Concentration of salivary magnesium in relation to dental caries among a group of adults

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Abstract

Magnesium is one of the major cations in plant and animal tissues and is an essential constituent of the bone and tissue, as well as the body fluids. Concentrations of most electrolytes in saliva are subjected to considerable alteration. The aim of this study was to investigate the salivary magnesium in relation to dental caries. A sample of 46 adults was involved with age range of 20-45 years. Samples of stimulated saliva were collected and prepared to be analyzed for magnesium estimation using atomic absorption spectrophotometer. Clinical examination was done for dental caries using WHO criteria. The salivary magnesium concentration was 0.38mg/dl. Neither the sex, nor the age influenced the concentration of magnesium in supernatant stimulated saliva. Negative correlations were found between salivary magnesium and age, salivary flow rate, while, a positive correlation was recorded with dental caries. All these associations were not proved to be significant ($P<0.05$). Further investigation should be done on whole saliva to clarify the association between magnesium and dental caries. The magnesium relation with the other elements must be considered.

Keywords: Salivary magnesium, dental caries.

Introduction

Saliva is essential for oral health. The protective function of saliva is based not only on the rate of secretion but also on the composition of the secretion [(1)]. Small amounts of magnesium are present in the saliva. Magnesium ranks after potassium as the most important cations in living cells. It is an essential ion, plays an integral role in many aspects of intermediary metabolism in fundamental enzymatic reactions through its activity as a cofactor and in protein synthesis as a protein activation [(2)]. Navia [(3)] has suggested a tentative classification of the elements into five groups according to their ability to promote or reduce caries in experimental animals, magnesium is one of the caries-promoting elements.

The possible mechanism of trace element action on dental caries is by altering the resistance of tooth itself or by modifying the local environment at the plaque-tooth enamel interface [(2)]. The evidence relating magnesium to dental caries is equivocal. Different studies reported a relation between magnesium and dental caries [(4, 5, 6)]. While, Borella et al [(7)] found no association between them.

Few Iraqi studies investigated the relation of salivary elements to dental diseases [(8, 9, 10)] rather than magnesium. Because of no previous Iraqi studies present regarding the salivary magnesium in relation to dental caries, this study was conducted to estimate the salivary magnesium in relation to dental caries, also, age, sex and flow rate differences.

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Materials and methods

The sample consisted of 46 adults (26 males and 20 females) with an age of 20-45 years. The salivary samples were collected at least one hour after breakfast. The subjects were asked to chew a piece of paraffin (0.5g) for two minutes then the saliva was removed by swallowing. Chewing continued for a fixed time (4 minutes) with the same bolus of paraffin and stimulated whole saliva was obtained. Salivary flow rate was calculated per one minute. The collected specimens were centrifuged for 40 minutes at 3000 rpm. The supernatant saliva was frozen at -20^{o}C to be ready for magnesium estimation which was done by atomic absorption spectrophotometer. Dental caries assessment was done using the criteria of WHO [11]. Student's t-test, correlation coefficient and analysis of variance (ANOVA) were used for statistical analysis, at a level of significance 5%.

Table (1): Caries experience (DMFS), salivary flow rate and salivary magnesium according to gender.

Sex	No.	DMFS Mean±SD		Flow Rate Mean±SD		Mg (mg/100ml) Mean±SD	
Males	26	17.1	9.7	1.70	0.89	0.34	0.15
Females	20	18.2	10.3	1.71	0.67	0.41	0.18
Both	46	17.7	9.9	1.71	0.80	0.38	0.17

Table (2): Concentration of salivary magnesium according to caries experience (DMFS).

DMFS	No.	Mg (mg/100ml) Mean ± SD	
1-10	12	0.31	0.18
11-20	19	0.47	0.23
>20	15	0.45	0.11

Table (3): Concentration of salivary magnesium according to salivary flow rate and age.

Flow Rate	No.	Mg (mg/100ml) Mean±SD		Age Group	No.	Mg (mg/100ml) Mean±SD	
0.5-1	12	0.44	0.21	20-29	22	0.39	0.21
1.1-2	22	0.37	0.17	30-39	14	0.38	0.20
>2	12	0.35	0.22	≥40	10	0.35	0.16

Table (4): Correlation coefficient between salivary magnesium and other variables.

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Mg	r = -0.08 P = 0.56	r = 0.15 P = 0.29	r = -0.18 P = 0.21

Results

Table 1 illustrates the caries experience (DMFS), salivary flow rate and salivary magnesium according to gender. Statistically, no significant differences were found in relation to gender (P>0.05). Salivary magnesium concentration according to the severity of dental caries is shown in Table 2. Although salivary magnesium increased wit the severity of dental caries, statistically, no significant differences were found (P>0.05). Table 3 demonstrates the concentration of salivary magnesium according to salivary flow rate and age. Salivary magnesium decreased with increasing salivary flow rate and age. Statistically, no significant differences were found (P>0.05).

Negative weak correlation coefficients were found between the salivary magnesium concentration and (age and salivary flow rate), while a positive weak correlation coefficient was recorded with caries experience (DMFS). All the associations were statistically not significant (P>0.05) (Table 4).

Discussion

Concentration of salivary magnesium determined in this study was similar to that reported by Shannon and Feller [12] and differed from other studies [13, 14]. The differences in the concentration of salivary magnesium may be attributed to the differences in the preparation of the salivary fractions (supernatant and sediment) [13] and type of saliva (stimulated or not) [13, 14]. Although salivary magnesium was higher among females than males, the differences were not statistically significant. This result is in agreement with other studies which proved that gender did not influence the concentration of magnesium in saliva [13, 15] and in enamel [8]. Another study showed that salivary magnesium was significantly higher in males than that in females [7]. The slightly higher salivary magnesium among females may explain the slightly higher mean DMFS among them.

A weak negative correlation was found between age and salivary magnesium concentration. This association, statistically, was not significant. This result is in accordance with other previous studies [15, 16], and in disagreement with Ben – Aryea [17]. A study done by Bales et al [13] found that the concentrations of magnesium in all salivary fractions (whole, supernatant and sediment) were lower in elderly than in young subjects although this finding was significant only for the supernatant. The concentration of magnesium in saliva was inversely related to salivary flow rate but statistically was not proved to be significant. Other studies [12, 18] also found a negative association between salivary magnesium and flow rate but for unstimulated saliva. The mean values of DMFS were increased with increasing salivary magnesium. This association was statistically not significant. This result is in accordance with another study [8] regarding enamel magnesium. This positive correlation between salivary magnesium and dental caries is in disagreement with Borella et al [7] who found no association between them. They conclude that the electrolytes levels in whole saliva might be more adequate than the levels in supernatant to evaluate the relationship with dental caries.

A number of studies have associated low caries prevalence in man and high levels of magnesium in water supplies [19], dental enamel [20] and dental plaque [6]. However, a significant correlation was noted

between dental caries and levels of magnesium in hard tissue [4] and in water [5]. In spite of the weak positive correlation between enamel magnesium and dental caries recorded, the impact of magnesium was confirmed [8]. On the other hand, magnesium is an essential nutrient for the *Streptococcus mutans* and has a significant effect on their growth [21]. Besides, the presence of other ions like Ca^{++} together with magnesium form a complex system that must be in some way related to dental caries [22] and the possible cariostatic properties of other elements like calcium, strontium and lithium may override magnesium stimulation [21]. The increased acid production in dental plaque by rinsing the mouth with magnesium [23] confirms the caries promoting effect of magnesium.

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