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The Relationship Between Calcium, Magnesium And Inorganic Phosphate of Human Mixed Saliva And Dental Caries

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Abstract

Selected elements in stimulated whole saliva, and dental caries experience were studied. The stimulated mixed saliva samples were obtained from (56) dental students with an age range between (18 – 23) years. Every salivary sample was centrifuged at (1800 r.p.m) for (6) minute at room temperature. The results showed that the DMFS and DMFT values for females were higher than that of the males in all age groups. The concentration of inorganic phosphate was higher than that of calcium and magnesium and the females showed lower values than males.

A negative correlation was recorded between the concentration of calcium, magnesium and inorganic phosphate with the DMFS and DMFT. Significant relation was found between the concentration of calcium with the DMFS and highly significant difference with DS and DMFT. Non significant difference was found between the concentration of inorganic phosphate with the DMFS and DMFT. Highly significant difference was found between the concentration of magnesium and DMFS, FS and DMFT.

Key wards: Dental caries, salivary minerals

Introduction

The composition of the saliva collected by spitting termed mixed saliva or oral fluid, which is made up of secretions of salivary glands, gingival exudate, fluid transudate of the oral mucosa, food debris, microorganisms and desquamated cells from oral epithelium^(1, 2).

The composition of the saliva (organic or inorganic), pH, it's antimicrobial factors, quantity that is secreted in a given period of time , and viscosity , are factors that influence the etiology of caries⁽³⁾.

The calcium and phosphate ions in saliva will help to prevent dissolution of dental enamel and help

remineralization phases. The calcium is the most efficient pH buffer for regulating the body fluids, while the phosphates have additional advantage of being resistant to depression of plaque pH towards the critical pH⁽⁴⁾.

The calcium and phosphate are present in whole saliva typically at (1.4 mmol / l) and (6 mmol / l) respectively in unstimulated saliva. While (1.7 mmol / l) and (4 mmol / l) respectively in stimulated saliva. Magnesium is a mineral that helps with the formation of teeth. It is present in whole unstimulated saliva at about (0.32 mmol /l) and (0.25 mmol /l) in stimulated saliva^(5,6). This study was carried out to determined:

1-Caries experience (DMFS & DMFT)

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and it's relation with the age and gender.

- 2-The concentration of calcium, inorganic phosphate, and magnesium in the stimulated saliva and it's relation with the age and gender.
- 3-The correlation between caries experience with the concentration of salivary elements selected in the study.

Materials and methods

Volunteers in this study were (56) healthy looking dental students in College of Dentistry, Hawler Medical University, with no serious medical history and did not receive any medications. Their ages ranged from (18 – 23 year), and they were permanent residence in Erbil city.

The personal information was recorded prior to oral examination on a special form used to record caries experience and concentration of calcium, inorganic phosphate and magnesium. The clinical examination started with the upper right second molar to upper left second molar, then lower left second molar ending with lower right second molar.

A set of four bitewing radiographs taken for each individual, two for the premolars and two for molar teeth on each side. Assessment of caries experience was carried out by calculating the DMFT and DMFS for each individual.

Collection of stimulated salivary samples were performed under standard condition ^(1,7). The sample collection were carried out between (9.00 – 9.30 am) that was at least (1.30 – 2.00 hours) after their breakfast. Subjects were asked to maintain their regular oral hygiene practice.

The person sits in an upright position with his head was slightly inclined forward so that the production of saliva was collected in the floor of

the mouth. The mouth was cleaned by a sterile gauze before sample collection. Each individual was asked to chew a piece of Arabic gum (2.0 gm) for one minute then ask the patient to spit all the saliva. Chewing was continued for five minutes using the timer. The saliva was spat out in a sterile screw capped test tube during the collection period,

After collection of saliva, five minutes for all individuals, the volume of the collected saliva then measured. The measurement should not include the foam which is formed during the collection, after that, the result is expressed as milliliters per minute ⁽⁸⁾.

Every salivary sample was centrifuged at (1800 r.p.m) for (6) minute at room temperature ⁽⁹⁾. A volume of three milliliters of the supernatant was taken and weighted by electronic sensitive balance and divided into two portions, one portion used for determination of inorganic phosphate by spectrophotometer, and the other portion was used in determination of calcium and magnesium using air – acetylene atomic absorption spectrophotometer. The two portions of the supernatant stored frozen at (– 20°C) in polyethylene tubes (10 ml), for subsequent analysis which was carried out in a maximum period of two weeks.

The data were subjected to the Student's t-test, analysis of variance (ANOVA test) and the least significant difference (LSD) for testing the significant differences between different groups, and Pearson's correlation for measuring correlation coefficient between caries experience and concentration of salivary elements.

Results

The sample consisted of (25) males (44.64 %), and (31) females (55.36

%). Age of the individuals ranged between (18 – 23) years. The mean age was 20.96 years for males and 20.38 years for females. Table (1) illustrates the distribution of examined students according to the age and gender.

Clinical and radiographic examinations showed that all students were affected by dental caries. Mean values and standard deviation of DMFS and DMFT indices for each age group were presented in table (2) and (3) respectively, the caries experience of total students were recorded to be (6.87_± 4.54) for DMFS, and (5.46_± 2.81) for DMFT .

The decayed fraction contributed the major part of the DMFS value both for total males and females, then the filling fraction and lastly the missing fraction. The DMFS and DMFT values for females were higher than that of the males in all age groups. According to the DMFS, there was statistically significant difference between males and females, among all age groups ($P < 0.05$). According to the DS, MS and FS, there was no significant difference between total males and females ($P > 0.05$), while for FS their was significant difference between the three age groups specially at (22-23) years ($P < 0.01$).

Statistically highly significant differences was seen between males and females ($P < 0.01$) in relation to DMFT, and statistically no significant difference present between the three age groups ($P > 0.05$).

Mean concentration of salivary inorganic phosphate, calcium and magnesium expressed in (mmol / l) are seen in table (4). The inorganic phosphate showed higher concentration (2.59 mmol /l), followed by calcium (1.09 mmol/l) and lastly, the magnesium (0.47 mmol/l). Females showed lower values than males. Statistically significant differences was seen between total

males and females regarding magnesium concentration and no significant differences was recorded for inorganic phosphate and calcium concentrations. Statistically there was no significant differences between the elements at different age groups ($P > 0.05$).

Figure (1) shows the minimum concentration of inorganic phosphate was higher than the medium concentration of calcium and the maximum concentration of magnesium.

The correlation coefficient between caries experience and the concentration of the salivary calcium, inorganic phosphate, and magnesium are seen in table (5). A negative correlation was recorded between the concentration of calcium, inorganic phosphate, and magnesium with the DMFS. and DMFT. However a statistically significant difference present ($P < 0.05$) between the concentration of calcium with the DMFS, and highly significant difference present ($P < 0.01$) with the DS and DMFT.

A statistically non significant differences present ($P > 0.05$) between the concentration of inorganic phosphate with the DMFS and DMFT, and highly significant difference present ($P < 0.01$) between the concentration of magnesium with the DMFS, FS and DMFT.

Discussion

In present study, caries experience was evaluated among (18 – 23) year old dental students. The DMFT and DMFS values for females were higher than that of the males in all age groups. This may be attributed to the less salivary flow rate in females than that of males ⁽²⁾ .

These results were in disagreement with others ⁽¹⁰⁾ in which males demonstrated higher values of DMFS

compared to females or there is no significant difference in caries experience between the two sexes in healthy looking dental students⁽⁹⁾.

The results also showed a decrease in concentrations of calcium, magnesium and inorganic phosphate with increased severity of dental caries. Other found that the concentration of calcium increased with increase severity of caries experience, and the inorganic phosphate decreased with increased severity of caries experience⁽¹⁰⁾. Both results found non significant differences present between these factors.

The inorganic phosphate had higher concentration followed by calcium and then magnesium. This come in agreement with others⁽¹¹⁾. In comparison to males, females showed less values of the total means of inorganic phosphate, calcium and magnesium. This may be attributed to the lower rate of salivary secretion compared to males. This result disagree with other⁽¹⁰⁾ who found that females exhibit a higher concentration of inorganic phosphate and calcium than males (statistically significant difference was not present).

In the present study, statistically significant difference was present between the concentration of calcium with the DMFS and highly significant difference present with DS and DMFT; non significant difference between the concentration of inorganic phosphate with the DMFS and DMFT. This may be due to the most important buffer in stimulated saliva is the bicarbonate. While there is highly significant difference present between the concentration of magnesium with the DMFS, FS and DMFT.

Several investigators⁽¹²⁾ found that the calcium phosphate – containing chewing gums increases the concentration of these elements in the

saliva and useful for promoting remineralization in caries prone patients. While others^(10,13) indicated increase in calcium concentration with the increase in caries severity, others also reported this positive association. On the contrary, some saw an inverse association in respect to inorganic phosphate⁽¹¹⁾. The present study reported a negative correlation with the DMFS and DMFT. This correlation was reported also by others^(11,14). There is a considerable confusion in literatures in respect to magnesium and dental caries. Epidemiological studies based on it's concentration in water, soil or teeth in relation to caries experience report either no or inverse association⁽¹⁵⁾. On the contrary experimental animals and *in vitro* studies described magnesium as a caries promoting mineral as it inhibits remineralization⁽¹⁶⁾.

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