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DMFT and PUFA Indices in First Permanent Molars of Iraqi Children in Najaf City

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Abstract

Objective: To determine the prevalence and severity of caries in the first permanent molars of children aged 8 to 10 years in Najaf, Iraq.

Subjects and Methods: This was a cross-sectional survey involving 1232 children aged 8 to 10 years in schools in Najaf, Iraq. Caries was assessed using the DMFT index and caries severity of permanent teeth was assessed using the PUFA index.

Results: The prevalence of caries in the first permanent molars was 56.1% (n=691). The caries severity of the first permanent molars (PUFA index) was 38.7%, meaning that the children have more severe caries in the first permanent molars.

Conclusion: Caries prevalence and severity increased with age and was high in first permanent molars.

Keywords: Dental caries, DMFT, PUFA, first permanent molar.

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Introduction

Dental caries is the demineralization of the inorganic part of the tooth and the dissolution of organic matter, which depends on the interaction of multiple factors [1,2]. These different factors include tooth morphology, bacteria, as well as other influencing factors such as diet and genetics [3]. Tooth decay is the most common chronic disease affecting both sexes, races, and ages [4,5]. The first permanent molars (FPM), due to their anatomical structure and early eruption, are very susceptible to caries. It is a common reason for children having to visit the dentist and often needing restoration or extraction of FPM. Therefore, estimating the caries risk in FPM at the individual and societal level helps to understand the pattern and severity of caries [6,7]. The development of FPM begins early in life. X-ray studies have shown that in addition to the germ of the deciduous teeth, the crypts of the FPM can be seen distal to the second deciduous molars right after birth. First, the crypts of the upper FPM are aligned in the maxillary high, above and behind the germ of the second deciduous molar, and the crypts of the lower FPM are located below the anterior edge of the mandibular ramus [7,8]. Eruption of the FPM is a unique morphological and functional event because it simultaneously establishes the mesial boundaries of the molars [9], but also helps to establish concordance between the anterior (dental) and posterior (temporomandibular) determinants of occlusion [10]. Nowadays, there is an increasing need to find methods that can more efficiently collect caries data in large population studies. This means saving economic resources and working time for health workers. Epidemiological studies are extremely important for public

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dental health as they are the only source of accurate information on the frequency and distribution of oral diseases and form the basis for assessing treatment needs [11]. The decayed and missing filled surface/tooth (DMFT) index has long been used and has been established as the main measure of caries occurrence [12]. However, it does not capture information about the clinical consequences of untreated caries, such as pulp involvement and dental abscesses and sepsis, which may be more serious than the carious lesions themselves. Deep carious lesions with pulp involvement are still considered as "dentinal caries." To improve the accuracy of caries diagnosis, Monse et al. [13] introduced an index that can be used to quantify different advanced stages of carious lesions, namely the "PUFA" index. PUFA records (P – pulp involvement, U – ulceration, F – fistula, and A – abscess). Surveys using PUFA have been conducted among school children in India to study caries prevalence and caries experience [14,15]. The aim of this study was to determine the prevalence of dental caries and untreated dental caries among school children in an elementary school in Najaf city, Iraq, and to collect data on the clinical consequences of untreated dental caries using DMFT and PUFA indices.

Subjects and Methods

Study design

The study was conducted from December 11, 2022, to May 21, 2023 in the Iraqi city of Najaf. Data were collected from children aged 8 to 10 years from several primary schools (six boys' schools) and (six girls' schools). The study received ethical approval from the local committee of the Faculty of Dentistry, University of Kufa. Prior to conducting the study, written informed consent was obtained from the parents/guardians after explaining the purpose of the study. In addition, permission was sought from the school authorities to conduct the study.

Sampling and sample size

There are 6 public primary schools (boys) and 6 public primary schools (girls) in Najaf city. They were selected from schools that were easily accessible and located in safe areas. A cross-sectional study was conducted on a total of 1232 children, of which approximately 682 were girls and 550 were boys. All children were examined individually in a common chair under natural light and a sterilized oral mirror and oral probes. Caries was assessed using the DMFT index and caries severity was assessed using the PUFA index of the first permanent molars. Initial carious lesions were not assessed. Teeth with early cavitation that could not be penetrated by the ball probe were not assessed as having caries; the criteria for the PUFA/PUFA index were applied without the use of instruments.

Dental caries

Clinical examination for caries was performed using a flat mouth mirror and a CPI probe. Systematic examination for caries was performed from the upper right to the upper left and then to the lower teeth. The examination covered all tooth surfaces. A tooth was considered present if any part of it was visible. A letter coding system was used for deciduous teeth and numbers for permanent teeth [16].

Dental caries indices: DMFT and PUFA indexes

The diagnostic criteria for caries were based on the World Health Organization (WHO). The dmft and DMFT indexes were used to measure caries status in children. Descriptive results were reported as frequencies and percentages as well as means and standard deviations. Data were analyzed using SPSS version 16. A p-value less than 0.05 was considered significant using the chi-square test [17] to determine differences between males and females. PUFA was recorded separately from DMFT/dmft and assessed the presence of visible pulp, root fragments leading to oral mucosal ulcers, fistulas, or abscesses [18]. PUFA definitions used were:

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P/p: Pulp involvement was recorded when the opening of the pulp cavity was visible, or the coronal tooth structure had been destroyed by the carious process and only the root or root fragments remained. Probing was not performed to diagnose pulp involvement.
U/u: Ulcers due to trauma caused by sharp tooth fragments were recorded when the sharp edge of the luxated tooth involved the pulp or root fragments, resulting in traumatic ulceration of the surrounding soft tissues (tongue or oral mucosa).
F/f: If there is a draining sinus associated with the endodontic tooth, consider a fistula.
A/a: If there is a pus-filled swelling associated with the endodontic tooth, consider an abscess [13,15,19].

Results

The prevalence of first permanent molar caries in Al-Najaf city was 56.1% (n=691) out of 1232 children 8 to 10 years of age (Table 1).

DMFT

The prevalence of lesions in the FPM increased between the ages of 8 and 10 (Table 2). Figure 1 to 3 summarize DMFT findings by sex.

PUFA

Summary of findings related to PUFA are described in Figures 4 through 8 and Tables 3 and 4.

Table 1. Caries distribution in the study subjects.

Samples	n	%	Samples	n	%
Total number	1232	100	Total Caries teeth	691	56.1
Female	682	55.35	Female Caries teeth	341	49.34
Male	550	44.64	Male Caries teeth	350	50.65

Table 2. DMFT destribution in the study.

gender	Age range	Decayed	missing	Filled	X^2	P-value
Male	8-9 years	24%	0.91%	0.91%	33.014	0.001*
	9-10 years	28%	2.7%	3.6%	33.864	
female	8-9 years	20%	0.6%	0.88%	33.014	0.002*
	9-10 years	28%	1.9%	3.4%	33.864	

Table 3. PUFA distribution by sex.

Gender	Age range	Pulp involvement (P)	Ulceration(U)	Fistula(F)	Abscess(A)	X^2	P-value
Male	8-9 years	9.1%	3.2%	3.2%	4.1%	27.561	0.0002*
	9-10 years	11.8%	5%	4.36%	5.2%	26.205	
Female	8-9 years	8%	2.9%	2.6%	3.2%	28.251	0.0012*
	9-10 years	9.8%	4.1%	3.3%	5.2%	29.854	

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Table 4. Sex comparison of DMFT and PUFA summary statistics.

Variables	Gender	Mean ± SD	SE	P-value
DMFT	Male	3.25±1.75	0.55	0.01
	Female	2.89±1.15	0.45	
PUFA	Male	1.24±1	0.38	0.05
	Female	1.17±0.78	0.45	

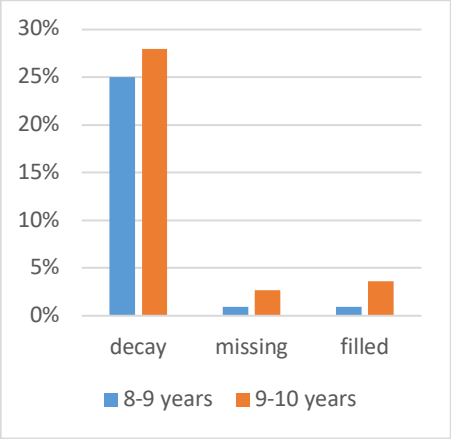

Figure 1. DMFT in males.

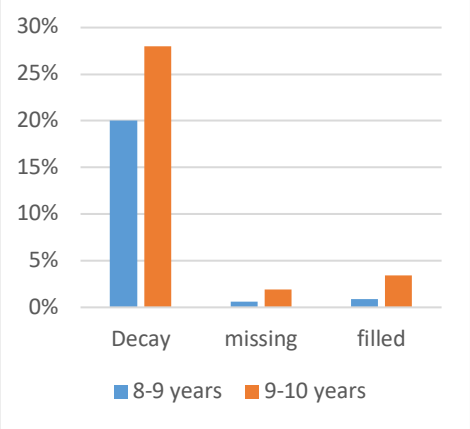

Figure 2. DMFT in females.

Figure 3. Representative caries lesions of permanent first molars found in the study.

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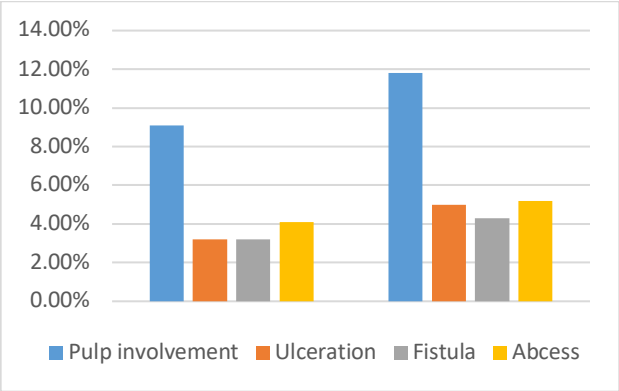

Figure 4. PUFA distribution in males.

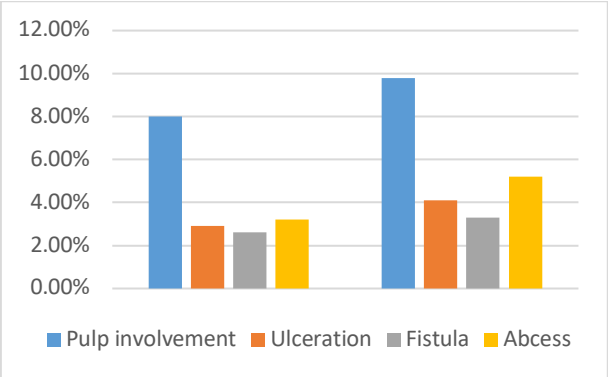

Figure 5. PUFA distribution in females.

Figure 6. Representative image of pulp involvement in permanent first molars found in the study.

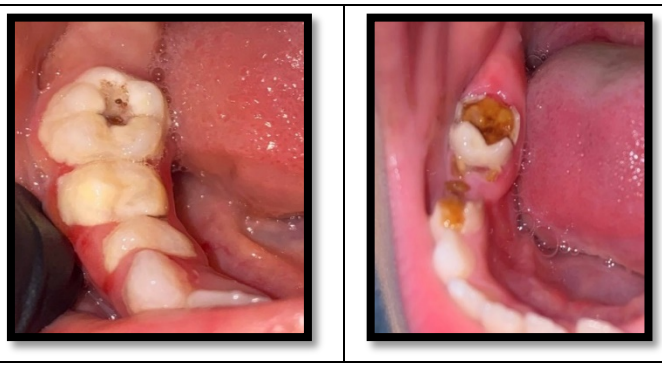

Figure 7. Representative image of ulceration near permanent first molars found in the study.

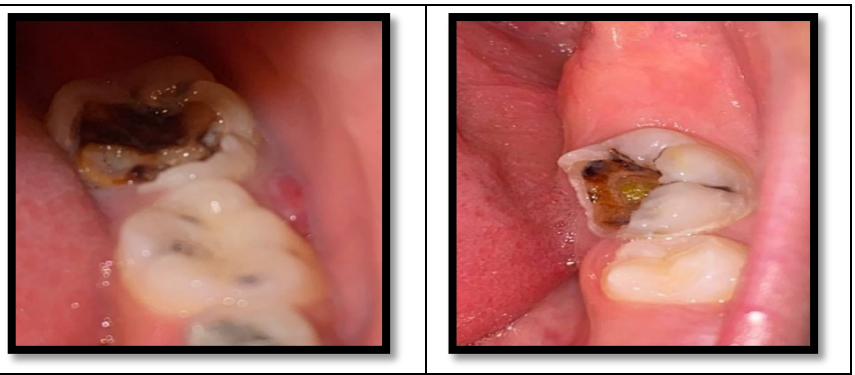

Figure 8. Representative image of fistula and abscess near permanent first molar found in the study.

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Discussion

First permanent molars are commonly the first teeth to erupt [20]. The first permanent molars have a significant impact on the dental health and overall well-being of a person. They absorb the greatest occlusal forces, control vertical distance, vertical dimensions, aesthetic proportions, and optimal anchorage sources [21]. This cross-sectional study investigated the impact of caries associated with the first permanent molar and its clinical implications in a sample of primary school students aged 8 to 10 years using DMFT and PUFA indexes. The mean DMFT values of first permanent molars in males and females were 3.25 and 2.89, respectively, while the mean PUFA values in males and females were 1.24 and 1.17, respectively. This study is the first to report the DMFT and PUFA indices of first permanent molars in Iraq. Other studies from Iraq reported DMFT scores for both deciduous and permanent teeth in mixed dentition [22–25]. When we compared our results with the prevalence reported in other countries, we noticed that it was relatively high. Abufan et al. in Sudan reported a prevalence of 61%, Rafi et al. in Abha, Kingdom of Saudi Arabia (KSA), reported a prevalence of 66.4% [26,27], and Que et al. in Central Africa reported a prevalence of 68.79% [28]. Joshi et al. reported a caries prevalence of 69.12%, with a higher prevalence in boys (70.01%) than in girls (68.22%) [29]. Any differences in reported prevalence may be attributed to sociodemographic factors, different sample sizes, different age groups, diagnostic criteria, or statistical methods. Chukwu et al. reported that first permanent molars accounted for 42% of all extractions due to caries, which was the highest proportion among all other teeth [30]. Salih showed that caries was more common in the first permanent molars (DMFT) [31]. Elfsay et al. showed different results for permanent caries between maxillary and mandibular, but in Benghazi, Libya, the overall prevalence was 50% [32], which is very close to the DMFT prevalence we are reporting here. Al Mansour revealed that the overall prevalence of caries in children aged 5 to 12 years in FPM was as high as 42% [7]. All reported differences in prevalence can be attributed to sociodemographic factors, different sample sizes, different ages, diagnostic criteria or statistical methods. The PUFA index meets the need for a more specific criteria for evaluating severity of caries. Since the past decade, international caries detection systems have focused more on developing more sensitive diagnostic criteria to help identify caries at an early stage [33,34]. In this study, the PUFA index was used to assess complications of untreated teeth. Only one earlier study by Kadhem examined the PUFA index in preschool children in Diwanya city, Iraq [35]. Looking at the age distribution of PUFA scores, we found that children aged 9 to 10 years had the highest score of 21.6%, while children aged 8 to 9 years had the highest score of 17.1%. This indicates a lack of awareness and neglect of oral health, as well as a lack of dental health education. Baginska et al. obtained similar results when evaluating the prevalence and experience of PUFA index in primary dentition [36]. Mons et al. showed that the prevalence of PUFA in children aged 6 to 12 years was 85% [13]. Ramazani and Rezaei showed that there was no significant difference in the prevalence or severity of untreated caries between males and females ($P > 0.05$), which contradicts our study [37]. When all maxillary and mandibular first permanent molars were evaluated in MIH-positive patients, the clinical consequences of untreated caries (mean PUFA) were significantly more common, which is highly consistent with our study [38]. Seker et al. showed that the prevalence of caries in first permanent molars in Vadodara was 55.38%; the proportion of children aged 8 to 10 years affected by caries was assessed using the DMFT index. The severity of caries in first permanent molars (PUFA index) was 56.22% [39]. The reason for our results of DMFT and PUFA index values (public schools) may be due to the lack of

understanding of parents and teachers, lack of free routine dental check-ups, and the prevalence of staple food packets over junk food packets. School staff should receive lectures on the importance of teeth and their protection from an early age.

Conclusion

The current study focused on. The results showed that the prevalence and severity of dental caries in first permanent molars is high in children.

Ethical approval and consent of the participants
The current work is approved by the University of Kufa, number 253, date 2023, 19 December.

Availability of data and materials
Further data are available upon request to the corresponding author.

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None.

Conflicts of interest
There are no conflicts of interest.

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