The effect of selectedsalivary elements and parametersin dental caries experience among a group of preschool childrenin Al-Najaf Al-Ashraf

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Abstract:

Background: Saliva is composed of anions, cations, nonelectrolytes, amino acids, proteins, carbohydrates, and lipids.Saliva is one of the most important etiological host factors in relation to dental caries. It affects the carious process by its organic and inorganic constituents; in addition to its physiological functions as (flow rate, pH and buffer capacity). The aims of this study were to determine the concentrations of major elements (calcium and phosphorus) and trace elements (ferrous iron, totalsalivary protein and Cupper) in saliva among a group of preschool children, and to explore the relation of these elements, flow rate and pH with dental caries.

Material and Methods: The sample consists of 40 children aged 4 and 5 years of age, selected from 4 kindergartens in Al-Najaf AL-Ashraf. Assessment and recording of caries experience was done by the application of decayed, missing, filled index (dmfs for primary teeth) (WHO,1987). Stimulated saliva was collected from children between 9-11 AM under standardized conditions and chemically analyzed to determine the concentration of calcium, phosphorus, iron, salivary total protein, and Zinc) calorimetrically by using ready-made kits and spectrophotometer machine. Data were analyzed using SPSS version 19.

Results: - All elements measured in saliva recorded statistically non-significant correlation with DMFS, except ferrous Fe ions which showed statistically significant correlation (r= 0.36, P=0.05). Salivary flow rate and pH correlated weakly and statistically not significant withdmfsThere were weak and statistically not significant correlations between all elements measured in saliva and salivary flow rate and ph.

Conclusions: It has been found that Ca and P ion present in high amounts in saliva in comparison to other selected elements.Their presence in saliva may indicate their presence in food, water and air.

Key words:salivary pH and flow rate, concentration of Ca, P, Fe, Zn and total protein, caries experience.

Introduction:

Saliva play a significant role in relation to dental caries through both flow rate and its organic and inorganic constituents, besides the physiological functions. Saliva enhances the clearness of food debris, cariogenic microorganism from the mouth with remineralizingions (1-3),Therefore saliva plays an important role in the equilibrium between the demineralization and the remineralization of enamel (4).Dental caries remains the most public oral health disease especially among children, it is

also a chronic pathological process (5). Studies showed conflicting results in about the effect of trace elements in correlation to dental caries. There is limitation in the studies concerning these aspects. In order to increase the knowledge about the effect of certain elements in saliva in relation to severity of caries this study was conducted.

MATERIALS AND METHODS: -

Subjects

The subjects selected for this study consisted of 40 children, aged 4 and 5 years of both genders selected from 3 kindergartensin Al-Najaf Al-Al AL Ashrafgovernorate, randomly selected in a systematic random sample,for each volunteers parents the objectives of the study were explained to, and they approved to participate.

Collection of Saliva and Recoding of Caries: -

For each child sample of Stimulated saliva was collected between 9-11 AM. At least one hour after breakfast. The collection of stimulated salivary samples from children were performed following instructions cited by Tenovuoand Largerlof (1996) (6).Each child should sit in relaxed position and was asked to chew apiece of uniform size of Arabic gum (0.35- 0.4 gm.) for one minute then to remove all saliva by expectoration. Chewing was continued for ten minutes, with the same piece of gum and saliva collected in sterile screw capped bottle. Within 15 minutes the Ph of saliva was measured using a digital Ph meter, salivary volume was estimated by measuring cylinder and the rate of secretion was expressed as milliliter per minute (ml/min).

Each salivary sample was centrifuged at 3000 r.p.m. (revolution per minute) for 10 minutes. The supernatant sampleswere stored and frozen at (-20ºC) in polyethylene tubes for subsequent chemical analysis which was carried out in a maximum period of three weeks.Oral examination was carried out by using plan mouth mirror and dental explorer. Assessment and recording of dental caries experience was done by the application of decayed, missing and filled teeth index (dmfs for primary teeth).

Chemical analysis was carried out at Poisoning Consultation Center, Medical city calcium, phosphorus and trace elements (ferrous iron, total salivary protein and zinc) ions were determined using Atomic Absorption Spectrophotometer (AAS). SPSS version 19 (Statistical Package for Social Sciences) was used for statistical analysis. Descriptive measurement (mean and standard deviation) were used to describe variables, statistical tests were applied also for differences between parameters including Person's correlation coefficient.level of significance was accepted at 0.05, when P <0.01was regarded ashighly significant. The confidence limit was accepted at 95%.

RESULTS: -

Table 1- : Caries Experience among Children by Age

fractions	Mean ± SD (4 years)	Mean ± SD (5 years)jou0i	t-test for ages	
			t	Sig
ds	3.89±4.50	6.89±6.05	2.35	Sig
ms	0.00±0.01	0.92±2.03	2.45	Sig
fs	0.44±1.82	0.95±2.25	1.06	Not
dmfs	4. 38±6.43	8. 83±10.37	3.25	highly

Table (1) show Clinical examinations showed that all children were affected by dental caries. Caries experience (mean value and standard deviation) of dmfs index for all children are presented in Table 1. The decayed surfaces (ds) contributed the major parts of this index followed by filled surfaces (fs) then missed surfaces because of caries (ms). For children involved in this study, statistically significant differences were recorded between children aged 4 years and those aged 5 years for means of ds andms ($P < 0.05$), in addition to that results showed that there were highly significant differences between these ages for means of dmfs ($P < 0.01$).

Table 2: Concentration of Elements in Saliva (Means ± SD)

Elements	Mean ± SD (PPM)
P	84.61±01.73
Ca	80.62±22.99
Total protein	0.75±0.17
Fe	0.67±00.25
Zn	0.22±00.12

Table 2, showed the concentration of elements in saliva (mean and standard deviation), Phosphorus ions were found to be the highest in values followed by calcium ions, total protein then ferrous ions and finally zinc

Table 3: Salivary pH and flow rate (Means ± SD)

Salivary parameter	Mean ± SD

pH	6.50±0.6
Flow rate	1.07±0.33

Results recorded in table 3, represents (mean and standard deviation) of salivary pH and flow rate of stimulated saliva expressed in ml/min. of all children.

Table 4: Correlation Coefficient between Elements Measured in Saliva and Salivary (Flow Rate and pH

Elements	PH		Flow rate	
P	R	0.06	R	0.25
	P	0.15	P	0.17
Ca	r	0.01	R	0.23
	P	1.01	P	0.27
Fe	r	-0.22	R	-0.33
	P	0.31	P	0.14
Zn	r	0.16	R	-0.09
	P	0.42	P	0.70
Total protein	r	0.07	R	0.14
	P	0.68	P	0.47

Table 4, demonstrates the correlation coefficient between elements in saliva with salivary pH and flow rates. Results showed that all elements measured in saliva correlated weakly with salivary pH and flow rate, where all of these correlations were statistically not significant.

Table 5: Correlation Coefficients between Salivary (Elements and Parameters) and Caries- Experience

Elements	Dmfs	
	r	**P**
P	-0.13	0.47

Ca	-0.05	0.81
Fe	0.36*	0.05
Zn	0.07	0.86
Total protein	0.13	0.57
pH	-0.21	0.28
F.R	-0.25	0.17

Table 5, represent the correlation coefficient between salivary elements and parameters and cariesexperience, only the correlation between ferrous Fe ions and dmfs was recorded as a positive weak and statistically significant correlation while other elements measured in saliva revealed weak and statistically not significant correlations with cariesexperience, the direction of association varied between positive and negative for different elements. Regarding the correlations recorded by salivary parameters with caries-experience results revealed that salivary pH and flow rate recordeda weaknegative but statistically not significant correlations with dmfs.

DISCUSSION

This study was conducted to explore the possible etiological factors involving some of the salivary elements and parameters and its relation to dental caries. The study group in this research involved 40 children with an age range 4-5 years old. Stimulated saliva is secreted in response to either masticatory or gustatory stimulation, it was collected rather than unstimulated saliva, to allow comparison with other Iraqi studies that were mostly performed on stimulated saliva,in addition to that stimulated saliva is much more easily obtained and more standardized to collect (7,8).

Regarding caries severity among those children, results revealed that the mean values of decayed surfaces represent the present disease, while missing surfaces represent the accumulative effect of dental caries and (dmfs) that represent the caries experience; were significantly higher among children aged 5 years compared to these of 4 years.Which may give an explanation to the increase in severity of dental caries with advancing age reported here in this study. These results could be explained by that, teeth of children aged 5 yearsold exposed to oral environment and cariogenic factors for longer period of time than teeth of children aged 4 years that no longer had been erupted. It was well established that the increases in severity of dental caries with age due to the fact that dental caries is an accumulative and irreversible disease (9).

In this study a higher calcium and phosphorus concentration were found among children. Results revealed that P ions concentration (84.62ppm) were higher than Ca ions (80.60ppm), this may explainthat, in this study by depending on stimulated saliva there will be an increase in the concentration of inorganic phosphorus in comparison to calcium and their level is time- dependent increase as the duration of stimulationincrease, while Ca decrease by going from unstimulated to stimulated saliva (2, 3, 10). In addition to that parotid glands contains more inorganic phosphate than does submandibular. Saliva contains less calcium but more phosphate compared to plasma (13,14).(12 ,11)

The variation in the sampling procedure and techniques of analysis in addition to difference in gender and ages among children may explain the variation in these Iraqi studies and others. (7, 15-16).

Salivary ferrous iron, total protein and zinc were recorded in saliva with the concentrations as seen in Table 2. these elements present in our environment as they present in foods,and water that used for drinking or cooking foods so they enter the blood stream via digestive system, lungs or sometimes by coming in contact with skin,their presence in the blood serum, allowed them to be introduced via gingival crevicular fluid into the whole saliva (17, 18), could explain their presence in saliva

dental caries is an accumulative and irreversible disease (9) which give an explanation to the increase in the severity of dental caries with advancing age reported here in this study.The correlation coefficient recorded here between Ca and P ions with dental caries, were found weakly correlated with dmfsand not significant ($P \geqslant 0.05$), these correlations could indicate the important role of saliva to maintain the integrity ofteeth andin the protection of tooth surface against caries development by maintaining supersaturation of Ca and P ions in saliva may enhance remineralization and increase resistance of outer enamel surface to acid dissolution (13). Other elements studied in saliva except Fe were statistically not significant with caries-experience Thesefindings indicated that iron considered as being caries inert element. Many studies found that salivary iron concentration is inversely related to the dental caries (19,20) while for other elements they have been found that when they increased in saliva caries severity decreased, which may act as cariostatic elements in saliva,these results were conflicting, since saliva is the main source for these elements in the outer enamel surface and these elements were reported by other studies to act as cariogenic elements (21, 22). The concentration of salivary elements changed continuously, since it affected and dependson their presence in systemic environment by type of food,water, presence of disease, air and even drugs as for iron supplements (23). While caries process is a multifactorial and longitudinal processinvolving interactions of a large number of factors with time (24).

flow rate and pH of saliva considered to be an indicator of caries susceptibility, as the most important caries-preventive functions of saliva are the flushing and neutralizing effects commonly referred to as "salivary clearance" or "oral clearance capacity", so the reduction in salivary flow rate is associated with reduction in buffer capacity and salivary pH, also affects oral sugar clearance negatively may cause the increase in the severity of dental caries (11, 12). There is an inverse association between caries experience and these two variables; such negative correlation was also recorded in the present study.

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