)	
University	59.21 (14.5)		66.60 (15.3)		71.24 (21.0)		65.22 (16.3)	
Job Status¥								
No job & retired	51.86 (17.5)	0.004**	63.31 (19.0)	0.036*	64.31 (23.7)	0.178^{NS}	56.11 (18.6)	0.015*
Housewife & student	59.48 (12.0)		67.76 (15.6)		70.49 (23.5)		64.65 (15.9)	
Worker & employee	62.07 (11.3)		67.26 (12.7)		77.38 (14.0)		63.24 (12.9)	
Professional	62.50 (12.7)		75.57 (12.4)		69.31 (25.5)		68.89 (18.8)	
Currently ill€								
Yes	52.24 (15.2)	0.007**	63.45 (16.7)	0.096^{NS}	63.57 (21.0)	0.087^{NS}	56.70 (18.0)	0.024*
No	59.68 (13.8)		68.70 (16.1)		71.16 (23.4)		64.21 (16.7)	

€*Independent t-test;* ¥*one-way ANOVA for more than two groups; *p-value < 0.05 is significant; **p-value < 0.01 is highly significant;* ^{NS}*: Not significant p > 0.05.*

3.2.1 Age groups

There was a statistically significant difference in the mean scores of physical domains in relation to the age groups of parents (p = 0.008). That is, the mean scores of physical domains were significantly higher in parents who were in the age group of ≤40 years when compared with the mean scores of parents who were in the age group of >40 years. And there was no significant difference in the mean scores of the other three domains in relation to the age group of parents.

3.2.2 Gender

The comparison of mean scores of four domains of the QOL scale in relation to the gender of parents did not show any statistically significant difference in the mean scores.

3.2.3 Marital status

The comparison of mean scores of four domains of the QOL scale in relation to parents' marital status showed no statistically significant difference in the mean scores.

3.2.4 Educational status

Out of 4 domains of QOL, only the mean score of the social relationship domain was statistically significantly different across the four levels of parents' educational status. That means scores of parents who had secondary level, tertiary school level, and university level of education are significantly higher when compared with the parents who had primary & less level of education (p = 0.045). The *post-hoc* test analysis indicates that the mean score of the social relationship domain was significantly higher in the parents who had a secondary level, tertiary school level, and university level of education

when compared with the mean scores of parents who had a primary and lower level of education and no difference in the mean scores between the parents with the education of tertiary school level and university level, was found. Also, no difference was observed between the scores of the parents with primary & less level and secondary level of education.

3.2.5 Job status

Out of 4 domains of QOL, the mean scores of three domains (physical, psychological and environmental) were statistically significantly different across the four levels of parents' job status. The mean scores of these three domains were significantly higher in parents who were housewives & students, employees and professionals when compared with the mean scores of parents who had no jobs & who were retired (p = 0.004, p = 0036 and p = 0.015). The *post-hoc* analysis showed the mean score of physical domains is significantly higher in parents who were housewives & students, employees and professionals when compared with parents who were with no job and retired. Still, the three mean scores were different from each other. Also, no significant difference was observed between the mean scores of parents who were with no job & retired; and homemakers & students. And the *post-hoc* analysis of the mean score of the psychological domain shows that the mean scores were significantly higher in parents who were housewives & students, employees and professionals compared to parents with no job and retired. Still, the three mean scores were different from each other. Also, no significant difference was found among the mean scores of parents who were with no job & retired, homemakers & students and employees. And the *post-hoc* analysis of the mean score of the environmental domain showed that the mean scores were significantly higher in parents who were housewife & students, employees and professional when compared with parents who were with no job and retired.

3.2.6 Currently ill

There was a statistically significant difference in the mean scores of two domains (physical domain and environmental) of the QOL scale between the binary response of parents (yes & no) towards their current illness (p = 0.007 & p = 0.024). That is, the mean scores of these two domains were statistically significantly higher in parents who were not currently ill than those who were currently ill. And the mean scores of the other two domains of QOL were not significantly different between the parents who were currently ill and those who were not.

3.3 Effect of characteristics of parents on the mean total score of the QOL scale

Table 9 shows the comparison of the mean total score of the QOL scale in relation to the characteristics of parents. Out of all the characteristics of parents, the QOL mean total score were statistically significantly different in relation to parents' job status and their current illness.

That is, the mean total score of QOL was statistically significantly different across the four categories of parents' job status (p = 0.006). And the *post-hoc* analysis of the mean total score of QOL showed that the mean total scores were significantly higher in parents whose parents were housewives & students, employees and professionals compared to parents with no job and retired. Still, the three mean total scores were not different from each other. Also, no significant difference

TABLE 9. Comparison of mean total QOL score scale in relation to the characteristic of cases.

Characteristics	Total score of QOL		
	Mean (s.d.)	t-value/ F-value	p-value
Age groups (in years)[€]			
≤40	67.96 (13.94)	1.062	0.290^{NS}
>40	65.30 (16.36)		
Gender[€]			
Male	71.29 (13.1)	1.528	0.129^{NS}
Female	66.14 (15.1)		
Marital status[€]			
Married	67.25 (14.3)	0.712	0.479^{NS}
Divorces & widow	64.58 (18.9)		
Educational status[¥]			
Primary & less	61.31 (16.1)	1.641	0.182^{NS}
Secondary school	62.78 (17.5)		
Tertiary school	68.73 (13.9)		
University	68.16 (14.3)		
Job Status[¥]			
No job & retired	60.96 (16.6)	4.314	0.006*
Housewife & student	68.39 (13.9)		
Worker & employee	69.44 (10.5)		
Professional	72.96 (14.2)		
Currently ill[€]			
Yes	61.43 (15.1)		
No	68.60 (14.5)	−2.536	0.012*

[€]*Independent t-test;* [¥]*one-way ANOVA for more than two groups; *p-value < 0.05 is significant;* ^{NS}*: Not significant p > 0.05.*

was seen among the mean total scores of parents who were with no job & retired, homemakers & students, and employees. And the mean total score of QOL was statistically significantly higher in parents who were not currently ill than those who were currently ill ($p = 0.012$).

Table 10 shows a correlation between Parental stress scale total score and the QOL total score of parents, in which a low negative statistically significant correlation between these two scores, was observed. That is, as the parental stress total scores increase, the parent's QOL total scores decrease ($p = 0.002$).

TABLE 10. Correlation between Total QOL score and Total parental stress score in cases.

	Total QOL score	Total STRESS Score
Total QOL score		
Pearson Correlation *r*	1	−0.250**
p value		0.002
N	150	150
Total stress score		
Pearson Correlation	−0.250**	1
Sig. (2-tailed)	0.002	
N	150	150

***p-value < 0.01 is highly significant; QOL: Quality of Life.*

4. Discussion

The present study is one of the few studies conducted to assess the Oral health status and BMI of children (healthy and SHCN children) and the parents' level of stress and their OHRQoL. The mean BMI, plaque and DMFT+df values of both cases and controls were estimated and compared. The correlation between BMI and plaque & BMI and DMFT+df of cases indicated no statistically significant correlation. But there was a statistically significant correlation between plaque and DMFT+df values in cases. Similar to our study, Alwattban RR *et al.* [6] also found that children's dental health and the severity of dental caries negatively impact the OHRQoL. In contrast, BMI did not have a significant impact. Alshehri *et al.* [20] revealed conflicting results on the relationship between BMI and dental caries in children showing a positive association.

In our study, the mean values of parent-child dysfunctional interaction score and difficult child score of cases were statistically significantly higher as compared to the mean scores of controls. The mean value total score of the PSI scale in parents of cases was statistically significantly higher when compared with the mean scores in parents of controls. Stress levels were noticeably higher in families with special needs children [21]. Children and adolescents who have high levels of stress in their parents or caregivers tend to have lower quality of life [22]. Health and oral health-related quality of life (HRQoL and OHRQoL) might deteriorate due to medical and psychological issues, as well as obstacles to receiving appropriate medical and dental care [23]. Understanding OHRQoL can help one understand the children's oral health [24].

The mean score of parent-child dysfunction was higher in parents who had secondary school, tertiary school, and university levels of education compared to the mean scores of parents who had primary and lower levels of education. Similar to our study, Alwattban RR *et al.* [6] also found that the education level and occupation of the caregiver and the age group of children affected the OHRQoL of the children, where children having caregivers with no schooling or having primary education level had better OHRQoL as compared to those whose caregiver had a university degree. In another study by Chaffee *et al.* [25], Early childhood Oral Health Impact Scale (ECOHIS) scores were lower when advocated by less educated caregivers. This might be attributed to the fact that quality-of-life-measures are subjective in nature and show the individual's expectations, so there is a high chance that caregivers having a lower educational-level think that dental caries is an unavoidable disease, which may not be controlled, thus causing cognitive dissonance between perceptions of caregivers' quality-of-life and actual experiences.

On comparing the mean scores of four domains (physical domain, psychological domain, social relationship domain, and environmental domain) scale in relation to the characteristics of parents, it was found that the mean scores of physical domains were significantly higher in parents who were in the age group of ≤40 years when compared with the mean scores of parents who were in the age group of >40 years. The mean score of the social relationship domain was statistically significantly different across the four levels of parents' educational status. Out of 4 domains of QOL, the mean scores of three domains (physical, psychological and environmental) were statistically significantly different across the four levels of parents' job status. The mean scores of these three domains were significantly higher in parents who were housewives & students, employees and professionals when compared with the mean scores of parents who were with no job & retired. This was in accordance with the findings of Alwattban RR *et al.* [6] who reported that the child symptoms and function domains and the parental distress domain were affected by caries severity.

However, it has been observed that the inaccurate perception of parents of their special children's dental health is a matter of concern, as most of the parents (90%) reported the dental health of their child as good when even the scores of caries experience of the children were not low. It is logical that children of caregivers who found their children's dental health as poor had increased dmft/DMFT scores and were more likely to have a negative impact on their OHRQoL as compared to those caregivers who estimated their children's dental health as good, the finding that showed a limited proportion (10%) needs to be emphasized. This reveals the need for a more reliable scale that can be used to evaluate the degree of dependence of SHCN children in the future, at least those who do not have intellectual problems, to avoid the requirement of proxy assessors to evaluate their OHRQoL.

Strengths of the study: Inclusion of SHCN children, investigating their oral health status and other parameters, including their parents in the assessment of OHRQoL and parent-

ing stress; all variables in one research is little challenging with time-constraints. The objective element in assessment of DMFT, plaque and BMI is the strength of the research.

5. Limitations of the present study

1. A convenience sample, including children and their caregivers, was taken from a single hospital, which could have caused sampling bias.
2. The study cannot be generalized to whole population of special children.
3. It is impossible to show all SHCN categories with ease and comparatively small samples; thus, larger samples are required by using all categories of SHCN for a more specific analysis.
4. As the study was conducted on children who reported to dental setup for treatment, it might have caused an overestimation of results. Moreover, the number of males and females in cases and controls should be equal for more accuracy of the findings, due to time-constraints.
5. The study depended on care-givers' answers, that can lead to information bias. Thus future studies should be conducted based on a scale that can be easily used and interpreted by special children to determine their OHRQoL.

6. Conclusions

The severity of dental caries, plaque accumulation, and education level of caregivers had a significant impact on the OHRQoL of the assessed population of special children; however, BMI did not show a significant relation with DMFT and plaque. The mean value of total score of the PSI scale in parents of cases was found to be statistically significantly higher when compared with the mean scores in the parents of controls.

ABBREVIATIONS

SCHN, Special Health Care Needs; OHRQoL, Oral Health related Quality of Life; DMFT, Decayed, missing, filled, teeth; PI, Plaque Index; BMI, Body mass Index; WHOQOL-BREF, World Health Organization Quality of Life Brief Version; PSI-SF, Parenting Stress Index-short format; QOL, Quality of Life; AAPD, American Academy of Pediatric Dentistry; Kgs, Kilograms; SPSS, Statistical Package for Social Sciences.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

SAeA—investigation, resources, visualization; ZMA—methodology, formal analysis, software; FAA—data curation, software, analysis; SAAR—investigation, formal analysis, visualization; RNA—investigation, resources, visualization; SAbA—visualisation, data curation, investigation; RAT—conceptualization, project-administration, supervision; TSA—validation, writing original draft, supervision; SMY—analysis, reviewing and editing, methodology; MZ—analysis, writing-review and editing, supervision. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance was obtained from Institutional Ethics Committee of King Khalid University, College of Dentistry, Abha (IRB/KKUCOD/ETH/2021-22/006). Parents'/guardians' consent was obtained prior to the start of study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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