

Dental Caries in Relation to Type of Disability: A Cross-sectional Study of Disabled Children in Tehran, Iran

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Abstract

Objectives Literature has reported high caries prevalence and unmet dental treatment needs among disabled individuals. This study was carried out to assess the oral health condition of disabled students in relation to age, gender, and type of disability in Tehran, Iran.

Methods The study involved 1,170 disabled students aged 6 to 20 years, each with one or more of the following disabilities: physical retardation (PR), hearing impairment (HI), visual impairment (VI), mental retardation (MR), and autism spectrum disorder (ASD). The mean decayed, missing, and filled teeth index was used as an oral health indicator (dmft for children aged 6-12 years, and DMFT for children older than 9 years). Mann-Whitney and Kruskal-Wallis tests at significant level of 0.05 were conducted for comparisons.

Results Mental retardation (MR) was the most prevalent disability (59.4%). The decayed component constituted the largest part of the mean dmft (82%) and DMFT (75%) indices in all age groups. Girls had significantly higher DMFT scores compared to boys ($P < 0.001$). Among the different disabilities, children with HI had the highest dmft score (mean \pm SD = 2.17 ± 2.86), while those with MR had the highest DMFT score (mean \pm SD = 3.76 ± 3.83). Additionally, the caries-free ratio was significantly higher among VI students in the 9-12 years (40.5%) and older than 13 years (38.8%) age groups.

Conclusion The high prevalence of untreated dental caries, particularly among those with HI and MR, points to significant unmet treatment needs and emphasizes the importance of regular dental check-ups and access to dental care. These results underscore the critical need for improved oral health services and preventive programs tailored to the specific needs of disabled students.

Keywords Disabled children; Disabled students; Dental caries; Caries-free

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Introduction

The Center of Disease Control and Prevention (CDC) defines (Disability) as “any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) and interact with the world around them (participation restrictions)”.¹ Individuals with disabilities often face various health challenges, including oral health issues. Recent studies indicate a high prevalence of dental caries, significant unmet treatment needs, and limited access to oral healthcare among this population.²⁻⁶ These oral health challenges can be attributed to developmental profiles⁷, limited physical abilities⁶, and communication barriers encountered by individuals with disabilities globally.⁸

To effectively address these issues, a variety of strategies are necessary, including enhanced attention, tailored adaptations, and comprehensive accommodative measures.⁹ One of the beneficial methods in this way is screening of health conditions by which we can lead policies in preventive health care for these people.

Additionally, it has been suggested that age, gender, and type of disability can affect disabled people's oral health.³⁻⁵

This is while the literature suggests that untreated dental caries could have a negative impact on the oral health-related quality of life of disabled children, their families, and caregivers.^{7,10,11}

The 2011 national census reported that the prevalence of disability in Iran was about 13 per 10,000 individuals. This number is anticipated to rise in the coming years.¹² As a result, the demand for oral healthcare among individuals with disabilities is expected to increase. This underscores the urgent need for reliable and up-to-date information on the oral health status of this population.¹³ Regrettably, large-scale epidemiological studies on the clinical oral health indices of individuals with disabilities in Iran are scarce. A study conducted in 2005 assessed the oral and dental health of mentally and physically disabled individuals, but it did not encompass other types of disabilities.¹⁴ Another study was carried out in 2007 without including individuals with physical disabilities.¹⁵ The oral hygiene status of only deaf and blind children was examined once in 2015.¹⁶ The oral health of disabled individuals has garnered attention globally. For instance, a German study investigated odontogenic infections in students with special care needs⁴, while Indian studies assessed the oral health status and treatment needs of 5-12-year-old children attending special

schools⁶ and those with hearing impairments.⁸ In Yemen, research has focused on dental caries and treatment needs among children with Down syndrome.¹⁷ Many studies have primarily reported the mean decayed, missing, and filled deciduous teeth (dmft) or the mean decayed, missing, and filled permanent teeth (DMFT) indices for broad age ranges, leading to potential misinterpretations. For instance, including children below seven years of age in the DMFT analysis can be misleading since they predominantly have deciduous teeth. This study aimed to address this gap by assessing the oral health status of students with disabilities in relation to age, gender, and type of disability in Tehran, Iran.

Methods

This descriptive cross-sectional study was carried out from October 2016 to June 2017 across 22 schools for disabled individuals in various socio-economic areas of Tehran, Iran. Written informed consent was obtained from both parents/guardians and school authorities prior to the clinical examination of the students. The study received approval from the Ethics Committee of the Dental School at Shahid Beheshti University of Medical Sciences (IR.SBMU.DRC.RDC1397.037).

Sample size and Subject recruitment:

To assess the oral health status, the study utilized dmft and DMFT as standard indices. Based on a standard deviation of 2.3 from a previous study, a sample size of 508 participants was calculated to achieve 95% confidence with a margin of error of 0.2.¹⁵ During the recruitment phase, a higher response rate from schools and parents we observed, resulting in a total of 1,170 participants. Tehran had 50 specialized schools for disabled students in 2016, categorized as follows: 27 for mental retardation (MR), six for physical retardation (PR), nine for hearing impairment (HI), six for autism spectrum disorder (ASD), and two for visual impairment (VI). Schools were numbered and randomly selected from each category using a random digit table. Four schools (two MR, one ASD, and one HI) were excluded due to scheduling conflicts or lack of cooperation. Finally, the study included 22 schools: 12 for MR, three for PR, four for HI, one for VI, and two for ASD. The students were classified into three age groups: 6-8 years old (mostly with primary dentitions), 9-12 years old (mostly with mixed dentitions), and older than 13 years old (mostly with permanent dentitions). Before dental examinations, demographic details such as age, gender, and type of disability were collected for each participant based on information provided by the school authorities.

Study design:

Ten dentists were trained using the World Health Organization (WHO) oral health surveys basic methods¹⁸, and underwent clinical calibration by examining 10 children during a two-day workshop. During this workshop, Children were examined by the workshop tutor who was a dental faculty professor with enough experience in epidemiological dental surveys (as the gold standard) and all the examiners. The children were examined by the workshop tutor (serving as the gold standard) and all the participating examiners. The children were also re-examined by the examiners on the second day. Both inter- and intra-examiner reliability for assessing dental caries were evaluated, with the mean inter-examiner agreement reaching a Kappa value of 0.85.

The study targeted 1,170 students with ASD, PR, MR, VI, or HI. Caries prevalence was evaluated for three distinct age groups: 6-12 years (assessed with dmft only), 9-12 years (assessed with both dmft and DMFT), and those older than 13 years (assessed with DMFT only). Additionally, the proportion of caries-free students was determined for each age group: 6-8 years, 9-12 years, and older than 13 years. The participants were examined in their classrooms while seated on standard chairs. Dental caries was assessed visually with DMFT/dmft indices, adhering to WHO criteria.¹⁸ Teeth were dried using cotton rolls, and the examination was conducted with a flashlight and mouth mirror. Periodontal probes were excluded from use to prevent any potential harm.

Following the oral examination, participants were shown how to brush their teeth and were advised to brush twice daily. Due to varying levels of learning and comprehension disabilities among the participants, the demonstration was given individually and repeated as necessary. In certain cases, and upon request from school authorities, fluoride varnish was applied after securing written consent from the participants' legal guardians or parents.

Statistical analysis:

Data entry and analysis were performed using IBM SPSS Statistics version 21.00. Descriptive statistics were computed, including percentages and frequencies for categorical data, and means and standard deviations for numerical data. Numerical outcomes were analyzed using Mann-Whitney and Kruskal-Wallis tests. If significant differences were found, post hoc tests were conducted for pairwise comparisons. A P-value of 0.05 or lower was deemed statistically significant.

Results

The study assessed the oral health status of 1,170 disabled students, including 839 males (71.7%) and 331 females (28.3%). Participants ranged in age from 6 to 20 years, with

a mean age of 12.9 ± 3.5 years. The majority were older than 13 years (50.3%), followed by the 9-12 years age group (39.8%), and the 6-8 years age group (9.9%). Table 1 provides a comprehensive summary of the demographic characteristics of the study population.

MR was the most common disability among the children examined (59.4%), followed by HI (18.4%), PR (11.8%), ASD (6.0%), and VI (4.4%).

Table 1 - Demographic characteristics of the study population

Variable		Male		Female		Total	
		n	%	N	%	n	%
Age Groups	6-8	81	69.8%	35	30.2%	116	9.9%
	9-12	362	77.7%	104	22.3%	466	39.8%
	13+	396	67.3%	192	32.7%	588	50.3%
Type of disability *	PR1	86	63.7%	49	36.3%	135	11.8%
	HI2	163	77.3%	48	22.7%	211	18.4%
	VI3	43	86.0%	7	14.0%	50	4.4%
	MR4	455	67.0%	224	33.0%	679	59.4%
	ASD5	69	100.0%	0	0.0%	69	6%

* Type of disability was missing for 26 (2.2%) participants. The reported percentages are for the remaining 1144 participants.

1-PR: Physical Retardation; 2-HI: Hearing Impairment; 3-VI: Visual Impairment; 4-MR: Mental Retardation, 5-ASD: Autism Spectrum Disorder.

Table 2 illustrates the caries-free proportion for each age group. While there was no significant difference between genders, students with visual impairment had a

significantly higher caries-free proportion in the 9-12 years and older than 13 years age groups, with p-values of 0.001 and 0.003, respectively.

Table 2 - Caries-free proportion in disabled students in Tehran, Iran. (n = 1,170)

	6-8 years	9-12 years	>13 years
	N (%)	N (%)	N (%)
Gender			
Male	25 (30.9%)	72 (19.9%)	81 (20.5%)
Female	8 (22.9%)	15 (14.4%)	27 (14.1%)
P-value **	0.382	0.208	0.061
Disability			
PR ¹	2 (22.2%)	5 (10.0%)	24 (31.6%)
HI ²	7 (24.1%)	26 (25.5%)	16 (20.0%)
VI ³	0*	13 (40.5%)	4 (38.8%)
MR ⁴	18 (29.0%)	32 (13.3%)	54 (14.4%)
ASD ⁵	6 (46.2%)	6 (27.3%)	9 (26.5%)
P-value ***	0.501	0.001	0.003
Total	33 (28.4%)	87 (18.7%)	108 (18.4%)

*: There was no student with visual impairment in this age group.

: Mann-Whitney test. *: Kruskal-Wallis test. 1-PR: Physical Retardation; 2-HI: Hearing Impairment; 3-VI: Visual Impairment; 4-MR: Mental Retardation, 5-ASD: Autism Spectrum Disorder.

Table 3 depicts the mean dental caries according to gender, age, and type of disability. Girls had a significantly higher score of DMFT than that of boys ($p < 0.001$).

With respect to age groups, the highest dmft score was among 6-8 years old group, while the highest DMFT score belonged to students older than 13 years ($p < 0.001$).

Based on the type of disability, children with HI had the highest dmft score (mean \pm SD = 2.12 ± 2.74), while the

highest DMFT score (mean \pm SD = 3.76 ± 3.83) belonged to children with MR ($p < 0.001$). Students with VI had significantly lower dmft and DMFT scores in comparison with other disabilities (mean \pm SD = 0.14 ± 0.53 and 1.74 ± 2.01 , respectively) ($p < 0.001$ in both).

Complementary post hoc analyses showed that decayed deciduous teeth and dmft rates in VI group were significantly lower than that of MR, PR, and HI. Moreover,

while the rate of filled teeth in children with HI was significantly lower in comparison with MR, and ASD groups, decayed permanent teeth and DMFT rate of

students with MR was significantly higher than that of the students with ASD, VI, and PR.

Table 3- Mean caries prevalence according to gender, age group and type of disability among disabled students in Tehran, Iran. (n = 1170)

Variable	dt ± SD	mt ± SD	ft ± SD	dmft ± SD	DT ± SD	MT ± SD	FT ± SD	DMFT ±SD
Gender								
Male	1.5 ± 2.3	0.08 ± 0.4	0.2 ± 0.8	1.8 ± 2.5	2.0 ± 2.7	0.1 ± 0.6	0.6 ± 1.5	2.8 ± 3.3
Female	1.9 ± 2.7	0.08 ± 0.4	0.4 ± 1.5	2.4 ± 3.1	3.2 ± 3.2	0.1 ± 0.5	0.8 ± 1.7	4.0 ± 3.8
P-value ¹	0.217	0.995	0.191	0.108	<0.001	0.552	0.019	<0.001
Age groups								
6-8	2.8 ± 3.2	0.1 ± 0.7	0.5 ± 1.6	3.4 ± 3.4				
9-12	1.3 ± 2.1	0.06 ± 0.3	0.2 ± 0.8	1.5 ± 2.3	1.8 ± 2.3	0.1 ± 0.6	0.3 ± 1.1	2.2 ± 2.6
13+					2.8 ± 3.2	0.1 ± 0.6	0.9 ± 1.9	3.9 ± 3.8
P-value ²	<0.001	0.001	<0.001	<0.001	<0.001	0.423	<0.001	<0.001
Disability								
PR	1.5 ± 2.1	0.03 ± 0.1	0.3 ± 1.6	1.9 ± 2.6	1.7 ± 2.2	0.07 ± 0.2	0.6 ± 1.5	2.5 ± 2.7
HI	1.8 ± 2.6	0.1 ± 0.7	0.2 ± 0.8	2.1 ± 2.8	2.1 ± 2.6	0.1 ± 0.5	0.2 ± 0.9	2.5 ± 3.0
VI	0.1 ± 0.5	0	0	0.1 ± 0.5	1.2 ± 1.6	0.02 ± 0.1	0.5 ± 1.1	1.7 ± 2.0
MR	1.7 ± 2.5	0.06 ± 0.4	0.3 ± 1.1	2.1 ± 2.7	2.8 ± 3.2	0.1 ± 0.7	0.8 ± 1.8	3.7 ± 3.8
ASD	1.1 ± 2.2	0.03 ± 0.1	0.1 ± 0.5	1.3 ± 2.2	1.1 ± 1.6	0.07 ± 0.3	0.8 ± 1.3	2.0 ± 3.0
P-value ²	<0.001	0.652	0.079	<0.001	<0.001	0.309	<0.001	<0.001

P<0.05 statistically significant, 1: Mann-Whitney test. 2: Kruskal–Wallis test. SD: Standard Deviation; DMFT/dmft: Decayed, missing, and filled teeth; M/m: Missing teeth; F/f: Filled teeth; D/d: Decayed teeth; PR: Physical Retardation; HI: Hearing Impairment; VI: Visual Impairment; MR: Mental Retardation, ASD: Autism Spectrum Disorder.

Discussion

This study provided the baseline data regarding the oral health status which can inform the development of targeted oral health programs. However, since the results pertain specifically to disabled students in Tehran, Iran, they may not be generalizable to similar populations in other regions of Iran.

Demographics of the study population:

In the present study, the majority of participants were males which aligns with the findings from Iran's 2011 national census on disability prevalence.¹² This predominance may also reflect a cultural tendency for families to enroll boys in school more frequently than girls, potentially due to the societal preference in Iran to offer better services to males, particularly in the context of disabilities.

In the present study, the majority of participants had mental retardation (59.4%). This finding aligns with the 2011 national census results on disability prevalence in Iran, which indicated that physical and intellectual disabilities are more common compared to other types.¹² The discrepancy between the national report and the present study may be due to several factors. Many individuals with

only physical disabilities attend regular schools and were therefore not included in this study. Additionally, physical disabilities often arise at older ages, frequently as a result of accidents, which means that the majority of individuals with physical disabilities were not represented in the study.

Dental caries in relation to gender and age:

In this study, girls exhibited a significantly higher DMFT score compared to boys, after adjusting for age and type of disability. This result aligns with several studies that have identified significant gender differences in mean dmft/DMFT scores.^{4,6} However, other research has found no such differences.^{3,7} These varying results may be attributed to cultural differences across different populations.

The present study observed lower dmft values in older age groups, a trend anticipated due to the natural exfoliation of carious deciduous teeth. This finding is consistent with previous research.^{3,8,19} On the contrary, higher DMFT values were observed in older age groups; this is also not surprising in permanent dentition as dental caries are irreversible and accumulative.¹⁷

Dental caries in disabled individuals in comparison to healthy individuals:

In this study, the dmft index for 6-8-year-old children was

approximately 3.42. A one-sample t-test was conducted using the dmft score of 5-6-year-old children without disabilities in Iran (dmft = 5.16)¹³; the results showed that dmft score for 6-8-year-old children with disabilities was significantly lower compared to children without disabilities in the same age group. This contrasts with many other studies, which have reported higher dmft/DMFT scores among disabled students compared to their healthy counterparts.^{3,4} There are similar studies that reported less dmft/DMFT values and better oral hygiene among these groups than among the general population.^{7,20} The discrepancies among different studies could be due to variations in age groups, severity of impairments, and socioeconomic characteristics of the populations studied. Furthermore, most children in this age group rely on parents or caregivers for their daily oral hygiene and dietary choices, making them less likely to consume unhealthy foods, including cariogenic snacks and beverages.⁷

Caries-free population:

The reported percentage of caries-free population in the 5-6-year-old healthy children was 12.7% on the national level¹³ and 28.4% in 6-8-year-old children in this study. This is not surprising with respect to dmft decrease with age. The caries-free ratio was only 0.4% for healthy individuals of 15-year-old at the national level¹³ while this percentage was 18.4% for students older than 13 years in this study. These results could be ascribed to the fact that disabled individuals are mostly dependent on their families and caregivers for oral health practices, as well as dietary choices, as mentioned earlier. It is most likely then, that the families and caregivers of the studied population had a fairly good level of awareness regarding oral health importance of their children in this study.

Results in comparison to similar studies:

The dmft score of disabled students in the present study was 1.95, which was relatively lower when compared to similar studies.^{3,8} However, the mean DMFT of disabled students in the present study was 3.19, which was higher than the reported DMFT scores in similar studies for the same age groups.^{3,8}

Dental caries in relation to type of disability:

The type of disability significantly impacted caries prevalence among individuals with disabilities. Children with hearing impairment had the highest dmft score, whereas those with mental retardation (MR) had the highest DMFT score. The caries-free ratio was significantly higher among VI students in 9-12 years and older than 13 years age groups, which is in accordance with a similar study³, but in contradiction with some other studies^{14,19} which reported no significant difference in the dmft/DMFT index regarding disability type and severity. Moreover, an

Iranian study¹⁵ reported that the dmft/DMFT score in VI participants was higher than students with MR and HI, which is completely in contrast with our results. The difference between the two studies could be a result of ten-year-gap between them; in addition, the two studies took place in different cities and cultural differences might have affected the results.

Other considerations:

The decayed component of mean dmft + DMFT index was the largest component of the index in all three groups. This has been confirmed by many former studies^{6,7}, showing the high rate of unmet treatment needs in this population. In addition, long-term consumption of medications in form of sweetened syrups can attribute to this condition, especially in the case of students with some forms of mental retardation or autism spectrum disorder.

Study strengths:

A notable strength of this cross-sectional study was the age-specific assessment of caries indices: dmft was calculated exclusively for students aged 6-12 years, and DMFT was determined only for students older than 9 years. Many studies have calculated caries prevalence among disabled children for different age groups (2-4, 7), yet most of them have used a wide age indicator for dmft/DMFT which deviates the results.

Study limitations:

There has been no recent report on the prevalence of disabilities in the country based on age, gender, or type of disability, making precise comparisons difficult in some cases. Another limitation was that the Iranian educational organization for disabled students categorizes students based on their most severe disability. Consequently, it was not possible to account for multiple disabilities in each student within the study. Additionally, schools in Iran are gender-segregated, and the limited number of female-specific schools may have influenced the representation of females in this study. Furthermore, there was no access to the families and caregivers of the participants, which limited the researchers' information on their socioeconomic status and risk factors for oral diseases. The results are attributable to disabled students in Tehran, Iran, only. Therefore, the results could not be generalized to same type of individuals in other parts of Iran.

Conclusion

These results underscore the critical need for improved oral health services and preventive programs tailored to the specific needs of disabled students. The high prevalence of untreated dental caries, particularly among those with HI and MR, points to significant unmet treatment needs and

emphasizes the importance of regular dental check-ups and access to dental care.

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Author Contributions:

Z.G. and H.F. and B.A: conceived and designed the experiments; B.A and H.G.: conducted the experiments; M.N. analyzed the data; B.A and Z.G and A.K: wrote the manuscript. All authors reviewed and approved the final version.

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