The association between some salivary factors and dental caries in group of school children and adolescents in Erbil city

Received: 17/6/2010 Accepted: 23/2/2011

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Abstract

Background and objectives: The protective function of saliva against dental caries achieved through its physico-chemical properties The purpose of this comparative study was to evaluate the relationship between some risk factors such as salivary flow rate, pH, oral hygiene (plaque index), buffering capacity, salivary level of lacto bacilli, streptococcus mutans and candida, with dental caries also aimed to determining which salivary factors correlate significantly to dental caries experience in children and adolescents.

Methods: In this study, salivary factors were measured in resting saliva. Resting saliva was collected to determine flow rate, pH, buffering capacity, microorganism level of lactobacilli, streptococcus mutans and candida of (400) healthy school student, (200) children (6-12) years and (200) adolescents (13-16) years in twenty schools in Erbil city of different socioeconomic status. Their teeth were examined to measure the caries experience using decay, missing, and filled teeth index (DMFT), and oral hygiene (plaque index) level using (Silness and Loe 1964) method.

Results: The mean DMFT in children was (5.35), while the mean DMFT in adolescents was (5.54). The mean oral hygiene in children was scored (1.21), while the mean oral hygiene in adolescents was (1.19). The factors showing significant relation ship to dental caries in children were flow rate, pH, oral hygiene (plaque index), lactobacilli, streptococcus mutans and candida, while the salivary factors showing a significant relation ship to dental caries in adolescent were pH, oral hygiene and count of lactobacilli.

Conclusion: Evidence from the current research support a central role of the salivary flow rate, pH, oral hygiene, count of salivary streptococcus mutans, lactobacilli and candida albicans in the increasing of dental caries in children. While in adolescent there was relation between dental caries and salivary pH, oral hygiene and count of lactobacilli.

Key words: Dental caries, salivary flow rate, pH, saliva, microorganisms, oral hygiene.

Introduction

During the past few years, a multifactorial approach has been applied to identify high caries risk groups and individuals among child and adolescent populations that includes saliva tests [1]. Most saliva studies have focused on the relation between saliva properties and dental disease [2]. Saliva properties reside principally in flow rate, pH and buffering capacity, and the organic and inorganic components [4]. The salivary tests most often used for clinical purposes are flow rate of unstimulated and stimulated saliva, buffering capacity, and growth of colony-forming microorganism and in most cases counts of lactobacilli, mutans streptococci, and yeast [5,6]. The aim of this study was to evaluate the relation ship between some salivary parameter and dental caries among two age groups of children aged (6-12) year and adolescent aged (13-16) years old in Erbil city.

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Methods

This study was conducted over a period of 8 month, from October 2008 to May 2009. The software STATA version 9 was used for sample size estimation .A lottery randomly sample selection of 400 healthy school student were included in the study, (200) children and (200) adolescents. The criteria of exclusion were the fixed or removable dental prosthesis or orthodontic appliance and the treatment with systemic antibiotics or other drugs capable of altering the salivary flow rate or the ecological constitution of oral microbiota interfering with the research. Determination of decay, missing and filled tooth (DMFT) was done by visual examination on ordinary chair under natural lights according to the criteria set by the WHO 1997 [7]. The oral hygiene (plaque index) was recorded according to the amount of plaque accumulation using the criteria established by Silness and Loe, 1964 [8]. (0= No plaque, 1= Plaque is not seen by naked eye, only by running the probe, 2=Plaque is seen by necked eye, 3= Abundance of plaque).

Salivary Analysis

1. Flow rate: Salivary samples were collected from subjects under close supervision after two hours of a meal between 9-00 am and 12.00. Prior to collection of sample subject were asked to sit and relax .Resting saliva was collected for five minutes .The saliva was collected in a graduated sampling tube fitted with a funnel to facilitate the collection process.

2. The pH: The pH of the collected unstimulated saliva was measured immediately after collection in the school, using pH meter (HANNA Model, pH 300, Portugal) and pH buffers (solution of pH 4, 7, 10).The accuracy of the pH meter was checked at regular intervals to ensure the reading was correct.

3. Buffering Capacity: Saliva buffering capacity was assessed immediately after the collection in the school using a commercial dentobuff strip test (CRT Buffer, viva dent).The buffer effect was determined by comparing visually the color changing in the dentobuff strip employing the manufacturers color chart the buffering capacity was rated as low, intermediate, or high according to company instructions.

4. Microbial composition: Salivary counts of streptococcus mutans and lactobacilli were determined from resting saliva at Hawler teaching hospital laboratory (laboratory of microbiology), The saliva samples were vortexed (Fisher Vortex, Genie 2, USA) to uniformly mix. Using a sterile loop, 0.1 of vortex 1:5 diluted saliva was spread on Blood agar plat (BA) for streptococcus mutans (SM). Rogosa, Mitchell and Wiseman agar plat (RMW) for lactobacilli (LB). The blood agar plates were incubated aerobically for 48 hours at 37 C. Rogosa MW agar plate were incubated aerobically for 96 hours at 37C. For identification of streptococcus mutans and lactobacilli api strep (BIOMERIEUX) were used The quantity of streptococcus mutans and lactobacilli colony were measured by using colony counter SC5 (STUART SCINTIFIC, made in UK) .The classification of test scores 1 and 2 corresponding to $<10^5$ and $\geq 10^5$ colony forming unit (CFU) /ml, respectively. To record the presence of yeast vortexed saliva sample were diluted ten fold to 10 in Reduced Transport Fluid, 0.1 were spread on sabouraud dextrose agar (SAB) plates using sterile loop spreader. The plates were incubated at 30C for 3 day's .Yeast colonies were recorded as present or absent.

Statistical analysis:

Mean & standard deviation (SD) of DMFT and plaque index were calculated with the help of the SPSS (Statistics Package for the Social Sciences, version 11.0) software. To analyze the DMFT in relation to salivary factors and oral hygiene scores the analysis of variance (ANOVA) test was used. The Chi-square test was used to investigate the association of the DMFT with microbial flora and the buffering capacity.

Results

Four hundred healthy school students were examined. The total number of children was (200) consist of (103) female and (97) male with age ranged from (6-12) while the total number of adolescent was (200) consist of (99) female and (101) male with age ranged from (13-16). The total mean of DMFT score for children was (5.35), while the total mean of DMFT scores for adolescents was (5.54). The total mean of oral hygiene in children was (1.21) while the total mean of oral hygiene scores for adolescents was (1.19). Table (1) the DMFT scores in children varied from 0-12 and in adolescents 0-13, only 9 subjects were caries free in the children group, while 3 subjects were caries free in adolescents group. As a result, the sample of decay, missing, filling teeth was dichotomized into (DMFT <4, 4-9, and >9) for further analysis to represent subject with low, medium and high caries activity respectively. Table (2) represent the analysis of flow rate, pH, oral hygiene and buffering capacity in resting saliva to dental caries level in children. The flow rate, pH and oral hygiene were the factors showing highly significant relation with dental caries in children ($p<0.05$). Table (3) represent analysis of flow rate, pH, oral hygiene and buffering capacity in resting saliva in relation to dental caries level in adolescent. Statistical analysis showed significant between pH and oral hygiene in resting saliva in relation to dental caries level. In both Tables (2 and 3) the mean plaque score were 1.07 and 1.16 in both group respectively having low caries activity. This value increased to 1.52 and 1.45 in the group with the highest caries activity, severity of dental caries correlated significantly with the mean plaque index. The relation ship between dental caries and concentration of lactobacilli, streptococcus mutance and presence or absent of candida albicans in resting saliva in both groups is demonstrated at Tables (4 and 5) respectively.

The caries level was also analyzed in relation to the presence or absent of candida. There was a highly significant relation ship between dental caries and level of SM, LB and candida in children, while in adolescents level of SM and candida was of insignificant value in relation to DMFT ($p>0.05$) and significant relation between DMFT and LB.

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Table 1: Distribution of dental caries in children and adolescents.

	Children (6-12)				**Adolescents (13-16)**			
	Male n=97 Mean (SD)	**Female** n=103 Mean(SD)	**Total** n=200 Mean (SD	**P** Value (t-test)	**Male** n=101 Mean (SD)	**Female** n =99 Mean (SD)	**Total** n =200 Mean(SD)	**P** Value (t-test)
DMFT	5.10 (3.36)	5.76(3.66)	5.35 (3.48	0.917 NS	5.34 (2.99)	5.72 (3.66)	5.54 (3.17)	0.114 NS
Oral hygiene (PI)	1.22 (0.41)	1.20 (0.57)	1.21 (0.314)	0.215 NS	1.22 (0.41)	1.16 (0.57)	1.19 (0.310)	0.715 NS

Table 2: Relationship between dental caries and unstimulated saliva variables in children.

DMFT	**Flow rate ml/min**	**pH**	**Oral hygiene**	**Buffering Capacity**		
	Mean (SD)	Mean (SD)	Mean (SD)	Low	Medium	High
				n (%)	n (%)	n (%)
Low < 4 n = 77	0.849 (.278)	6.69 (.219)	1.07 (.427)	16 (20.8)	44 (57.1)	17 (22)
Medium 4 – 9 n =76	0.851 (.362)	6.51 (.287)	1.21 (.313)	25 (32.9)	36 (47.4)	15 (19.7)
High > 9 n = 47	0.724 (.261)	6.47 (.305)	1.52 (.371)	16 (34)	25 (53.2)	6 (12.8)
P value	0.052 S	0.000 HS	0.00 HS	0.319 NS		

Table 3: Relationship between dental caries and unstimulated saliva variables in adolescent

DMFT	**Flow rate ml/min**	**PH**	**Oral Hygiene**	**Buffering Capacity**		
	Mean (SD)	Mean (SD)	Mean (SD)	Low	Medium	High
				n (%)	N (%)	n (%)
Low < 4 n =76	1.451 (.312)	6.81(.175)	1.16 (.464)	19 (25.0)	36 (47.3)	21 (27.7)
Medium 4– 9 n =85	1.370 (.278)	6.71 (.169)	1.19 (.310)	21 (24.3)	48 (57.4)	16 (18.3)
High > 9 n =39	1.299 (.447)	6.63 (.134)	1.45 (.360)	14 (36.9)	17 (41.0)	8 (22.1)
P value	0.065 NS	0.000 HS	0.001 HS	0.285 NS		

Table 4: Relationship between dental caries and microbial flora in children.

DMFT	Streptococcus mutans		Lactobacilli		Candida albicans	
	$< 10^5$ n (%)	$\geq 10^5$ n (%)	$< 10^5$ n (%)	$\geq 10^5$ n (%)	Present n (%)	Absent n (%)
Low < 4 n =77	43 (55.8)	34 (44.2)	44 (57.1)	33 (42.7)	48 (62.3)	29 (37.7)
Medium 4-9 n =76	18 (23.7)	58 (76.3)	24 (31.6)	52 (68.4)	56 (73.7)	20 (26.3)
High > 9 n = 47	10 (21.3)	37 (78.7)	21 (44.7)	26 (55,3)	22 (46.8)	25 (53.2)
P value	0.000 HS		0.006 HS		0.011 S	

Table 5: Relationship between dental caries and microbial flora in adolescents.

DMFT	streptococcus mutans		Lactobacilli		Candida albicans	
	$< 10^5$ n (%)	$\geq 10^5$ n (%)	$< 10^5$ n (%)	$\geq 10^5$ n (%)	Present n (%)	Absent n (%)
Low < 4 n =76	39 (50.7)	38 (49.3)	44 (58.9)	32 (41.1)	36 (47.3)	41 (52.7)
Medium 4-9 n = 85	34 (39.8)	51 (60.2)	33 (38.8)	52 (61.2)	34 (40.0)	50 (60.0)
High > 9 n = 39	17 (44.4)	21 (55.6)	16 (40.7)	23 (59.3)	23 (61.9)	16 (38.1)
P value	0.391 NS		0.042 S		0.70 NS	

Discussion

Although the prevalence of dental caries has declined markedly over the last 20 years in most countries in the Western world, the disease is still a major problem for both adult and children especially in developed countries [9,10]. The caries experience in the present study is considered high in children (5.35). The caries experience in the adolescent is increased to (5.54). The mean DMFT scores increased with age. The DMFT values were higher than those reported previously in similar age group from other population [11,12]. There was statistically no significant difference observed in the mean DMFT between male and female in both groups. This come in contradicts with the result of previous studies [13]. The mean oral hygiene (PI) in children (1.21). The mean oral hygiene (PI) in adolescents (1.22). There was no significant difference observed in the mean oral hygiene between male and female in both groups. This result contradicts with the result of El-Qaderi et al [14]. Salivary flow rate of resting saliva were significant among the three caries groups in children, this result comes in agreement with some study confirmed the importance of salivary output in maintaining a healthy oral environment [15], and contradicts with other study [16)] while the salivary flow rate were not significant different among the three caries groups in adolescent, this come in agreement with AL-Samarrai SK [17]. The salivary pH is the factors which associated significantly with caries activity in children and adolescents. The result of our study comes in agreement with Farsi [18]. and contradicts LIene-Puy et al [19]. A highly significant statistical relation was obtained between oral hygiene index and dental caries experience in both group ($p<0.01$). It was similar to the result of Peterson et al [20]. In a clinical study conducted to determine risk indicators of dental caries in the permanent dentition the only variable that was found to be a consistent risk indicator of the presence and severity of both dentin and enamel caries was poor oral hygiene [21] When the buffering capacity was evaluated no significant relevance was found between this variable and caries level as a protector factor against caries in both children and adolescent ($p>0.05$). The presence or absence of candida was significantly correlated with dental caries in children. This result comes in agreement to that reported by Akdeniz et el [22]. In adolescents the presence or absence of candida was irrelevant to the caries levels. This result comes in agreement with Farsi. The presence of high level SM in saliva with value 10^5 colony forming units (CFU) /ml was found in most of children sample. A highly significant statistical correlation was obtained between SM and dental caries in children, this corroborating the infectious theory of dental caries. This type of positive relation has been reported earlier [23.] Thenisch et al in their systemic review to find the usefulness of bacterial testing in caries risk assessment , reported the presence of mutans streptococci both in plaque or saliva of young caries-free children , appears to be associated with a considerable increase in caries risk [24]. While statistical significant relation was recorded between dental caries and LB level in both groups, this come in contrast with the results of other studies [25, 26].

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