IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 12 Ver. II (Dec. 2015), PP 84-94
www.iosrjournals.org

Prevalence of dental caries, gingival status, and enamel defect and its relation to nutritional status among kindergarten children in Sulaimani city

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Abstract: *A sample of 914 children (421males and 49 females) aged 4 and 5 yers old Was randomly selected from different kindergarten in sulaimani city to determine the prevalence and severity of dental caries, gingivitis and enamel Defect in relation to nutritional status and to determine the relation of these oral variables to age , gender. The assessment of nutritional status was performed using anthropometric Measurement. Diagnosis and recording of dental caries and enamel defect were According to the criteria of WHO 1987 and 1997 respectively. Plaque index of Silness and LÖe (1964) and calculus index of Ram fjord (1964) were applied to Assess oral cleanliness. Gingival index of LÖe and Silness (1963) were used for recording gingival health condition.*

The result showed that the prevalence of underweight, stunting and Wasting was found to be 16.4%, 33.0% and 4.7% respectively. The prevalence of malnutrition was higher among females than males, dental caries prevalence was 69.3%, 72.8% and 65.1% for underweight, stunted and wasted children respectively.ds Constitutes the highest mean value among dmfs components for both Malnourished and well nourished. Although underweight , stunted and wasted Children had higher caries experience (dmfs) than that of well nourished groups, The differences were proved to significant for stunted and wasted children Only. Higher plaque and calculus indices were recorded among malnourished Children than wellnourrished children which were proved to be significant for Underweight and stunted children regarding plaque index and wasted children Regarding calculus . The prevalence of gingivitis was found to be 100% for Malnourished children, while 99.9% for wellnourished group. N0 significant differences were found regarding gingival score between malnourished and wellnourished children($p>0.05$) except for stunted children . The prevalence of enamel defect was 52.7% , 44.7% and 51.2% for defect was 52.7% , 44.7% and 51.2% for underweight, stunted and wasted groups respectively. The prevalence was higher among malnourished than well nourished children and higher among males than females except for wasting. Mean number of teeth

with enamel defect was higher among malnourished than well nourishedchildren, the difference was proved to be significant for W/A indicator only.

I. Introduction

Nutrients are substances that are obtained from food and are used by the Body to promote growth, maintenance and repair It involve the intake of food and all the processes involve in digestion , absorption ,transportation , metabolism of nutrient and excretion, thus malnutrition is a poor nourishment resulting from improper diet or some defect of metabolism that prevent the body from utilizing its intake of food properly the relationship among oral health condition , nutritional status and general health are complex with many interrelating factors. The oral cavity is considered to be a mirror of nutritional status of the body. When malnutrition occur during a period of rapid development like during gestation and first few years of life it may caused irreversible effect on developing oral hard and soft tissue Teeth of, children who suffer from protein calorie malnutrition tend to be crowded and rotated possibly caused by inadequate development or retarded growth of the jaw bone (1). An association of delay eruption with malnutrition had been observed in rats fed protein-or protin- calori-deficient diets. An extensive study was conducted for the eruption pattern of deciduous and permanent teeth in Norwegian children during and after world war II . During the war these children showed a delay in the eruption of both dentitions as well as lower weight and height values for their age. A delay in eruption may be associated with a delay in caries acquisition (2). The number of deciduous teeth was lower among malnourished as Compared to the wellnourished(3). Singh et al (2000) (4) stated that "the total number of teeth erupted among malnourished children was lesser than healthy children but this difference was not significany". Malnutrition is undesirable for all tissue; it is even worse for enamel. Once the tooth erupts into the oral cavity, this tissue has no cellular mechanism to repair whatever developmental damage has taken

place and therefore, the lesion is to a large extent irreversible . A cause-effect relationship between nutrition and dental caries has not been directly demonstrated (5), indirect evidence in support of this effect can be found in the studies of Sweeney and Guzman (1966) (6) and Sweeney et al (1969) (7) they found a high prevalence of linear enamel hypoplasia and dental caries in the primary teeth and their association with early infectious episodes. Infante and Gillespie(1976) (8) observed a strong correlation between the degree of linear enamel hypoplasia and caries experience in the

primary teeth of undernourished Guatemalan children. On the other hand, there are a limited number of studies investigating Malnutrition and salivary hypo function in humans (9). In Iraq, few studies concerning nutritional status assessment of preschool Children had done (10) and some studies regarding the Relation of oral health to nutritional status in Baghdad(11 , 12). Beside that there is no previous study in sulaimani city concerning the relation between Nutritional status and oral health , so that this study was conducted.

The aims of this study were to investigate nutritional status of 4and 5 year old preschool children by anthropometric measurement in sulaimani city, and to determine the prevalence and severity of dental caries, gingivitis, dental plaque, and dental calculus and enamel defect of primary teeth in relation to age, sex and nutritional status.

II. Materials and methods

Basic data:

According to a report by the ministry of education (2005) there are (2719) kindergarten children aged 4-5 year old living in sulaimani city including 1234 for four year old (624 females and 610 males) and 1485 for five year old (725 females and 760 males) in 12 kindergarten .

The sample

This survey was conducted among preschool children (4 and 5)year old living in sulaimani city. Prior to data collection permission from the Ministry of Education was obtained in order to meet subjects no obligation. the examination was started 3ʰ of October -2006 till the end of December 2006 . After consulting the variables under the study and depending on the previous Iraq studies(11 ; 12) .The sample size composed of (914) children of 4 and 5 years showing different socioeconomic status distributed in 8 kindergartens which were randomly selected from different areas of sulaimani city. Any children with systemic disease, incomplete information and uncooperative children were excluded. Assessment of anthropometric measurements and oral health status were recorded.

Materials

These materials were used for oral and anthropometric assessments :

1. plane dental mirrors(No.4).
2. Sickle shaped dental explorers(No. 00).
3. Tweezers.
4. Kidney dishes.
5. Cotton.
6. Disinfectant solutions.
7. Portable lamp for artificial illumination.
8. Dram for holding the instruments.
9. A scale for weight records (kangyan).
10. Ordinary measuring tape for recording the height.

Anthropometric measurements

Measurement of weight

Children would be weighted by scale with minimum clothes, without shoes. The scale used should be checked and standardized daily in the morning before weighting children against a known weight of ten kg and adjusted after weighting every 20 children(13).

Measurement of height

The ordinary measuring tape is fixed at the wall, child will be standing up after removing his/her shoes feet parallel to each other and pointed forward and the back of the child is straight in upright position. The knee will be straight and the child's head will be in a position that the line between the lower border of the orbit and the upper margin of the external auditory(Frankfort plane)is horizontal. The sliding head piece is lowered to rest firmly on the head; the measurement should be recorded to the nearest mm (14).

The following indices were used for the purpose of assessment of nutritional status:

1. Weight for age(W.F.A)

2. Height for age(H.F.A)

3-Weight for height(W.F.H)

Because of unavailability of Iraq standard for comparison, the values of nutritional indicators were compared with international reference values, for this purpose it was recommended to use the reference population that defined by the United state national center for Health statistics (USNCHS). A recommendation that endorsed by the WHO (1993) (15) and urged the adequacy of these data for application from different ethnic back ground.

Oral health assessment was performed according to the basic method of oral health survey of the WHO (1987) (16). Examinations were carried out while the child was seated in a straight chair with tall back on which the child head will be rested, portable lamp was used to provide a constant source of light.

Dental caries detected using plane mouth mirror and dental explorer starting from upper right side and ending with lower right side . A tooth should be considered present in the mouth when any part of it is visible or can be touched with the tip of the explorer without unduly displacing of soft tissue. An alphabetical coding used for primary teeth. Dental caries diagnosis was recorded according to WHO (1987) (16) criteria

The examined unite is the surface, the carious lesions were counted for all surfaces of the tooth involved using dmfs .Missing teeth, retained roots , temporary crown were recorded as four surfaces for anterior teeth and five surfaces for posterior teeth .

The examination unites is the tooth ,information on the decayed , missing and filled teeth index can be calculated as follows (dmft)

d-Included all teeth with code B and
C **m**-Included teeth with code E **f**-
Included teeth with code D

Dental plaque thickness adjacent to the gingival margin was assessed following the criteria of Silness and Loe(1964) (17) A modification was done to examine six Ramfjord index teeth that represent the whole primary dentition which includes:

* The maxillary the right second molar
* The maxillary left central incisor
* The maxillary left first molar
* The mandibular left second molar
* The mandibular right central incisor
* The mandibular right first molar

If the permanent tooth was present, it was given a priority over primary tooth in scoring, only fully erupted tooth was scored, a tooth is consider to be fully erupted when the occlussal or incisal surface has reached the occlusal plane. If the index tooth was missing or partially erupted the area would be excluded. Three surfaces would be examined including mesial, buccal and lingual (18).

Gingival index described by Loe and silness (17) was used.

Dental calculus will be recorded following the criteria of Green and Vermilion (1964) (19).

Enamel defect was determined based on modified developmental defect of enamel index (20)

Inter-calibration and intra-calibration had been done to ensure the consistent utilization of the diagnostic criteria for dental caries, periodontal and enamel defect. In ter-calibration had been done with well experiential examiner.

The examination were done for 15 children who were examined twice with a time lap of 14 days between the two examination. These two calibrations were used to assess the significance of observation bias, by using student's t-test and paired t-test respectively. In both of them, there were no significance differences ($p > 0.05$).

Table 1. Inter and intra- calibration of oral variables.

Variables	Calibration	No.	Observation	Mean ± SD	Sig.
dmfs	Inter	15	1st	16.13 7.68	N.S
		15	2nd	18.46 7.79	
	Intra	15	1st	18.46 7.79	N.S
		15	2nd	17.26 6.80	
Pll	Inter	15	1st	0.86 0.42	N.S
		15	2nd	0.73 0.33	
Gl	Inter	15	1st	0.70 0.26	N.S
		15	2nd	0.61 0.30	
CALI	Inter	15	1st	0.10 0.10	N.S
		15	2nd	0.08 0.09	
Enamel defect	Inter	25	1st	0.53 0.43	N.S
		25	2nd	0.56 0.42	
	Intra	25	1st	0.56 0.42	N.S
		25	2nd	0.52 0.43	

After inter and intra-calibration had been performed, examination of 50 children has been carried out to clarify and overcome the difficulty that may occur During our survey regarding our examination and/or collecting the data such as excluding 3 year age because of difficulty in examination and incomplete information regarding the questionnaires.

Data analysis and processing were carried out using statistical package for social science(spss version 13.0).

Statistical tests, that were used in this study, student' s t-test, Paired t-test, Chi-square test, Correlation coefficient(Spearman and pearson).

III. Results

The sample

In this study, the sample consisted of 914 kindergarten children of age four and five years (421 males and 493 females). Table 2 shows the distribution of children examined according to age and gender.

Table 2 Distribution of children according to age and gender

Age	Male		Female		Both	
	No.	%	No.	%	No.	%
4	213	23.30	264	28.88	477	52.18
5	208	22.75	229	25.05	437	47.81
Both	421	46.06	493	53.93	914	100

Anthropometric measurements

Table 3. illustrates the distribution of children according to nutritional status by age and gender using cutoff point-ISD. According to W/A, 16.4% of children was underweight, according to H/A, 33.0% of children was stunted, while regarding to W/H indicator, 4.7% was wasted. Prevalence of malnutrition was found to be higher among females than that among males in both ages. The prevalence of stunted children was higher than underweight and wasted children.

Table 3. Distribution of children according to(eight/Age) ,(Height/Age)and(Weight/Height)indicators by age and gender

Age	Gender	(weight/Age)				(Height/Age)				(Weight/Height)			
		Malnourished		wellnourished		Malnourished		Wellnourished		Malnourished		Wellnourished	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
4	Male	35	16.4	178	83.6	62	29.1	151	70.9	9	4.2	204	95.8
	Female	44	16.7	220	83.3	88	33.3	176	66.7	13	4.9	251	95.1
	Both	79	16.6	398	83.4	15	31.4	327	68.5	22	4.6	455	95.3
5	Male	31	14.9	177	84.1	75	36.1	133	63.9	8	3.8	200	96.2
	Female	40	17.5	189	82.5	77	33.6	152	66.4	13	5.6	216	94.3
	Both	71	16.2	366	83.7	15	34.7	285	65.2	21	4.8	416	95.1
Total	Male	66	15.6	355	84.3	137	32.5	284	67.4	17	4.0	404	95.9
	Female	84	17.0	409	82.9	165	33.4	328	66.5	26	5.2	467	94.7
	Both	150	16.4	764	83.5	302	33.0	612	66.9	43	4.7	871	95.2

The prevalence of dental caries according to nutritional status is demonstrated in Table 4. It reveals that the prevalence of dental caries was 69.3% for underweight children and 71.7% for their well nourished children, 72.8% and 70.5% for stunted and well nourished children respectively, 65.1% and 71.7% for wasted and well nourished group respectively. The prevalence of dental caries was highest among stunted than that among underweight and wasted groups , and highest among a total females than a total males for all indicators.

Table 5 illustrates caries experience(dmfs) according to nutritional status by age and gender. According to W/A, mean dmfs was higher among underweight children than that among their well nourished children but statistically, there was no significant difference($p>0.05$). while regarding to H/A, mean dmfs was significantly higher among stunted children than that among their well nourished group. On the other hand, mean dmfs for

wasted was higher than that among well nourished children. This difference was found to be statistically significant. Mean dmfs was higher among total males than females for all indicators.

Table 4. prevalence of dental caries according to (Weight/Age), (Height/Age) and (Weight/Height) indicators by age and gender

Age	Gender	(Weight/Age) Malnourished No.	no.	%	Wellnourished No.	no. %	(Height/Age) Malnourished No.	no.	%	Wellnourished No.	no. %	(Weight/Height) Malnourished No.	no.	%	Wellnourished No.	no. %
4	Male	35	24	68.5	178	116 65.7	62	42	67.7	151	98 64.9	9	3	33.3	204	13 67.1
	Female	44	28	63.3	220	151 68.6	88	58	65.9	176	121 68.7	13	9	69.2	251	171 68.1
	Both	79	52	65.8	398	267 67.1	150	100	66.6	327	219 66.9	22	12	54.5	455	308 67.6
5	Male	31	19	61.2	177	131 74.0	75	57	76.0	133	93 66.9	8	5	62.5	200	145 72.5
	Female	40	33	82.5	189	150 79.4	77	63	81.8	152	120 78.9	13	11	84.6	216	172 79.6
	Both	71	52	73.2	366	281 76.8	152	120	78.9	285	213 74.7	21	16	76.2	416	317 76.2
Total	Male	66	43	65.1	355	247 69.6	137	99	72.2	284	191 67.2	17	8	47.0	404	282 69.8
	Female	84	61	72.6	409	301 73.6	165	121	73.3	328	241 73.4	26	20	76.9	467	343 73.4
	Both	150	104	69.3	764	548 71.7	302	220	72.8	612	432 70.5	43	28	65.1	871	625 71.7

Table 5. Caries experience(dmfs)according to (Weight/Age), (Height/Age)and (Weight/Height)indicators by age and gender

Age	Gender	(Weight/Age) Malnourished No.	Mean±SD	Wellnourished No.	Mean±SD	t-test	(Height/Age) Malnourished No.	Mean±SD	Wellnourished No.	Mean±SD	t-test	(Weight/Height) Malnourished No.	Mean±SD	Wellnourished No.	Mean±SD	t-test
4	Male	35	5.1 6.2 4.8	178	3.7		62	5.1 6.6 4.3	151	3.5		9	1.7 2.8 4.1 5.1	204		
	Female	44	3.1 3.4 5.3	220	3.9		88	4.1 5.7 4.7	176	3.6		13	3.0 3.8 3.8 5.1	251		
	Both	79	4.0 4.9 5.1	398	3.8		150	4.5 6.1 4.5	327	3.6		22	2.5 3.4 5.1	455	3.9	
5	Male	31	5.5 7.2 6.8	177	5.4		75	6.4 8.1 6.1	133	4.9		8	12.9 18.1 5.1 6.0	200		
	Female	40	7.1 8.2 6.0	189	5.6		77	5.68 5.2 6.9	5.2	152		13	9.4 12.2 5.6 5.9	216		
	Both	71	6.4 7.8 6.4	366	5.5		152	6.0 6.8 6.6	285	5.4		21	10.7 14.4 5.4 5.9	416		
Total	Male	66	5.3 6.7 6.0	355	4.6	Ns	137	5.8 7.4 5.2	284	4.2	2.67	17	6.9 13.5 4.6 5.6	404		Ns
	Female	84	5.0 5.5 5.7	409	4.7	Ns	165	4.9 5.5 6.0	328	4.7	Ns	26	6.2 9.4 4.6 5.6	467		Ns
	Both	150	5.1 6.5 5.8	764	4.6	Ns	302	5.3 6.5 5.6	612	4.4	** 2.1	43	6.5 11.0 4.6 5.6	871		*** 2.01

*p<0.01, d.f= 419; ** p<0.05 d.f=912 *** p<0.05 d.f=912

Regarding the wellnourished children , mean dmfs was higher among total females than males.

The mean ds for both malnourished and wellnourished children was higher than mean ms and fs. Mean value of ds and ms components were higher among wasted children than underweight and stunted groups. While ms mean value was higher among wellnourished group according to H/A indicator than other groups. Mean value of ds was higher among malnourished children than wellnourished children in all indicators.

Statically it was found to be not significant($p>0.05$)except for H/A indicator which was statistically significant.

The mean ms was higher among wellnourished than underweight children but statistically, this difference was not significant ($p>0.05$). Although the mean ms higher among stunted and wasted children than their wellnourished group but statistically, the difference was found to be not significant for stunted ($p>0.05$),while significant for wasted children. Mean fs was higher among wellnourished than malnourished children according to all indicators and statistically, the differences were found to be not significant($p>0.05$).

Table 6. shows the plaque index according to nutritional status by age and gender. The mean values of plaque index for underweight and stunted children were significantly higher than that among wellnourished

children. Although the mean plaque index for wasted were higher than that for well nourished, but statistically , no significant difference was found.

Both underweight and stunted males and females and wasted males had a significantly higher plaque index compared with their wellnourished group.

While no significant difference was found between wasted and wellnourished females regarding plaque index (P>0,05). In general plaque index was found to be higher among males than females among all indicators.

Table 6. plaque index according to (Weight/Age), (Height/Age) and (Weight/Height)indicators by age and gender

Age	Gender	(Weight/Age) Malnourished No. mean±SD	wellnorished No. mean±SD	t-test	(Height/Age) Malnourished No . mean±SD	wellnorished No.. mean±SD	t-test	(Weight/Height) Malnourished No. mean±SD	wellnorished No. mean±SD	t-test
4	Male	35 0.83 0.17 0.78 0.19	178 0.78 0.18		62 0.83 0.20	151 0.78 0.19		9 0.99 0.17	204 0.78 0.19	
	Female	44 0.82 0.20 0.78 0.20	220 0.78 0.21		88 0.80 0.19	175 0.78 0.20		13 0.76 0.22	251 0.79 0.20	
	Both	79 0.83 0.19 0.78 0.20	398 0.78 0.20		150 0.81 0.19	327 0.78 0.20		22 0.85 0.22	455 0.79 0.20	
5	Male	31 0.93 0.26 0.79 0.22	177 0.79 0.22		75 0.83 0.24	133 0.79 0.22		8 0.83 0.25	200 0.81 0.23	
	Female	40 0.84 0.26 0.76 0.18	189 0.76 0.18		77 0.81 0.22	152 0.76 0.18		13 0.79 0.18	216 0.78 0.20	
	Both	71 0.88 0.26 0.77 0.20	366 0.77 0.20		152 0.82 0.23	285 0.77 0.20		21 0.80 0.20	416 0.79 0.21	
total	Male	66 0.88 0.22 0.79 0.21	355	* 3.2	137 0.83 0.29 0.78 0.20	284	◘ 2.04	17 0.91 0.22	404 0.79 0.21	₪2.1
	Female	84 0.83 0.23 0.77 0.19	409	** 2.35	165 0.81 0.20 0.77 0.19	328	◘◘ 2.10	26 0.77 0.20	467 0.78 0.20	Ns
	Both	150 0.83 0.23 0.78 0.20	764	*** 3.89	302 0.82 0.21 0.78 0.20	612	◘◘◘ 2.92	43 0.83 0.21	271 0.79 0.20	Ns

*P<0.01;d.f=419,**P<0.05;d.f=491 ◘P<0.05;d.f=419,◘◘P<0.05;d.f=491

₪P<0.05;d.f=419

***P<0.01;d.f=912 ◘◘◘P<0.01;d.f=912

Regarding three indicators , the prevalence of gingivitis for malnourished children was 100%, while for wellnourished group was 99.9% Gingival index according to nutritional status by age and gender is demonstrated in Table 7 . Gingival index was found to be higher among males than females . Although , thre were no significant differences in gingival index between malnourished and wellnourished groups, except stunted children, the mean gingival index among malnourished groups was higher than that among wellnourished groups. Total stunted males had significantly higher gingival index than their wellnourihed males group. Mean gingival index was found to be higher among males than females.

Table 7. Gingival index according to (Weight/Age), (Height/Age) and (Weight/Height)indicators by age and gender

Age	Gender	(Weight/Age) Malnourished No. Mean±SD	Wellnorished No. Mean±SD	t-test	(Height/Age) Malnourished No. Mean±SD	Wellnorished No. Mean±SD	t-test	(Weight/Height) Malnourished No. Mean±SD	Wellnorished No. Mean±SD	t-test
4	Male	35 0.64 0.15 0.18	178 0.60		62 0.64 0.18 0.18	151 0.60		9 0.37 0.16 0.18	204 0.61	
	Female	44 0.61 0.21 0.23	220 0.62		88 0.64 0.21 0.23	175 0.61		13 0.55 0.20 0.23	251 0.63	
	Both	79 0.63 0.18 0.21	398 0.61		150 0.64 0.20 0.21	327 0.61		22 0.62 0.20 0.20	455 0.62	
5	Male	31 0.64 0.25 0.19	177 0.64		75 0.67 0.22 0.19	133 0.62		8 0.57 0.23 0.20	200 0.64	
	Female	40 0.61 0.19 0.20	189 0.63		77 0.63 0.16 0.21	152 0.63		13 0.63 0.22 0.20	216 0.63	
	Both	71 0.63 0.22 0.19	366 0.64		152 0.65 0.20 0.20	285 0.63		21 0.61 0.22 0.20	416 0.62	

*P<0.05;d.f=2, **P<0.05;d.f=2

Table 8. Calculus index according to (Weight/Age), (Height/Age) and (Weight/Height)indicators by age and gender

Age	Gender	(Weight/Age) Malnourished No. mean±SD	wellnorished No. mean±SD	t-test	(Height/Age) Malnourished No . mean±SD	wellnorished No.. mean±SD	t-test	(Weight/Height) Malnourished No. mean±SD	wellnorished No. mean±SD	t-test
4	Male	35 0.3 0.8 178 0.1 0.03			62 0.8 0.6 151 0.3 0.4			9 50 1 204 0.2 0.3		
	Female	44 5 0.7 220 0.1 6			88 0.6 0.5 175 7 7			13 0 0 251 5 6		
	Both	79 3 0.7 398 0.1 5			150 0.7 0.5 327 4 5			22 3 1 455 3 4		
5	Male	31 20 0 177 0 30			75 50 46 133 0.8 0.9			8 500 14.1 200 6 0.7		
	Female	40 0.5 0 189 0 0.5			77 0 0 152 0.7 0.5			13 0 0 216 0 0.4		
	Both	71 10 0 366 0 20			152 20 32 285 0.7 0.7			21 1.9 87 416 0.5 0.6		
total	Male	66 10 0.6 355 0.08 21		Ns	137 20 34 284 0.6 0.7		Ns	17 2.3 9.69 404 0.4 0.6		* 5.06
	Female	84 3 0.5 409 0.06 5		Ns	165 0.3 0.3 328 4 50		Ns	26 0 0 467 3 4		Ns
	Both	150 7 0.5 764 0.07 14		Ns	302 10 23 612 2 4		Ns	43 90 6 871 1 3		** 4.3

*P<0.01;d.f=491 * *P<0.01;d.f=912

Table 8. demonstrates the mean value of calculus index according to nutritional status by age and gender. Although calculus was very low in these ages but there was a significant difference between wasted and wellnourished children. For underweight and stunted children there were no significant differences with their wellnourished group(P>0.05).

Prevalence of enamel defect according to nutritional status by age and gender is illustrated in Table 9 The prevalence of enamel defect was higher among malnourished children than wellnourished children according to all indicators. Beside that ,the percentage was highest among underweight children than wasted and stunted Also it was higher among underweight and stunted males than females while wasted females had higher enamel defect than wasted males .

Table 9 Prevalence of enamel defect according to (Weight/Age), (Height/Age) and (Weight/Height)indicators by age and gender

Age	Gender	(Weight/Age) Malnourished			wellnourished			(Height/Age) Malnourished			wellnourished			(Height/weight) Malnourished			wellnourished		
		No.	**no.**	**%**	**No.**	**no.**	**%**	**No.**	**no.**	**%**	**No.**	**no.**	**%**	**No**	**no.**	**%**	**No.**	**no.**	**%**
4	Male	35	22	62.9	178	77	43.3	62	37	59.7	151	62	41.1	9	3	33.3	204	96	47.1
	Female	44	20	45.5	220	94	42.7	88	33	37.5	176	81	46.0	13	5	38.5	251	109	43.4
	Both	79	42	53.2	398	171	43	150	70	46.7	327	143	43.7	22	8	36.4	455	205	45.1
5	Male	31	15	48.4	177	61	34.5	75	32	42.7	133	44	33.1	8	4	50	200	72	36.0
	Female	40	22	55.0	189	55	29.1	77	33	42.9	152	44	28.9	13	10	76.9	216	67	31.0
	Both	71	37	52.1	366	116	31.7	152	65	42.8	285	88	30.9	21	14	66.7	416	139	33.4

Total	Male	66	37	56.1	355	138	38.9	137	69	50.4	284	106	37.3	17	7	41.2	404	168	41.6
	Female	84	42	50	409	149	36.4	165	66	40.0	328	125	38.1	26	15	57.7	467	176	377
	Both	150	79	52.7	764	287	37.6	302	135	44.7	612	231	37.7	43	22	51.2	871	344	39.5

Table 10 shows the mean number of teeth with enamel defect according to the three indicators by age and gender. Mean value of enamel defect was highest among underweight than wasted and stunted. It reveals than the mean number of teeth with enamel defect was higher among malnourished children than wellnorished children for all indicators. Statistically, these differences were found to be not significant for H/A and W/H indicators(P>0.05), while significant difference was found regarding W/A indicator.

Table 10. Mean number of teeth with enamel defect according to (Weight/Age), (Height/Age) and (Weight/Height)indicators by age and gender

Age	Gender	(Weight/Age) Malnourished No. Mean±SD	Wellnorished No. Mean±SD	t-test	(Height/Age) Malnourished No . Mean±SD	Wellnorished No.. Mean±SD	t-test	(Weight/Height) Malnourished No. Mean±SD	Wellnorished No. Mean±SD	t-test
4	Male	35 2.11 1.52	2.20 178 2.16		62 1.83 1.53	2.05 151 2.23		9 1.00 1.65	1.80 204 2.19	
	Female	44 1.22 1.43	1.72 220 2.03		88 1.95 1.50	2.98 176 2.00		13 1.07 1.41	1.60 251 2.00	
	Both	79 1.62 1.47	1.98 398 2.09		150 1.45 1.51	1.99 327 2.11		22 1.04 1.52	1.64 455 2.09	
5	Male	31 1.96 1.14	2.66 177 1.91		75 1.64 1.80	2.41 133 1.06		8 1.62 1.25	2.19 200 2.05	
	Female	40 1.90 1.04	2.43 189 2.53		77 1.32 1.12	2.17 152 2.70		13 2.38 1.12	1.55 216 2.56	
	Both	71 1.92 1.09	2.52 366 2.25		152 1.48 1.09	2.29 285 2.32		21 2.09 1.18	1.81 416 2.33	
total	Male	66 2.04 1.33	2.41 355 2.05	* 2.49	137 1.72 1.31	2.25 284 2.05	Ns	17 1.29 1.45	1.96 404 2.13	Ns
	Female	84 1.54 1.25	2.10 409 2.28	Ns	165 1.24 1.32	2.04 328 2.35	Ns	26 1.73 1.27	1.68 467 2.28	Ns
	Both	150 1.76 1.29	2.25 764 2.17	** 2.42	302 1.46 1.32	2.14 612 2.22	Ns	43 1.55 1.36	1.79 871 2.21	Ns

*P<0.05;d.f=419, **P<0.05;d.f=912

IV. Discussion

This study was designed to estimate the nutritional status and its relation to oral health status of preschool children in Sulaimani city. The collected data are intended to be used as a base line in evaluating the future efforts to improve health preventive program of the population .

In nutritional studies, choices of malnutrition definition are important for comparison of the findings of different researches. From the public health point of view, the important problem is marginal malnutrition. Therefore , in prevalence studies one need classification on severity , so that it is possible to distinguish normal subject at one hand and mild, moderate and sever malnutrition on the other hand. The objective of using fixed cut-of point (-ISD)is than they represent purely statistical separation of malnutrition from normal(21).NCHS reference population was recommended as normulative value for international use (22). Beside that . in present study _ISD was used as acut –off point because although it is a mild one but has an effect on many body tissues (23).

The prevalence of malnutrition according to (Weight/Age),(Height/Age) and (Weight/Height) was found to be 16.4%, 33.0% and 4.7 % respectively. The comparison of malnutrition of present study with other is difficult due to using different criteria and classification of malnutrition. However, the prevalence of malnutrition in present study was higher than that reported by Gataa (2005) (11) and lower than that reported by Al-Obaidi(1995) (24) and Hassan (2006) (12) except for

stunted children which was higher. The prevalence of malnutrition was higher among females than males for all indicators. This finding is in contrast with other investigations (11,12,24). They attributed their results to the fact that Y chromosome is weaker than X chromosome, while it is agreement with Al-Sa'ati result(1976) (25) who attributed to the cultural preference of boys that receiving more parental care and better food supplements.

The percentage of stunted children was higher than other types. This finding is in accordance with the finding reported by Gataa(2005) (11), howver, it is in contrast with Al-Obaidi(1995) (24) studies. This controversy can be attributed to the use of different cut-off point. To emphasis this, in Abu Slaih study (1993) (26) underweight was more prevalent type of malnutrition if –ISD was used as a cut-off point. Than maternal education is significantly associated with nutritional status of children but father's education is unrelated to children's nutritional status.

In present study, although dental caries prevalence was higher among stunted than that among their wellnourished group and vice versa for underweight and wasted children , the dental caries experience (dmfs) was higher among underweight children than wellnourashed children , it was found to be statistically not significant. While wasted children have a significantly higher dental caries severity than their wellnourished groups. This result is in accordance with previous Iraqi studies (12,24) regarding wasted children On the other hand, the higher caries severity is in agreement with Al-Obaidi study (1995) (24) and disagreement with Hassan result (2006) (12) regarding stunted group and in accordance with that reported by Hassaan (2006)(12) regarding underweight children. This finding may be due increase susceptibility of teeth to dental caries in malnourished children as result of changing in tooth formation, changes in saliva composition function jaw development (27,28).

Although the prevalence of malnutrition and dental caries were higher among females than males but dmfs mean value was higher among total males than females. This result which is in agreement with Al-Obaidi study(1995) (24) may be attributed to the effect of delayed eruption of teeth as a result of malnutrition was mor among malnourished females(23). Wasted children had a highest caries experience (dmfs) than the stunted and underweight children. The higher dental caries than stunted group which is in accordance with (12,24) may be attributed to the effect of chronic malnutrition on tooth eruption was mor than acute (23);therefore caries would be developed later in life.

According to age, caries experience was found to be increase with age for both groups,it was higher among 5 years than 4 years, this finding which is in agreement with Al-Obaidi(1995) (24) may be attributed to irreversible and accumulative nature of the disease(29). The mean of decayed surface for both malnourished and wellnourashed groups was higher than mean of missed and filled surfacea. This result is in agreement with finding that reported by Al-Obaidi (1995) (24), who attributed to parent's ignorance toward dental education. Ms component was higher than fs component coul d be due to restriction of therapeutic toward extraction more than restorative type; which is completely absence among all malnourished groups. While ds and ms components were higher among malnourished groups. The differences between ds components among malnourished and wellnourished children were found to be not significant except for H/A, which may be attributed to long effect of chronic malnutrition on tooth formation that make it more susceptible to dental caries (2).

In the present study, the mean plaque was found to be higher among malnourished than wellnourished children. This result is in agreement with the finding that reported by Al-Obaidi(1995) (24) which may attributed to that most of malnourished children are in low socioeconomic families (FAO/WHO/1992) that less care to their children and they thought that tooth brushing and oral hygiene is not so important things. For both malnourished and wellnourished groups, the higher plaque index among males than females may be due to that females take care for their teeth more than males and they thougt that teeth is one of the s=esthetic things in human. Highly significant differences that recorded regarding and (acute and chronic) malnoutrition have more adverse effect on oral hygiene than acute one.

In both malnourished and wellnourished children the mean calculus was found to be very low which may be due physiological property of saliva (30). The calculus found to be higher among malnourished than wellnourished children, this result is in agreement with Al-Obaidi study (1995) (24) who attributed to that in malnourished children there is ignorance of oral hygiene so more plaque accumulated , beside that, in malnourished children the changes occur in salivary gland secretion and composition that help the calcification of dental plaque to calculus (31,32).

The higher gingival mean was found among malnourished children than wellnourashed children for all indicators, this result is agrees with other studies (Sawyer and Nwoku, 1985) (33) they attributed the occurrence and severity of gingivitis to the deterioration in nutritional status. Also nutritional deficiency may reduce host resistance to plaque associated microorganisms (34) by inducing the susceptibility mucosal surfaces to increase invasion of the microorganisms and by producing in salivary flow and composition (35). A stunted group had a higher gingival mean than the other groups, this result which is in agreement with Dashash study (2002) (36) may be attributed to that the chronic malnutrition had more effect on tissues than other types (37).

The prevalence of enamel defect in this study was found to be higher among malnourashid children than wellnourshed children, as mean number of teeth with developmental defect of enamel. This finding is in agreement with Rugg-Gunn et al study(1997) (38) Prevalence of enamel defect was higher among males than females for two groups(underweight and stunted) which may attributed to that the potential factors contributing to gender differences in the expressing of enamel hypoplasia, bearing on two central issues: The first is the impact of theorized inherent males vulnerability to physiological stress on gender differences in enamel hypoplasia; the second issue is the potential contribution to gender differences in enamel hypoplasia of the intrinsic differences in males and females enamel comsition and development. Based on the concept of inherent male's vulnerability males on stressful environment would be expected to exhibit higher enamel hypoplasia than females (39). Among wasted females the prevalence of enamel defect was higher than males, this finding is agrees with Gataa (2005) (11) who attributed to the earlier eruption among females than males. The white opacities were the most common type of enamel defect was seen in the present study as well as reported by other previous Iraqi studies (40).

In conclusion the prevalence of stunting was highest than underweight and wasting and malnutrition was more prevalent among females than males.

the prevalence of dental caries was 72.8%, 69.3% and 65.1% for stunted underweight and wasted children respectively. malnourished children had a higher mean dmfs than wellnourished group but it is proved to be statistically significant for H/A and W/H only. Higher gingival, dental plaque and calculus scores were found among malnourished children than that of wellnourished groups. The prevalence of enamel defect was found to be 52.7%, 51.2% and 44.7%

Another study is needed to be extended to involve other parts of Kurdistan region to obtain a national base line data for planning oral and dental preventive programs. A longitudinal study is needed to assess the nutritional status and its effect on the development, maintenance and subsequent challenge of oral tissue.

Other studies are needed to evaluate the relation of nutritional status on chemical and microbial composition of dental plaque. Laboratory investigations are needed to evaluate nutritional status and its relation to oral condition.

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