ORIGINAL ARTICLE

CONTENTS

Oral health status in relation to nutritional status amongst 6-12 years aged orphans in Baghdad city, Iraq

Rawan Saad AlKadhaly[1], Muna Saleem Khalaf[1], Ghada Abdulmunim Mohammed[2]

[1]DEPARTMENT OF PEDODONTICS AND PREVENTIVE DENTISTRY, COLLEGE OF DENTISTRY, UNIVERSITY OF BAGHDAD, BAGHDAD, IRAQ

[2]PROSTHODONTICS, COLLEGE OF DENTISTRY, AL-FARAHIDI UNIVERSITY, BAGHDAD, IRAQ

ABSTRACT

Aim: We aimed to assess selected measures of oral health, namely, enamel defect, eruption of permanent teeth, and dental caries. The nutritional status of orphans was investigated by physical examination, and then the nutritional status was correlated with measures of oral health.

Materials and Methods: A total of 192 orphans aged of 6 and 12 living in all orphanages in Baghdad, Iraq, were studied. Enamel defect was derived from the WHO's modified developmental defects of enamel index, investigation of caries using Decay -Missing – Filled index (DMF) for permanent teeth, the decay-missing filled index for primary teeth (dmf) index. All permanent teeth were inspected for eruptive stage. According to body mass index (BMI) for age, subject's visits and birthday dates were recorded as day/month/year. Height was measured in centimetre and weight in kilogram. Data were then transfer data to BMI Excel calculator.

Results: The prevalence of enamel defect was low in the sample, and fully erupted teeth had high prevalence amongst orphans (more than 9 years old). A high percentage of caries existed amongst orphans, and the highest percentage of the sample was normal in weight.

Conclusions: Enamel defect was higher amongst normal weight then overweight children. The mean of permanent teeth eruption increased with increased BMI for age. A high caries prevalence existed amongst orphans.

KEY WORDS: children, orphan, enamel defect, oral health status, public health

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INTRODUCTION

Orphans are defined by UNICEF and its international partners as children under the age of 18 who have lost one or both parents In 2016, Iraq had over 4.5 million orphans as a result of the violence that followed the 2003 war, as well as instability and population displacement, [1]. Good oral health is necessary for optimal physical and mental health and is thus a basic human right [2]. Enamel is generated by ameloblast cells, which are lost when a tooth erupts into the oral cavity; enamel cannot therefore regenerate itself. The main stages of amelogenesis are the period of matrix production, the secretory stage, and the period of maturation, which consists of mineral crystal growth and the loss of protein and water , the severity of developing enamel defects depends on the length and force of the insult, as well as the stage of enamel organ development at the time the lesion occurs [3]. The processes of tooth eruption are still not completely known, but active eruption appears as root formation starts. This phenomenon leads to the assumption that eruptive force originates from the periodontal ligament. The eruption force is provided by the periodontal ligament once the tooth has pierced the gingiva, but not whilst the tooth is still intraosseous, The fact that active tooth eruption occurs as root formation begins supports the concept that the periodontal ligament is the source of eruptive power; nonetheless, the mechanics of tooth eruption are yet unknown. Only once the tooth has broken through the gingiva can the periodontal ligament aid in tooth eruption, Pre-eruptive movements occur during crown creation and are very tiny that they could only be detected by vital staining experiments. Some authors divided eruption into three stages: Pre-eruptive movements, eruptive movements and post-eruptive movements [4]. Periodontal disease and tooth decay are the two most common oral health problems, and both are caused by plaque. If not treated, tooth loss can impair a person's ability to eat, speak, and feel good about themselves. Malnutrition poses a significant concern to some vulnerable communitiesPlaque has been connected to each of the most prevalent oral diseases, namely, tooth decay and gum disease. If left

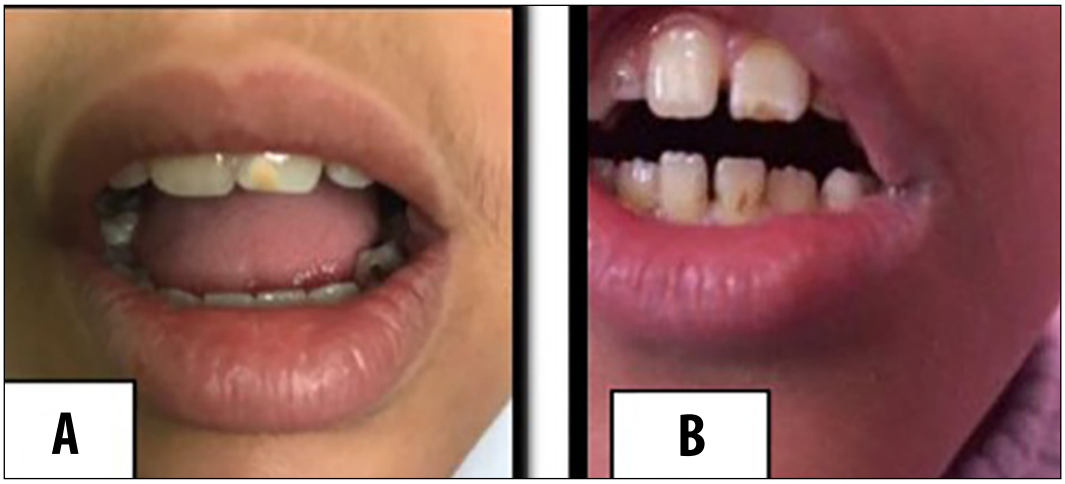

Fig. 1. Clinical appearance of developmental defect of enamel. A: Demarcated opacity; B: Hypoplasia.

untreated, tooth loss may occur, which is detrimental to one's self-esteem and ability to talk and chew food [5]. Nutrition refers to a living entity's utilisation of components from its surroundings to support its own essential activity [6]. Without sufficient nutrition, an organism is more likely to become unwell [7].

AIM

The aim of our research was to assess selected measures of oral health: enamel defect, eruption of permanent teeth, dental caries, and to investigate the nutritional status of orphans by their physical examination to link nutritional status to oral health outcomes.

MATERIALS AND METHODS

One hundred ninety-two children aged 6–12 years old were examined from all orphanages in Baghdad city, Iraq. Preceding the process of data collection, consent was obtained from the Directorate of Labor and Social Affairs/Department of Persons with Special Needs in Baghdad City to run the study. The research was conducted from November 2022 until the end of January 2023. A pre-study ethical approval was obtained from the scientific committee of the Department of Pedodontics and Preventive Dentistry and the ethical committee at the College of Dentistry/University of Baghdad to achieve the subject without obligation. In accordance with WHO's [8] requirements for oral examinations, children were examined in a setting designed for maximum effectiveness and cooperation. To acquire good illumination and provide the kids with the most comfort, the examiner used an aperture where sunlight entered as a source of light whilst standing behind the kids' heads. The tools used were several pairs of tweezers, a plane mouth mirror, containers, gauze, and a CPI probe. The criteria for enamel defect were derived from WHO's modified developmental defects of enamel (DDE) index [8], which was utilised in the study and registration of permanent teeth. They were classified as delimited opacity, diffuse opacity, and hypoplasia according to their clinical presentation (Fig.1).

All the permanent teeth of the children were examined regarding their eruptive stage in natural light by a dental mirror and the registration of teeth was performed as stated by the FDI notation system [9] (Fig.2).

The primary teeth were coded alphabetically, whereas the permanent teeth were coded numerically. The CPI probe can be used to confirm visual evidence of caries on the tooth surfaces Carious lesions were seen on all tooth surfaces that were compromised. When calculating tooth loss due to caries, the front teeth were counted as having four surfaces and the back teeth as having five retained roots were counted as five decayed surfaces for the posterior and four decayed surfaces for the anterior teeth (8) (Fig.3).

According to the body mass index (BMI) indicator, to achieve categorisation of BMI for age, subject's visits and birthday dates were recorded as day/month/year. After measuring height in centimetre and weight in kilogram, data were transferred to the BMI Excel calculator (summary report Paediatrics. 2007, Geneva, Switzerland) [10], <5% (underweight), 5%–85% (normal), 85–95% (at risk of overweight), and >95% (overweight or obese). According to age that ranged between 6-12 years old the average would be 9 years old, so the age groups was less or equal to 9 years old and the second group would be more than 9 years old. The statistical tests Student's t-test and one-way ANOVA were used. A p value of <0.05 was considered statistically significant.

RESULTS

This study included a total of 192 orphans aged 6-12 years. Children aged less or equal to 9 years old had

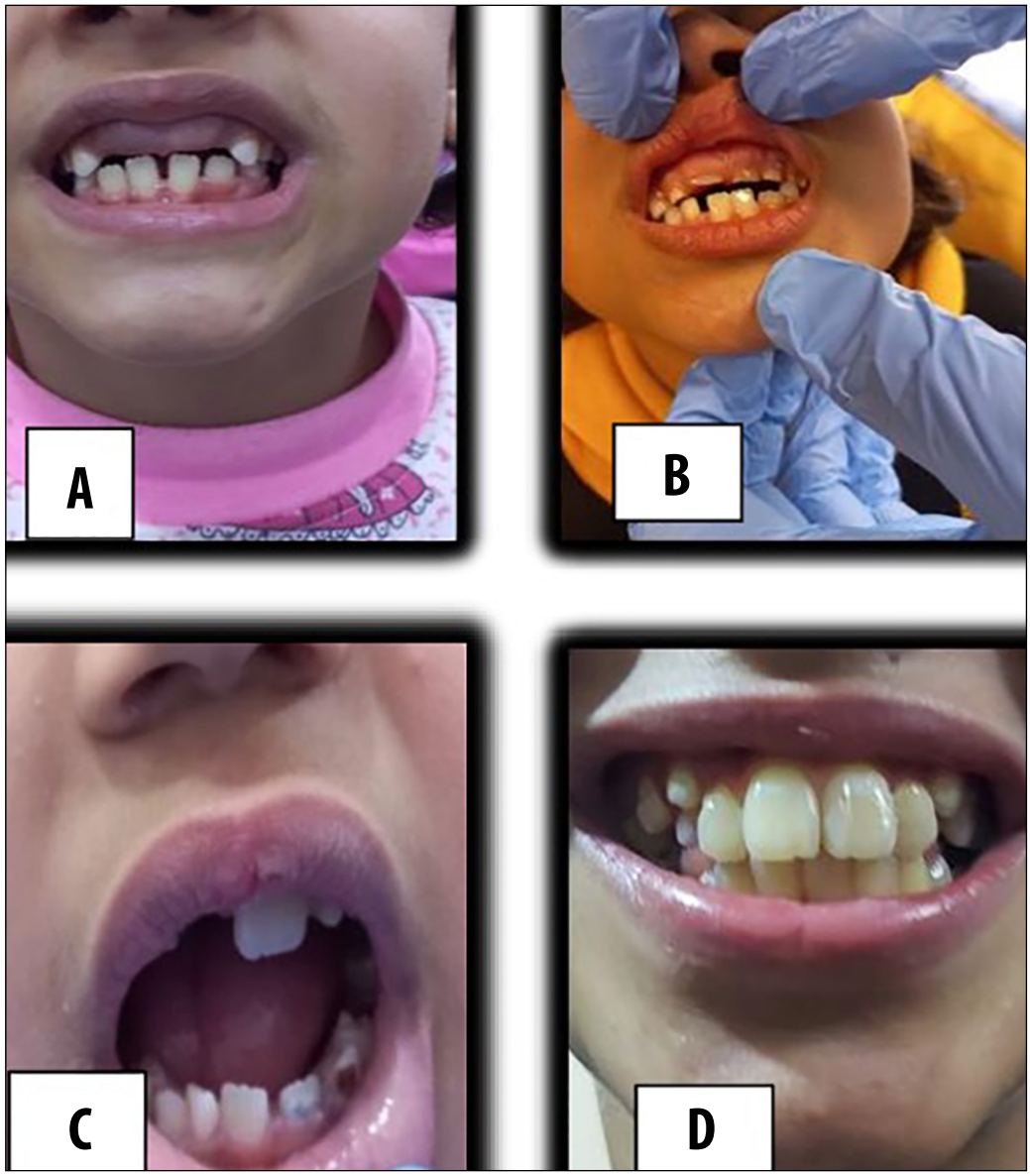

Fig. 2. Eruption stages of permanent teeth. A: stage 0; B: stage 1; C: stage 2; D: stage 3.

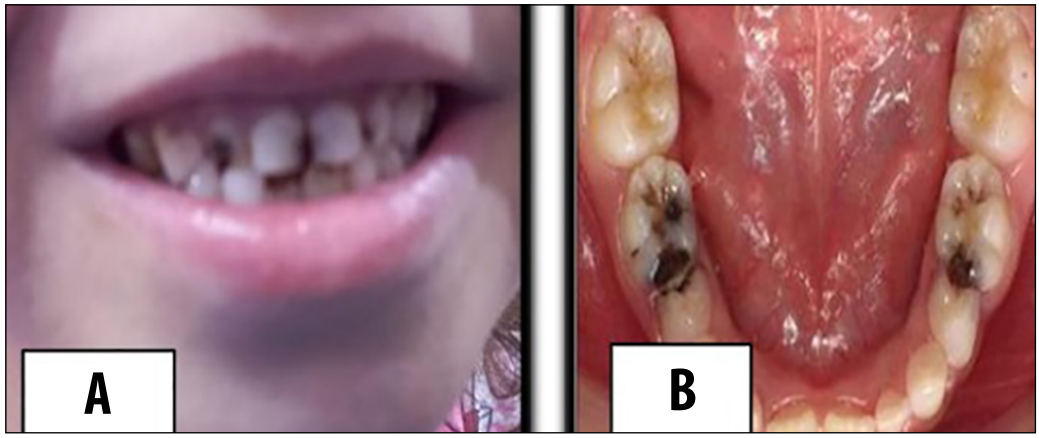

Fig. 3. Caries in primary teeth. A: anterior caries; B: posterior caries.

the same percentage (50%) as children more than 9 years old. Boys and girls constituted close proportions, with boys forming 46.88% while girls 53.13%. Children in governmental orphanages constituted 68.75% of the study sample, while in the private orphanages were 31.25%. Regarding BMI-age relation, the high

Table 1. Descriptive and statistical test of eruption (ER) scores with age and gender

	Variables	Group 1(<=9, Male)*		Group 2 (9+, F)**		T test	P value***
Age	ER0	15.229	0.559	5.458	0.516	12.836	0.000
	ER1	0.604	0.091	0.542	0.109	0.441	0.659
	ER2	1.771	0.163	0.792	0.105	5.065	0.000
	ER3	5.563	0.501	15.792	0.511	14.293	0.000
	Total teeth eruption	7.938	0.528	17.125	0.473	12.959	0.000
Gender	ER0	11.667	0.696	9.176	0.743	2.446	0.015
	ER1	0.667	0.122	0.490	0.077	1.219	0.225
	ER2	1.644	0.140	0.961	0.142	3.430	0.001
	ER3	9.022	0.659	12.137	0.747	3.127	0.002
	Total teeth eruption	11.333	0.665	13.588	0.686	2.346	0.019

* Group 1: according to gender: male , according to age equal or less than 9 years old. ** Group 2: according to gender: female, according to age: more than 9 years old. ***Significant at $P < 0.05$.

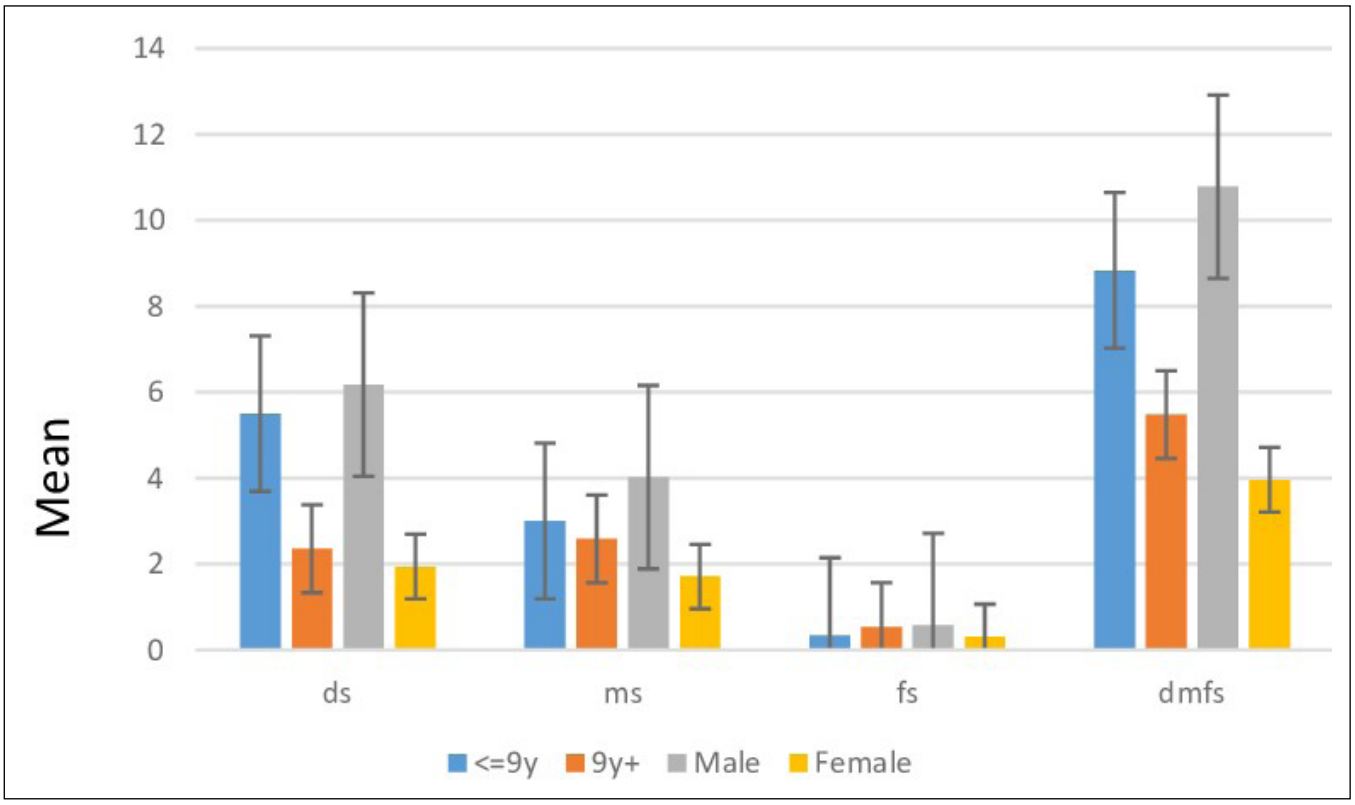

Fig. 4. Descriptive and statistical test of primary caries experience.

prevalence was for acceptable weight (74.48%), while underweight and overweight had the same percentage being the least percentages. The prevalence of enamel defect was 31.13% of the total sample. The demarcated opacity had the highest mean among the sample followed by diffuse opacity then hypoplasia had the least mean. According to age the highest percentage (66.67%) was amongst older children (more than 9 years old). According to gender, the higher percentage was for females that had DDE about 56.67%. It was found that the upper centrals were the most affected teeth by the DDE [11-21], followed by upper molars [16], respectively. Conversely, the upper left lateral incisor 42 and first premolar tooth 44 had the least percentage. According to age, children with eruption stage 0 were more amongst the youngest children less or equal to 9 years old with a high significant difference ($P< 0.01$), also stage 1 of teeth eruption was more amongst youngest children but with no significant difference stage 2 teeth eruption was more amongst younger

Table 2. Descriptive and statistical test of permanent caries experience

Variables.	Caries	Group 1 (<=9, Male)*		Group 2 (9+, F)**		T	P value***
		Mean	±SE	Mean	±SE		
	DS	**1.000**	**0.192**	**2.021**	**0.568**	**1.703**	**0.091**
Age 1: ≤9 years 2: >9 years	MS	0.438	0.157	0.333	0.113	0.539	0.591
	FS*	0.021	0.015	0.688	0.109	6.054	**0.000**
	DMFS*	1.458	0.239	3.042	0.582	2.517	**0.013**
Gender 1: male 2: female	DS	2.111	0.606	0.980	0.179	1.791	0.076
	MS*	0.178	0.087	0.569	0.163	2.115	**0.036**
	FS*	0.533	0.109	0.196	0.056	2.763	**0.007**
	DMFS	2.822	0.610	1.745	0.259	1.625	0.107

* Group 1: according to gender: male , according to age equal or less than 9 years old. ** Group 2: according to gender: female, according to age: more than 9 years old. ***Significant at $P < 0.05$.

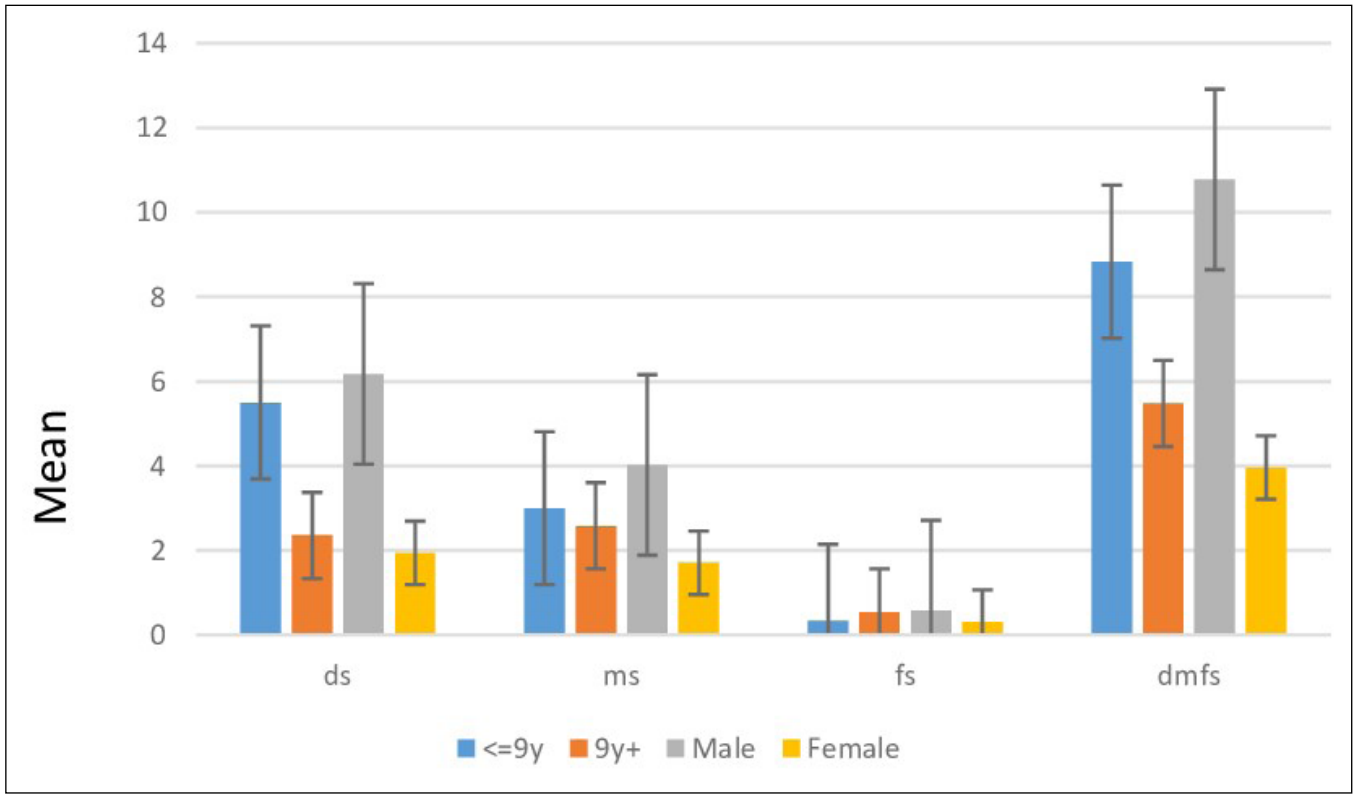

Fig. 5. Descriptive and statistical test of permanent caries experience.

children with significant difference between them. Conversely, stage 3 of teeth eruption had the highest mean amongst older children (more than 9 years old), with high significant difference. According to gender, stage 0 and 2 teeth eruption was greater amongst males than female, with a significant difference between them. Stage 1 was also greater amongst males, but with no significant difference statistically. Stage 3 teeth eruption had a higher mean amongst females than males, with a high significant difference (Table 1).

According to caries, there was high percentage of caries prevalence among the children of both private and governmental orphanages (88.54%). The high caries percentage was more among younger children (51.76 %). According to gender, caries percentage was more among males (51.76%) than female. Caries experience for the primary dentition according to age and gender groups, the decay in primar teeth fraction(d) mean value showed significant decline with advancing age with P<0.001 for both. In regard to missing teeth reflected by surfaces (m), the mean rank value higher among orphans at age 9 years or less (P=0.589), no

Table 3. Descriptive and statistical test of primary caries experience according to nutritional status

Variables.	Underweight		Normal		Overweight		Obese			
	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE	F	P value
ds	4.500	1.232	3.713	0.520	4.938	1.340	4.235	1.621	0.267	0.849
ms	0.500	0.342	2.867	0.457	4.000	1.633	3.176	1.189	1.309	0.273
fs	0.625	0.287	0.476	0.110	0.313	0.151	0.059	0.059	0.797	0.497
dmfs	5.625	1.217	7.056	0.712	9.250	2.492	7.471	2.471	0.503	0.680

Table 4. Eruption of permanent teeth in relation to nutritional status

Variables.	Underweight		Normal		Overweight		Obese			
	Mean	±SE	Mean	±SE	Mean	±SE	Mean	±SE	F	P value
ER0	10.625	1.873	10.685	0.571	8.813	1.889	8.647	2.307	0.670	0.571
ER1	0.500	0.316	0.615	0.083	0.813	0.228	0.059	0.059	2.035	0.110
ER2	1.313	0.395	1.385	0.124	1.063	0.213	0.588	0.258	1.744	0.159
ER3	10.563	1.756	10.224	0.567	12.063	1.870	13.294	2.273	1.164	0.325
Total teeth eruption	12.375	1.791	12.224	.535	13.938	1.733	13.941	2.141	0.581	0.628

significant difference among the age groups in regards to filling in primary teeth fs was found. The mean rank of decay-missing-filled primary teeth reflected by surface (dmfs) showed significant difference. In regard to gender the Figure 4 illustrates higher and significant mean of ds, fs and dmfs among males compared to females of institutionalized orphans, high ms mean in males than females and significant elevated dmfs mean rank in males than females (P=0.000) as shown in fig. 4.

Table 2 showed caries reflected by surface DMFS for permanent teeth among age and groups, the DS mean showed progressed with advancing age as found with no significant difference among age groups. Results showed there was higher percentage of MS among younger children with no significant difference among the age groups. In regard to FS fraction, there was a significant high mean among older children. Significant increased DMFS mean rank was revealed in age group older than 9 years old for orphan groups. According to gender. High mean rank DMFT was found to be elevated in males than females although statistically not significant (Fig.5).

ORAL HEALTH STATUS IN RELATION TO NUTRITIONAL STATUS

Regarding the BMI for age index, the weight and height of children were recorded. We found that the highest percentage of the sample was normal in weight (74.48%), whereas the least belonged to the overweight and underweight group, which had the same percentage of 8.33%. In relation to BMI, the highest percentage was for children with normal weight followed by overweight then obese children. The least percentage was for thinnest children. The demarcated opacity had the highest mean amongst normal weight children with no significant difference, whereas underweight children had no demarcated enamel defect amongst them. Diffused opacity was found only amongst normal weight children, and is no diffuse opacity existed amongst underweight, overweight, and obese children. Hypoplasia had the highest mean (0.563) amongst overweight children, with no significant difference, followed by normal weight children. Obese children had the least mean amongst underweight orphans. According to BMI the higher percentage of caries was amongst normal-weight orphans, followed by overweight and then underweight. The lowest percentage was amongst obese children in this sample. According to caries experience in primary dentition according to BMI-age grades, the ds and ms mean had high value in the overweight group, with no significant difference amongst institutionalised orphans. Meanwhile, the mean of fs was higher amongst underweight orphans with a non-significant difference. The dmfs mean was higher amongst overweight children, with no significant difference amongst BMI-age groups of institutionalised orphans (Table 3).

According to BMI-age, caries reflected by surface (DMFS) for permanent teeth in institutionalised, results demonstrated a high mean of DS in overweight group, with no significant difference. Conversely the least mean in the obese group had no significant difference. With regard to the MS mean, the value in the obese group was high with no significant difference from BMI-age in the institutionalised orphans. By contrast, it was low

in the overweight group of orphans. According to FS, the highest mean was amongst overweight orphans, with no significant difference amongst BMI-age groups, there was high with no significant DMFS mean value in overweight group. The same DMF result was revealed for orphan groups. Permanent teeth eruption (mean and standard error) by BMI was found that the mean value of permanent teeth eruption increased with increased BMI for age, without statistically significant difference. Additionally, the mean of the un-erupted permanent teeth was the least amongst the thinnest group. Meanwhile, the obese group had the highest mean value of the erupted permanent teeth. Comparisons amongst the nutritional status categories in relation to the eruption stages, stage 0, stage 3, and the total eruption stages of permanent teeth eruption; there was a highly significant difference between the thinnest group and the other nutritional status groups (Table 4).

ORAL HEALTH STATUS IN RELATION TO RESIDENCE

The sample was more amongst governmental than private orphanages – 132 vs 60 children respectively. Study showed that enamel defect was found more amongst governmental than private orphan children, 70% vs 30% respectively. The relation between types of enamel defect and type of resident, ED1 was more amongst governmental orphanages, with no significant difference, whereas no ED2 was found amongst children in private orphanages and governmental had a significant higher mean. Nevertheless, ED3 had non-significant higher mean amongst private orphanages. Caries had large number amongst governmental and private orphanages with larger prevalence amongst governmental orphanages, 65.88% vs 34.12% respectively. The relation between primary teeth caries and resident, ds had higher mean in private orphanages, whereas ms had higher mean amongst children of governmental orphanages, and both had no significant difference. Regarding fs no one of children of private orphanages had filling in primary teeth so governmental orphanages had significantly higher mean of fs. According to dmfs the higher mean was amongst private orphanages with no significant difference. DS, MS, and DMFS had higher mean amongst children of private orphanages with only DS had significant difference statically. Meanwhile, FS had significant higher mean amongst orphans of governmental orphanages. Total permanent teeth eruption was more amongst children of private than governmental orphanages with no significant difference. With regard to eruption stages (ER0, ER1, and ER2) was more amongst children of governmental orphanages, and only with ER2 was the difference significant. Additionally, ER3 had higher mean amongst children of private orphanages with no significant difference.

DISCUSSION

In this study, the prevalence of the enamel defects for the total sample was 31.13%, which was higher than that reported by Idiculla et al. in India [11]. However, it was lower than that reported by Abd-alalmeer and Al-Haider in Iraq [12]. Studies have found varying estimates of the prevalence of enamel developmental defects. This discrepancy may be attributed to changes in sample size and age, as well as in technical assessment processes (such as the type of lighting used or whether or not the teeth were dried). Another possible explanation for the discrepancies between these studies is that they all used slightly different terminologies and diagnostic criteria [13]. Concerning gender, enamel defect was more common amongst females than males, with significant differences between them. This finding disagreed with that of Abd-alameer and Al-Haider [12]. Variations may exist amongst the studies regarding the sample size. Likewise, an individual may be vulnerable to develop DDEs amongst various groups of children. The age of 6–7 years reportedly falls within the mixed dentition stage. This stage is characterised by the eruption of permanent teeth (mandibular first molars, mandibular central incisors, and upper maxillary first molars) [11]. A significant correlation has been found between delayed eruption and male gender. A statistically significant correlation has also been found between the number of normal eruptions of permanent teeth in females and boys. According to numerous international studies [14, 15], females' permanent teeth began to erupt earlier than those of boys [15]. Herein, the percentage of caries prevalence amongst children in private and governmental orphanages is high at 88.54%, and they were comparablein value. This value was higher than that estimated by Sharma et al. [16], but lower than those estimated by Abdalmajeed [17] . This may be due to different sample size, age, and variations in the methods used for determining the prevalence of dental caries. Environmental factors affect caries etiology, such as the fluoride level in Baghdad's public water supply, which Ahmed et al. [18] estimated to be 0.14 ppm. Males demonstrated significantly higher caries experience for primary dentition than females amongst orphans. This finding may be related to the earlier shedding of deciduous teeth in females than it does in males [15], in contrast to the result of Ahmed et al. [18] but in accordance with that of Khare et al. [19].

Normal weight had the highest prevalence amongst orphan children, consistent with the finding of Abdalmajeed [17]. This may be an indication of improvement in nutritional status amongst Iraqi institutionalised orphan children throughout the current years. The present study revealed that the mean of BMI-age and age had a greater correlation amongst orphan children more than nine years' old. This result disagreed with that in Khare et al. [19], in which institutionalised orphans are found to have the non-significant very weak inverse relationship between BMI and age. Amongst the institutionalised, males had a lower mean BMI than females, with significant relation that agreed with [18]. However, the study failed to reach the level of significance. Caries experience with permanent dentition is found to be higher in the thinness group than in the acceptable weight group of institutionalised orphans. Most of them may be related to low economic background, so they are at high risk for dental caries [20]. Children who are underweight may have a lower DS because their permanent teeth come in later. High quantities of fatty acids may restrict the growth of cariogenic bacteria and reduce the amount of dietary fermentable carbohydrates in overweight/obese people. A fatty layer over plaque prevents sugar from fermenting. Conversely, excessive consumption of caries-protective diets such as high-fat items may account for the reduced prevalence of caries in overweight and obese individuals. In the primary and permanent dentitions of institutionalised orphans, the ms/MS ratio contained a greater proportion of dmfs/DMS than fs/FS. This finding indicated that if therapy was to be administered, it should focus on tooth extraction rather than the preservation of deciduous and permanent teeth. It describes the minimal dental care that these children received. This finding concurred with that of Gunawardane et al. [21]. Enamel defects were greater amongst children in governmental than private orphanages. The highest prevalence was diffuse opacity with a significant difference. Sample size, dental care (which may be more and better in governmental orphanages), and type of nutrition can be the reason for the difference. Eruption of permanent teeth stage 2 was greater amongst orphans of governmental than private orphanages with significant statistical relation. Sample size can explain this difference in addition to the possibility that governmental orphans had more dental care and fillings in primary teeth than those in private (fs had a high prevalence with a significant difference in governmental orphanages, whereas ds was more amongst the private) so this can keep normal space and better oral condition for permanent teeth eruption. Moreover, governmental orphans had a higher mean of BMI, height and weight which can explain the difference. In this study, caries had a larger number amongst governmental and private orphanages, with a larger prevalence amongst private orphanages. Regarding (ds) orphans were low amongst private and governmental, and this finding is in accordance with. The lower (ds) levels seen amongst governmental than private orphans may be partly due to the effectiveness of scheduled dietary control and regular oral-hygiene measures or to the duration of being an orphan because of the effect of neglect [22]. DS amongst orphans of governmental orphanages was less than in private orphanages, with significant differences between them. This result may be explained by low dental knowledge about teeth importance amongst private orphanages and seeking treatment in case of pain only. Amongst institutionalised orphans, caries experience in primary dentition (dmfs) was found to decrease with advanced age. The age difference was significant possibly because of the natural exfoliation of primary teeth. Conversely, caries experience in permanent teeth significantly increased with advancing age, consistent with the result of Abdalmajeed (2016) [17] owing to the eruption of the permanent teeth and establishment of the contact area. The severity of dental caries may continue to increase with age due to the accumulative and irreversible nature of dental caries [23]. Moreover, ds and DS were more amongst private than those in governmental orphanages, whereas fs/FS was more in governmental than private orphanages. Thus, governmental orphanages had more knowledge about dental care and more visit to dental care for orphan children. Furthermore, in relation to the fact that life condition in governmental orphanages is more organised and children may have lived there from age 6 to 12 consistently. Conversely, children in private orphanages can live only for a few months or years.

CONCLUSIONS

The prevalence of enamel defect was low in amongst orphan children. Enamel defect was higher amongst normal weight then overweight children, and teeth eruption (fully erupted teeth) was higher amongst older children (more than 9 years old). We further found that the mean value of permanent teeth eruption increased with increased BMI for age. Caries prevalence amongst children in private and governmental orphanages was high. The caries percentage of primary was amongst normal-weight orphans followed by overweight, whereas of permanent dentition was found to be high amongst the thinness group.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

CORRESPONDING AUTHOR
Rawan Saad AlKadhaly
University of Baghdad
University, intersection, Baghdad, Iraq
e-mail: rawan.Abd2202@codental.uobaghdad.edu.iq

ORCID AND CONTRIBUTIONSHIP
Rawan Saad AlKadhaly: 0009-0006-8118-130X B C D
Muna Saleem Khala: 0000-0002-2184-1568 A C D
Ghada Abdulmunim Mohammed: 0009-0007-7442-2627 D E F

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