Nutritional Status Effect on Gingival Health Condition in Relation to some Salivary Elements among Fifteen-years Old Adolescents

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Abstract:

Background: Malnutrition in human life may adversely affect various aspects of growth and increase the severity of oral health problems. This study was conducted among malnourished adolescents aged 15 years in comparison to well-nourished group to determine gingival condition in relation to salivary zinc, magnesium, sodium and potassium.

Material and methods: The sample of the present study included 89 malnourished and 95 well-nourished students aged 15 years. The body mass index was used to determine the nutritional status. Diagnosis of dental plaque and gingival health condition were recorded through the application of plaque index and gingival index. The stimulated saliva was collected to determine salivary zinc, magnesium, sodium and potassium.

Results: The mean plaque and gingival index value among malnourished were lower than those of well-nourished groups, with no significant difference [$P > 0.05$] and significant difference [$P < 0.05$] respectively. The mean values of all inorganic salivary elements were lower among malnourished group than well-nourished group with highly significant difference [$P<0.01$]. No significant correlation was recorded between gingival index and all salivary elements in malnourished group; whereas a positive statistically significant correlation was indicated for salivary zinc in well-nourished group.

Conclusion: Malnutrition affect on lower gingivitis and reducing salivary zinc, magnesium, sodium and potassium.

Keywords: Malnutrition, dental plaque, gingival health, stimulated salivary element.

Introduction:

Adequate nutrition is important to growth and maintenance of the oral tissues. The mouth is often described to be the mirror of the body [1]. The soft tissues of the oral cavity are made up of epithelial cells that have rapid rates of replication, metabolism, and maturation which require a steady supply of essential nutrients. Typically, these cells have a turnover of every three to seven days [2], making tissues of the oral cavity a sensitive indicator of adequate nutritional status [3,4]. Malnutrition may influence the biological gradient and adversely affect the prognosis of periodontal conditions [5]. So it may affect on the susceptibility of periodontal tissue either directly or indirectly through the following channels: by alterations in the differentiation, development and maturation of gingival margin, attachment epithelia, periodontal membrane and alveolar bone. This is done by changes in supporting soft tissue structures and by differences in functional ability of saliva [6,7]. Studies reported an inversely relationship between protein intake and gingivitis [8,9]. Similarly, other study found insignificant difference between the amount of salivary protein and the gingival index among over-nutrition condition [10].

Material and Methods:

Assessment of nutritional status was done through using body mass index BMI to determine the nutritional status of adolescent aged 15 years. The BMI index represents a number that is calculated from weight and height according to the following formula:

$$\text{BMI} = \frac{\text{Weight [Kg]}}{\text{Height [meter]}^2}$$

Once again, no BMI database for Iraqi was available for comparison. Therefore, the reference population defined by the National Centre for Health Statistics, in collaboration with the National Centre for Chronic Disease Prevention and Health promotion was recommended, together with the tabulated Z-score of WHO depending on age and gender [2007]. In this study, the cut-off point of BMI at SD below -2 was used to determine the person as malnourished, the SD between median and below +1 for well-nourished. Examinations and oral health assessments were performed according to the basic method proposed by WHO [1997] [11]. Clinical examinations were performed by using plane mouth mirror and dental explorer. Dental plaque thickness adjacent to gingival margin was assessed following the criteria of Silness and Löe [1964] [12]. For diagnosis and assessment of gingival health condition, gingival index described by Löe and Silness [1963] [13] was used. The collection of the stimulated salivary samples from the individuals was formed under standardized conditions [14]. The Atomic Absorption Spectrophotometer was used to determine zinc, magnesium, sodium and potassium.

Results:

Results observed that the mean value of plaque among malnourished was lower than well-nourished, with no statistically significant difference [$P > 0.05$]. Similar picture was recorded for males. While among females the mean values of plaque for malnourished group was higher than well-nourished. But there was no statistically significant difference [$P > 0.05$]. Concerning gingival index, the results demonstrated that the mean gingival index was lower among malnourished group than well-nourished group with significant difference [$P < 0.05$]. Concerning males, the same finding was recorded with significant difference [$P< 0.05$]. While no significant difference was recorded for the mean gingival value among females [$P>0.05$] as shown in table 1.

Data of the present study showed that all inorganic salivary elements that studied in the

present study were lower among malnourished group than well-nourished group with highly significant difference [P<0.01]. Similar picture was found among males. While among females, data of the present study showed that all inorganic salivary elements that studied in the present study were lower among malnourished group than well-nourished group with highly significant difference[P<0.01], except potassium whereby the difference were not significant [P> 0.05] as shown in table 2.

Concerning malnourished students, the relations for the total sample between mean plaque index and zinc and magnesium were not significant in positive direction, while in negative for the other elements. Data analysis in each gender showed that among males the relations between plaque index and zinc, potassium were in positive direction while other were negative direction, however these relations were not significant. While among females, data showed that the relations between mean plaque index and sodium and potassium were in negative direction while other were in positive direction however these relations were not significant. Concerning well-nourished students, the relations for the total sample between plaque index and all salivary elements were in positive direction. Data analysis in each gender showed that among males the relation was not significant in positive direction for all salivary elements. While among females the relations were not significant in negative direction concerning zinc and in positive direction for the other elements as shown in table 3.

Concerning malnourished students, the relations for the total sample between mean gingival index and zinc was in positive direction, while in negative for the other elements, however all these relations were not significant. Data analysis in each gender showed that among males the relations between mean gingival index and zinc and potassium were not significant in positive direction while other were in negative direction, all these relations were not significant except concerning sodium whereby the relation was significant in negative direction. While among females, the relation between gingival index and magnesium was in positive direction while other were in negative direction however these relations were not significant. Concerning well-nourished students, the relation for the total sample between gingival index and all salivary elements were in positive direction however these relations were not significant except concerning zinc whereby the relation was significant in positive direction. Data analysis in each gender showed that among males the relation between gingival index and sodium was not significant in negative direction, while in positive for the other elements. While among females the relations was not significant in negative direction concerning potassium, while in positive for the other elements as shown in table 4.

Table [1]: Mean plaque and calculus index among malnourished and well-nourished groups students aged 15 years by gender.

		Malnourished			Well-nourished			Statistical tests	
	Gender	**No.**	**Mean**	**±SD**	**No.**	**Mean**	**±SD**	**Z –value**	**P-value**
Plaque Index	**Males**	44	0.808	0.427	47	0.941	0.513	-0.965	0.334
	Females	45	0.795	0.348	48	0.753	0.289	-0.471	0.638
	Total	89	0.801	0.387	95	0.846	0.424	-0.300	0.764
Gingival Index	**Males**	44	1.111▲	0.441	47	1.326▲▲	0.456	-2.289*	0.022
	Females	45	0.880	0.430	48	0.965	0.428	-0.974	0.330
	Total	89	0.995	0.448	95	1.144	0.476	-2.200*	0.028

[*P<0.05, **P<0.01 between malnourished and well-nourished] [▲P<0.05, ▲▲ P<0.01 between males and females]

Table [2]: Concentration of inorganic salivary elements among malnourished and well-nourished students aged 15 years by gender.

		Malnourished			Well-nourished			Statistical tests	
	Gender	**No.**	**Mean**	**±SD**	**No.**	**Mean**	**±SD**	**Z-value**	**P-value**
Zinc [ppm]	**Males**	44	0.0612▲▲	0.022	47	0.128▲▲	0.058	-6.105**	0.000
	Females	45	0.048	0.020	48	0.076	0.057	-4.728**	0.000
	Total	89	0.054	0.022	95	0.102	0.063	-6.765**	0.000
Magnesium [ppm]	**Males**	44	1.046▲▲	0.820	47	3.836	2.815	-7.321**	0.000
	Females	45	2.362	0.595	48	3.260	1.636	-3.908**	0.000
	Total	89	1.711	0.972	95	3.545	2.302	-8.283**	0.000
Sodium [mmol/L]	**Males**	44	6.191	2.664	47	7.692▲	2.431	-3.356**	0.001
	Females	45	5.207	1.395	48	6.571	2.094	-3.916**	0.000
	Total	89	5.693	2.164	95	7.125	2.324	-5.181**	0.000
Potassium [mmol/L]	**Males**	44	12.205	2.993	47	15.638▲	4.331	-3.804**	0.000
	Females	45	12.467	3.672	48	13.625	3.813	-1.254	0.210
	Total	89	12.337	3.337	95	14.621	4.180	-3.630**	0.000

[*P<0.05, **P<0.01 between malnourished and well-nourished] [▲P<0.05, ▲▲ P<0.01 between males and females]

Table [3]: Correlation coefficient [r] between mean plaque index and inorganic salivary elements among malnourished and well-nourished students aged 15 years by gender.

	Gender	Malnourished		Well-nourished	
		R	P	R	P
Zinc [ppm]	Males	0.168	0.275	0.192	0.197
	Females	0.066	0.669	-0.127	0.391
	Total	0.040	0.709	0.102	0.324
Magnesium [ppm]	Males	-0.102	0.508	0.137	0.359
	Females	0.083	0.586	0.031	0.832
	Total	0.038	0.727	0.100	0.337
Sodium [mmol/L]	Males	-0.127	0.413	0.021	0.891
	Females	-0.107	0.485	0.283	0.052
	Total	-0.098	0.363	0.179	0.083
Potassium [mmol/L]	Males	0.058	0.708	0.258	0.080
	Females	-0.174	0.252	-0.194	0.186
	Total	-0.070	0.517	0.090	0.386

** P<0.01

Table [4]: Correlation coefficient [r] between mean gingival index and inorganic salivary elements among malnourished and well-nourished students aged 15 years by gender.

	Gender	Malnourished		Well-nourished	
		R	P	R	P
Zinc [ppm]	Males	0.144	0.351	0.218	0.142
	Females	-0.017	0.913	0.140	0.344
	Total	0.091	0.396	0.349**	0.001
Magnesium [ppm]	Males	-0.095	0.539	0.112	0.455
	Females	0.009	0.951	0.036	0.810
	Total	-0.200	0.060	0.118	0.255
Sodium [mmol/L]	Males	-0.310*	0.041	-0.144	0.334
	Females	-0.016	0.917	0.187	0.202
	Total	-0.147	0.170	0.134	0.195
Potassium [mmol/L]	Males	0.081	0.601	0.217	0.143
	Females	-0.161	0.291	-0.029	0.843
	Total	-0.059	0.582	0.178	0.085

* P<0.05 ** P<0.01

Discusion:

In the present study among well-nourished group aged 15 years, the mean plaque and gingival values were lower than those of Al-Azawi [15]. These might be attributed to the differences in the sample size, criteria for assessment and environmental condition, and the differences demonstrated in gingival index between males and females were significant and highly significant for both malnourished and well-nourished groups respectively. However, there might be an increase in their social awareness and they might be oriented towards behaviour resulting in improvement of oral hygiene, particularly among the females. This is also confirmed by findings of the present study that illustrated a significant difference in mean gingival index between gender, as females demonstrated healthier gingival than males, a finding which goes in line with Al-Azawi [15]. When females seemed to be more concerned about their oral hygiene compared to males this explains a higher mean plaque index for students aged 15 years among males than females in both malnourished and well-nourished groups, this finding coincides with other studies [10, 15].

The gingival health condition is not attributed to plaque only. Salivary physicochemical properties were in relation to plaque and gingival indices [16]. This confirm by results of present study that showed inverse relation between gingival index severity and concentration of salivary zinc among permanent dentitions. Zinc is a necessary component of many enzymes. It participates in an early phase of collagen metabolism, as well as diminishes the production of acids in a dental plaque in a way of enzymatic inhibition, causing oxidation of thiolic groups in main enzymatic systems of carbohydrate metabolism [17].

Generally, a well balanced diet is required to maintain an optimal general and oral health, especially when adequate amounts of protein, vitamins, essential fatty acids and micronutrients because they play important roles in the health of periodontal tissues [18,19]. The result of present study showed that lower mean plaque and gingival indices

among malnourished students aged 15 years in comparison to well-nourished group.

This could be attributed to the difference in concentration of salivary elements especially in the present study whereby zinc was found to be lower among malnourished students. It is important to note that zinc deficiency is related to the increase in the severity of periodontal disease [20, 21].

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