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Dental Caries Experience and Severity in Relation to Salivary TNF- α and AlP in a Group of Overweight Children Compared with Normal Weight Children

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Abstract: ***Some factors released by the human body have an effect on bodyweight and dental caries experience and severity especially in children. So this study was designed to explore the relation of the salivary TNF-α and salivary AlP with the dental caries of two groups of normal weight and overweight children. Thirty six school children were selected randomly for the study to explore the dental caries occurrence and severity. The total sample consisted of two groups; normal weight and overweight children. CDC growth chart was used for both genders to determine the weight status according to age and gender. Dental caries experience was recorded by dmfs, DMFS for primary and permanent teeth respectively. Dental caries severity was recorded by(d1, d2, d3, d4), (D1, D2, D3, D4) for primary and permanent teeth respectively. Salivary samples were collected in a plane tube, for biochemical analysis for the TNF-α and AlP. There was non-significant relation of the dental caries either by experience or severity to the level of salivary TNF-α and salivary AlP in both normal weight and overweight children.***

Keywords: TNF-α, AlP, saliva, overweight, dental caries

1. Introduction

TNF-α is a type of cytokines, released by the host when there is inflammatory response. Dental caries or trauma are normally cause inflammatory responses in the dental pulp that will induce the release of TNF- α. [1,2]

Release of various cytokines by caries affected pulp and/or odontoblasts was reported by many studies, examples of these cytokines are: transforming growth factor-b1 (TGFb1), vascular endothelial cell growth factor (VEGF), IL-1b, IL2, IL4, IL6, IL10,IL11, interleukin 8 (IL8/CXCL8), C-C chemokine ligand 2 (CCL2/MCP1), CCL20/MIP3a, CXC chemokine ligand 10 (CXCL10), interferon-g (IFN-g), epithelial cell-derived neutrophil attractant 78 (ENA78) and tumor necrotic factor- α (TNF- α). [3-6]

Variety of diseases are associated with increased level of certain cytokines such as tumor necrosis factor-alpha (TNF-α), interleukin-1_ (IL-1_), IL-6, IL-8, and epithelial cell-derived neutrophil attractant 78 (ENA-78); which considered as pro-inflammatory factors causing both local and systemic inflammatory responses. [7-11]

Furthermore a study made by Kim et al. reported that TNF-α and IL-1β pathways could be induced by S.mutans. [12]Beside that, there was a significant high level of TNF-α (P=0.041) in extracted fluid from amalgam restored teeth. [13]

Some studies found that individuals with class III obesity and non-alcoholic steatohepatitis showed higher body mass index (BMI) and higher TNF-α mRNA expression in the white adipose tissue compared to that of patients with non-alcoholic fatty liver disease (p=0.01, for all associations). In addition the obese mothers exhibited higher levels of serum TNF-α. [14, 15]

Conversely; some studies showed that the TNF-α and BMI were not associated and its level did not reduce obesity. [16,17] Some authors found that the levels of TNF-α in adipose tissues of obese rats, suggest improvement of inflammation and administration of mice by TNF-α reduced the body gain and fat-pad weight. [18, 19]

There was a positive correlation between the salivary alkaline phosphatase and the dental caries as stated by many researchers. [20-25] Furthermore a previous study measured the level of salivary alkaline phosphatase among three groups (severe, moderate and caries free) and revealed a non-significant difference. [26] Numerous studies have been performed to determine whether an association exists between overweight/obesity and caries; however, the results of these studies have been inconsistent. [27-29] Many studies reported a strong relation between the overweight status of patients with high prevalence of dental caries [27,28,30-34], on the other hand;other studies said that there is no relation between the two [29,35-39] , while another study found that there was an inverse relation between the caries activity and the BMI [40].

2. Aims of the Study

This study was designed to explore the relation of the salivary TNF-α and salivary AlP with the dental caries experience and severity of two groups of normal weight and overweight children.

3. Materials and Method

One hundred six school children were selected randomly for the study to explore the dental caries occurrence according to WHO 1987 [41], dental caries severity according to the criteria

of Manjie et al, 1989 [42] , salivary samples were collected according Fejerskov and Thylstrup[43]

1) The patient should not eat or drink (except water) one hour before saliva collection.
2) A pre – sampling period of one minute is recommended.
3) A fixed collection time (10-15 min. for unstimulated saliva) should be used.
4) The patient should sit in a relaxed position in an ordinary chair.
5) Samples containing blood should be discarded if chemical analyses of saliva are planned.

Saliva collected in a plane tube, centrifuged 10 minute at 3000 xg, and the centrifuged supernatant liquid was stored in deep freeze at (-20ºC) till the time of biochemical analysis for alkaline phosphatase detection by different volume of sample (20, 40, 60, 80 and100) µl. The salivary AlP activity was spectrophotometrically determined according to the recommendation of the German Clinical Chemistry Association (using the kit of Human Company, Germany). The detection of TNF-α was performed by using ELISA kit at wave length 570 nm. The principle of detection was determined by double-sandwich Elisa technique. The pre-coated antibody was human TNF-α monoclonal antibody and the detecting antibody is polyclonal antibody with biotin labeled.

The weight status was performed by measuring the child's weight in Kilograms using a digital balance, and dividing it to the square value of the child's length measured by using ordinary measuring tab fixed at the wall while the patient stood in front of the tab, then by putting a straight object on its top point to mark the proper reading, by this equation the BMI was gotten; a CDC growth chart was used for both genders to determine the weight status according to age and gender. Consent from the school director was taken by a written form according to the low of ministry of education. Data analysis was done by using SPSS version 25.

4. Results

The distribution of the total sample (106) consisted of (58.5%) children in normal weight group, and (41.5%) overweight children (Table1).

Mann-Whitney test for comparing the level of salivary TNF and AlP in both normal weight and overweight groups revealed a statistically non-significant difference (Table 2).

Caries experience in primary and permanent teeth in most of their fractions (ds, dmfs, DS, FS, DMFS) between normal weight and overweight children, were higher in normal weight than overweight children although with statistically non-significant differences (for all fractions) (Table 3).

Caries severity was higher only for the d2, D1 fractions in the overweight group than normal weight group although with statistically non-significant difference. All the rest fractions were higher or equal in normal weight group than overweight with statistically non-significant difference. (Table4)

Correlation coefficient (Spearman's rho) for the AlP with caries experience and caries severity in primary teeth revealed negative (except d1, d3, dmfs in normal weight group which was positive), weak, statistically non-significant relation (Table5).

On the other hand, correlation coefficient (Spearman's rho) for the TNF with caries experience and severity in primary teeth revealed positive (for the d3,d4 in normal weight group and d1, d3, and dmfs in overweight group) or negative (for the d1, d2, dmfs in the normal weight group and d2, d4 in overweight group), weak, statistically non-significant relation (Table 6).

Besides that, correlation coefficient (Spearman's rho) for the salivary TNF, AlP and BMI revealed positive, weak, statistically non-significant relation (Table 7).

5. Discussion

Unhealthy life style is strongly associated with systemic disease, this point had paid the attention of many authors because of its substantial morbidity and mortality.[44,45] The result of this study showed that there was non-significant difference of dental caries experience and severity between the normal weight and overweight groups. These results are in accordance with many studies. [29,35-39,46-48]

As described by many studies, this point was controversial, the unhealthy diet rich with fat and sugar (refined and added), poor consumption of fruit and vegetables may increase both BMI [49] and dental caries, but on the other hand, untreated dental caries may cause pain or discomfort which in turn affect the patient diet and food intake [31] causing low BMI, malnutrition or impaired growth [50,51]

In addition, there is an indirect effect of dental caries on the child's BMI by endocrine, immune or metabolic responses causing growth defects, malnutrition or malabsorption of nutrients. [52]

The controversial results among different studies may be attributed to different criteria for BMI classification across studies; some studies used the CDC centiles, others employed the international age and gender appropriate data sets recommended by IOTF, or use the criteria according to WHO. Or it may be the result of utilization of different indices and definition of dental caries, i.e some authors preferdmft, others reported dmfs.

The results of the present study showed non-significant difference of the salivary TNF-α with dental caries between normal weight and overweight groups which may give an impression that the level of salivary TNF-α is not as that present in other body places.

A non-significant difference was found concerning dental caries with the salivary AlP which agrees with a previous study. [26]

On conclusion: the dental caries is not related either by experience or severity to the level of salivary TNF-α and salivary AlP in both normal weight and overweight children.

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Table 1: The distribution of the total sample

	No.	%
Normal weight	62	58.5
Over weight	44	41.5
Total	106	100

Table 2: TNF and AlP in normal weight and overweight children

	Normal weight mean rank	Over weight mean rank	Z	Sig.
TNF	18.67	18.04	0.199	0.84
AlP	16.84	22.08	1.604	0.109

Table 3: Caries experience in primary and permanent teeth among different nutritional status groups.

Dental caries	Normal weight mean rank	Over weight mean rank	Z	Sig.
ds	20.02	15.81	1.156	0.248
ms	18.48	18.54	0.023	0.982
fs	18.5	18.5	0	1
dmfs	20.2	15.5	1.288	0.198
DS	14.41	10	1.868	0.062
MS	13	13	0	1
FS	13.24	12.5	0.686	0.493
DMFS	14.41	10	1.867	0.062

Table 4: Caries severity in primary and permanent teeth among different nutritional status groups

Dental caries	Normal weight mean rank	Over weight mean rank	Z	Sig.
d1	18.87	17.85	0.327	0.743
d2	17.17	20.85	1.047	0.295
d3	20.33	15.27	1.39	0.165
d4	20.09	15.69	1.474	0.141
D1	12.21	14.69	1.394	0.163
D2	14.41	10	1.873	0.061
D3	13.71	11.5	1.239	0.215
D4	13.5	13.5	0	1.000

d1, D1=slight loss in the enamel surface in smooth surface, and dark pit and fissure which are hard on probing; d2,D2= white enamel lesion on smooth surface, and distinct sticking on probing at the pits and fissures in primary teeth; d3,D3=coronal caries involving the dentine but not the pulp; d4,D4= coronal caries with possible or definite pulp involvement ; all for primary and permanent teeth respectively

Table 5: Correlation coefficient between AlP and dental caries in primary teeth by nutritional status

Dental caries	Normal weight		Over weight	
	r	P	r	P
d1	0.229	0.294	-0.005	0.987
d2	-0.108	0.625	-0.264	0.383
d3	0.090	0.684	-0.267	0.378
d4	-0.145	0.509	-0.241	0.429
dmfs	0.123	0.576	-0.272	0.368

Table 6: Correlation coefficient between TNF and dental caries in primary teeth by nutritional status

Dental caries	Normal weight		Over weight	
	r	P	r	P
d1	-0.201	0.358	0.246	0.418
d2	-0.123	0.576	-0.166	0.588
d3	0.010	0.964	0.466	0.108
d4	0.139	0.527	-0.035	0.909
dmfs	-0.007	0.974	0.393	0.184

Table 6: Correlation coefficient between TNF ,AlP and BMI

	r	P
TNF\BMI	0.032	0.854
TNF\AlP	0.060	0.726
BMI\AlP	0.164	0.338