

Risk Factors Associated with Caries Experience in Children and Adolescents with Intellectual Disabilities

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Purpose: the purpose of this study was to examine caries experience and associated risk factors in children and adolescents with intellectual disability (ID). **Methods:** a total of 86 participants aged 3-13 years (33 with ID and 53 healthy) were included in the study. Participants received an oral examination and their caregivers completed a questionnaire. Caregivers were required to determine the "level of function" of their children with regards to performing self care daily activities (brushing teeth, feeding and self dressing, walking and performing toilet activities). Four levels of function were determined; (A) being completely independent, (D) completely dependent, (B) and (C) partially dependent on caregivers. **Results:** In healthy participants the mean dft score was 8.83 ± 4.99 whereas in those with ID the mean dft score was 6.81 ± 6.11 . The mean DFT score in healthy participants was 2.32 ± 2.98 while the mean DFT in those with ID was 0.92 ± 1.57 . Both dft and DFT scores were significantly different between participants with ID and healthy ones ($p = 0.042$, $p = 0.044$ respectively). Caries status was not associated with gender, age or caregivers' education in the study sample. Significant associations were found between caries experience in participants with ID and their type of school ($p=0.01$), nature of diet ($p = 0.001$) and "level of function" ($p = 0.007$). **Conclusions:** the type of school, nature of diet and "level of function" may be considered as influential risk factors associated with caries experience in children and adolescents with ID.

Keywords: caries, intellectual disability, children

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INTRODUCTION

The American Health Association defines a child with disability as a child who, for various reasons, cannot fully make use of all his/her physical, mental and social abilities.¹ According to the World Health Organization estimates, individuals with disabilities comprise 10% of the population in developed countries and 12% in developing countries.² Because of their special care needs, oral hygiene in such individuals may be difficult or impossible to maintain, leading to greater requirement for professional care. Therefore, children with disabilities are more likely to develop early childhood caries that may require treatment at a very young age.³ Furthermore, adults with disabilities demonstrate an increased incidence of dental caries and

periodontal disease that may become particularly problematic. Both children and adults with disabilities are often referred to the hospital or specialist practitioner with an accumulation of untreated disease.⁴

The National Survey of Children with Special Health Care needs (2001) showed that dental care was the most commonly needed service that was not received.⁵ According to the American Academy of Pediatric Dentistry's recent Reference Manual, pediatric dentists were concerned about diminished access to oral health care for children with intellectual disability (ID) as they transition to adulthood.^{6,7}

Studies investigating the caries experience in children with ID have produced different findings.^{8,9} Miller and Taylor showed greater caries prevalence in the permanent teeth of orthopedically handicapped children.¹⁰ Caries prevalence was highest in children with mental retardation followed by those with cerebral palsy, visually impaired, those with epilepsy, Down syndrome and children with hearing impairment. Ivancic Jokic *et al* evaluated the oral health condition and dental caries status in healthy children and those with disability (cerebral palsy, mental retardation, Down syndrome, autism and hearing/speaking disorders).¹¹ Their results revealed a significantly poor level of oral hygiene and high level of caries prevalence in both disabled and healthy children. Alternatively, O'Keefe reviewed 27 studies that met three criteria, (adult humans with mental retardation or a similar ID/ had at least one quantitative measure of oral health status/ and the study compared the

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subjects to a control or comparison group without ID). The results showed that adults with ID had caries rates similar as or lower than the general population.¹²

Moreover, Dental caries in children with disabilities has been reported in the literature to be influenced by various risk factors.⁵ Oredugba and Akidayami assessed the oral health status and associated sociodemographic caries risk factors of children and young adults attending a day center for individuals with special health care needs. They found no association between caries status and gender, age or parents' education.¹³ Marshal *et al* explored the association between caries status of children with autism and Caries Risk Assessment Tool. Oral hygiene was found to be the most important risk indicator associated with new caries in children with autism.¹⁴

Research comparing children with ID versus healthy children with respect to dental caries remains controversial. The aim of the present study was to examine caries experience and associated risk factors in children with ID.

MATERIALS AND METHOD

The study protocol was reviewed and approved by the Institutional Review Board at King Abdulaziz University, Jeddah, Saudi Arabia prior to commencement. A total of 86 children were recruited from the Pediatric Dental Clinics at both the Faculty of Dentistry, and King Abdulaziz University (KAU) Hospital. Parents/caregivers consented to participate in the study before beginning. The age of recruited children ranged between 3–13 years. The children's medical records were reviewed to determine their medical diagnosis, and degree of ID (if present on record). According to their intellectual functioning, the children were divided into two groups:

- a) The study group which included 33 children diagnosed with any level of intellectual disability as verified by their medical records.
- b) The control group which included 53 children with normal intellectual functioning.

Examiners designed and pre-tested a questionnaire prior to the study to check its readability and caregivers' understanding of questions. The questionnaire asked about demographic, medical, and dental data as well as participants' oral hygiene practices, dietary habits and caregivers' perception of the oral health status of their children. They interviewed caregivers and assisted them fill out the questionnaire.

Because participants' medical charts did not always document the level of intellectual disability, caregivers of children and adolescents with ID were required to determine the "level of function" of their children.¹⁵ This was completed by asking caregivers about five areas of self care in the child's and adolescent's daily activities; tooth brushing, feeding self, dressing self, walking and performing toilet. Based on caregivers' responses, children and adolescents with ID were grouped into four levels of function: (A) fully independent for all five activities; (B) independent for tooth brushing but

dependant for one to four other activities; (C) dependant for tooth brushing plus one to three other activities; (D) fully dependant for all five activities.¹⁵

All children were given oral examinations performed using mouth mirrors and dental explorers under optimal lighting. Gentle physical restraints including mouth props, parents or dental assistants holding the child's head was used with children who were unable to provide adequate cooperation or those with excessive bodily movements. Two investigators were calibrated to do extra- and intra- oral examinations on children (Kappa= 0.85, p=0.0001). Caries was diagnosed according to the World Health Organization (WHO) criteria.¹⁶ A tooth was considered decayed when there were frank carious lesions which were defined as a break of 0.5 mm or more into enamel. A tooth was classified as filled if it had any type of restoration excluding sealants. Because many included children were at the age of mixed dentition, the missing "m" component of the dmft was not included. Caries experience (dft/DFT) was calculated by adding decayed + filled (dft) for primary teeth and decayed + filled (DFT) for permanent teeth.

SPSS software version 12 was used for statistical analysis. Descriptive statistics were calculated as means, standard deviations (SD) and median numbers of decayed and filled surfaces. Comparisons between the two study groups were done using Mann Whitney U tests. In each group, the associations between dft, DFT and total mean dft/DFT (addition of dft+DFT) scores and different variables were assessed using Mann Whitney U and Kruskal Wallis tests. Significance level was set at 5%.

RESULTS

A total of 86 children and adolescents were examined; 33 with ID with mean age (7.88 ± 2.7 years) and 53 healthy with mean age of (7.13 ± 2.35 years). The sample consisted of 44 (51.16%) males and 42 (48.84%) females. Table 1 presents demographic data and caries experience in participants with ID and healthy ones. It can be seen that caries experience was not associated with gender, age or caregivers' education for both participants with ID or healthy ones.

Caries experience: the mean dft score was 6.81 ± 6.11 and 8.83 ± 4.99 in participants with ID and healthy ones respectively. The difference in the dft score was statistically significant between the two groups of participants ($p = 0.042$). Additionally, significant differences in the "d" components of the dft scores were found between the two groups ($p = 0.051$). In participants with ID, the "d" component was 6.47 ± 6.31 , whereas in healthy participants the "d" component was 8.32 ± 5.20 . Participants with ID had a mean DFT of 2.32 ± 2.98 while healthy ones had a mean DFT of 0.92 ± 1.57 . The means were statistically significant at $p = 0.044$. A significant difference ($p = 0.031$) in the "D" component was also found between participants with ID ($D = 2.04 \pm 2.57$) and healthy ones ($D = 0.77 \pm 1.45$). The mean dft/DFT scores of both groups were not statistically different ($p = 0.44$) as seen in Table 2.

The majority of children with ID were diagnosed at birth

Table 1. Demographic characteristics and caries experience for healthy participants and those with ID

Demographic characteristics		Caries status			
		participants with ID		Healthy participants	
		Mean dft/ DFT± SD	Test p value	Mean dft/ DFT± SD	Test p value
participant gender†	male	7.72 ± 5.94	0.58	9.19 ± 4.4	0.71
	female	9.13 ± 6.32	0.561	8.22 ± 5.6	0.490
Participant age (years)†	<6	9.38 ± 7.4	0.59	9.05 ± 4.9	0.45
	>6	8.04 ± 5.7	0.554	8.47 ± 5.2	0.687
Mother's education††	Cannot read and write	11.80 ± 5.1	3.66	8.80 ± 5.9	2.05
	Can read and write	7.38 ± 6.5		7.5 ± 5.3	
	High school	7.13 ± 4.6		10.13 ± 5.2	
	College	5.00 ± 2.9		8.62 ± 4.2	
Father's education††	Cannot read and write	17.00 ± 0	2.83	8.25 ± 6.7	0.43
	Can read and write	8.07 ± 6.5		8.67 ± 3.5	
	High school	7.60 ± 4.1		8.35 ± 5.4	
	College	4.60 ± 2.7		9.00 ± 4.5	

† Mann Whitney U test used for comparison
 †† Kruskal Wallis test used for comparison

Table 2. Caries status for healthy participants and those with intellectual disability

Caries status		participants with ID	Healthy participants	Test† p value
Primary teeth				
d	Mean ± SD	6.47 ± 6.31	8.32 ± 5.20	1.94 0.051*
	Median	4	8	
f	Mean ± SD	0.34 ± 0.97	0.36 ± 0.96	0.03 0.978
	Median	0	0	
dft	Mean ± SD	6.81 ± 6.11	8.83 ± 4.99	2.07 0.042*
	Median	5	9	
Permanent teeth				
D	Mean ± SD	2.04 ± 2.57	0.77 ± 1.45	2.18 0.031*
	Median	1	0	
F	Mean ± SD	0.28 ± 0.89	0.15 ± 0.61	0.53 0.605
	Median	0	0	
DFT	Mean ± SD	2.32 ± 2.98	0.92 ± 1.57	2.09 0.044*
	Median	1	0	
dft+DFT Mean	± SD	9.28 ± 4.85	8.36 ± 6.06	1.1 0.441

† Mann Whitney U test used for comparison
 *Statistically significant at ≤0.05

Table 3. Diet and Oral hygiene habits versus caries experience for healthy children and children with intellectual disability.

Diet and oral hygiene habits:		Caries experience			
		Participants with ID		Healthy participants	
		Mean dft/ DFT± SD	Test p value	Mean dft/ DFT± SD	Test p value
Type of feeding††	Oral	8.21 ± 6.19	1.36	9.28 ± 4.85	-
	Tube	14.00 ± 2.83	0.386	0	
	Both	7.00 ± 0		0	
Nature of diet†	Solid	5.26 ± 3.3	3.43	8.62 ± 5.1	0.395
	Soft	13.31 ± 6.1	0.001*	13.00 ± 0	
Frequency of sugary snacks/day††	None	7.78 ± 6	0.26	4.00 ± 1.6	0.266
	1	7.56 ± 5.9		8.56 ± 5	
	2-3	8.83 ± 5.9		9.38 ± 5.6	
	>3	10.14 ± 8		9.25 ± 4.2	
Frequency of tooth brushing/day††	None	9.82 ± 6.3	1.78	11 ± 5.5	0.507
	1	7.54 ± 6.2		9.05 ± 4.7	
	2	8.00 ± 6.7		7.38 ± 5	
	3	7.00 ± 2.8		6.00 ± 0	
Who brushes teeth††	Parent brush	10.75 ± 6.7	2.77	9.64 ± 4.7	0.288
	Parent supervise	4.50 ± 2.6		9.88 ± 3.9	
	Child brush	8.68 ± 6.4		7.58 ± 5.7	
Oral hygiene (parent's perspective)††	Poor	17.33 ± 4.62	13.48	11.17 ± 3.13	0.018*
	Acceptable	6.73 ± 4.91		10.12 ± 5.9	
	Good	10.00 ± 0		7.4 ± 4.55	

† Mann Whitney U test used for comparison,
 †† Kruskal Wallis test used for comparison
 * Statistically significant at ≤0.05

(84.8%). The results showed that 97% of children with ID had other associated medical problems compared to 26.4% of healthy children (p = 0.0001). Medical problems commonly seen in children with ID included heart, respiratory, growth delays, seizures, verbal & physical limitations. Among children with ID, those with mild delays showed mean dft/DFT = 7.11 ± 7.42, those with moderate delays showed mean dft/DFT = 5.91 ± 3.08, and those with severe delays showed mean dft/DFT = 15.17 ± 4.03. There was a significant association between caries severity and level of ID (p = 0.007) with greater severity in children with severe ID.

Results show that children with ID attending special needs schools or training centers had mean dft/DFT = 5.06 ± 4.93 while those staying at family homes had mean dft/DFT = 10.67 ± 6.07, a difference found to be statistically significant (p = 0.01). With regards to functional level, there was no association between the different levels and caries experience at p = 0.09. However, with increasing dependence, there was an increase in caries experience {level (A):

mean dft/DFT = 6.67 ± 6.35 , level (B): mean dft/DFT = 4.751 ± 4.1 , level (C): mean dft/Dft = 9.44 ± 5.55 , level (D): mean dft/DFT = 11.3 ± 6.6 }

Diet and oral hygiene habits: Among children with ID, 90.9% were orally fed, 6.1% were tube fed, 3% were orally and tube fed. The tube fed children showed highest mean dft/DFT 14.00 ± 2.83 ($p=0.39$). Moreover, in children with ID a significant association was observed between soft diet intake and caries experience at ($p = 0.001$).

No significant associations were found between the number of sugary snacks eaten per day or hygiene habits (number of tooth brushings/day) and caries severity. However, there was a significant association between parents' perception of the oral hygiene of their children with ID and healthy children and their caries status ($p = 0.03$) and ($p = 0.018$) respectively as seen in table 3.

DISCUSSION

The caries process involves diet, susceptible host and microflora. The evaluation of caries risk is a recommended part of contemporary pediatric dental practice.¹⁷ Children with ID are often found to be at increased risk for oral disease due to diminished or limited ability to understand and assume responsibilities for their dental health and to cooperate with preventive oral health practice.¹⁸

In our study, the mean dft and its "d" component in children with ID were significantly lower than in healthy children. However, the mean DFT and its "D" component were significantly higher than in healthy children. Possible causes may be reluctance of dentists to treat permanent teeth in children with ID due to their inadequate training in addition to poor access to dental care as children with ID get older and their dental health becomes a low priority compared to their chronic illness. Our results agree with Declerck *et al*¹⁹ who reported that dental caries experience was higher in special need children than in non special. Choi and Yang however, reported that the dft, dfs and DMFT indices of special needed children were significantly lower than normal children and that the DMFT and DMFS indices increased with age in both groups.²⁰ O'Keefe also reported that caries rates in adults with ID were the same as or lower than the general population.¹²

In the present study, age gender, parents' education did not have a profound impact on caries experience in children with ID and healthy children. This is in accord with Oredugba and Akindayomi who reported no significant association across gender age parent education and caries experience of children and young adults attending a day institution for those with special needs.¹³

The severity of ID however, seemed to be an important risk factor in determining caries status. In children with ID, those with severe disability had significantly greater caries experience. Children with severe ID have low physical abilities and hence more difficulties in tooth brushing and maintaining oral health. Prolonged retention of food in the oral cavity might additionally be a factor in these children result-

ing in higher prevalence of decay. On the other hand, children with mild to moderate disability can be instructed in oral hygiene and can perform such procedure with encouragement and motivation by caregivers.²¹

Attending special schools or training centers, was significantly associated with lower caries experience. This is possibly reflecting the strict dietary and preventive measures and improvement in the functional performance in children with ID. Our findings agree with those of Crack *et al* who report that among handicapped individuals aged 2–65 years, those living in training centers had the lowest caries experience.²² In a Swedish study adults living in institutes had lower decayed and filled surfaces compared with those living in community and private homes.²³ On the contrast, Pradhan *et al* showed no association between caries experience among adults with intellectual disabilities and their residence settings, family homes, community housing and institutions.²⁴

This study shows a tendency for children who were more dependants for their self care activities to have higher levels of caries experience. Dependant children were more severely disabled and required assistance in tooth brushing reflecting the inadequacy with which oral care may be provided by their caregiver. This finding could account for the significant association between severe ID and high caries experience in this study. Desai *et al* surveyed 300 children aged 9-13 years with disabilities and concluded that children who were more dependent on caregivers for their self-care activities tended to have higher levels of dental disease.¹⁵

Dietary choices of children with ID showed significant association with caries experience in this study. Children on soft diet had greater caries severity. This finding is not unexpected, but it should be noted that diet is only one factor that can be modified by the caregiver without much resistance from their care recipient unlike oral hygiene care.

Although not statistically significant, children from both groups who did not have their teeth brushed had greater caries experience. This could also account for the significant association between high caries experience and severe ID. In addition, poor oral hygiene as judged by parents in the present study was significantly associated with high caries prevalence.

This study adds to the understanding of caries risk in patients with ID. Dental providers should identify caries risk indicators then tailor a preventive plan depending on level of ID. Our study suggests that attending special schools or training centers and strict diet are key strategies. Special schools and training centers help to develop an Education Plan (EP) for students with disabilities to help providers understand the students' disabilities and how it affects the learning process. In addition, these schools play an important role to improve academic and functional performance. Preventive strategies involving caregivers and school staff together with the implementation of intensive preventive programs in special schools are important to reduce caries experience.

CONCLUSIONS

Based on this study results we can conclude that the severity of ID, attending special schools/training centers and the nature of diet are significant risk factors associated with dental caries experience in children with ID.

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