Caries experience in relation to salivary physicochemical and immunological changes among asthmatic patients in Mosul city / Iraq

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ABSTRACT

Background: Asthma is a pulmonary disorder characterized by reversible stenosis of the peripheral bronchi. This disease could affect the oral health; as a result asthmatic patients may have a higher risk of developing dental diseases. This study was conducted to evaluate the caries experience and salivary elements among asthmatic patients using Ventoline inhaler.

Materials and methods: The study group consisted of 30 male asthmatic patients with an age range 20-24years (under Ventoline inhaler). The control group includes 30 subjects matching with study group in age and gender. Plaque and DMFS index were used for recording caries experience. Stimulated salivary samples were collected and then salivary flow rate, S-IgA and salivary elements concentrations (Ca, Na, K and PO_4) were determined.

Results: The mean value of dental caries (DMFS) and plaque index (Pl I) were found to be higher among study group compared to control group with statistically significant difference for Pl I ($P<0.05$), while not significant difference was observed for DMFS ($P>0.05$). The mean value of salivary flow rate, Ca, PO_4, Na and K ions concentrations were found to be lower among study group compared to the control group with no statistically significant difference ($P>0.05$), except for Ca and K ions the differences were statistically significant ($P<0.05$). S-IgA in the study group was higher than the control group and the difference was not significant ($P>0.05$).

Conclusions: Individuals with asthma have a higher caries prevalence, worse oral cleanliness and lower salivary elements compared to the control group, so a special preventive programs need to be designed for those patients.

Key words: Caries experience, salivary immunoglobulin A, asthma. (J Bagh Coll Dentistry 2013; 25(4):86-90).

INTRODUCTION

Asthma is one of the most common chronic diseases throughout the world and is a serious global health problem that affect people of all ages (more than three hundred million people worldwide) and accounts for 1 of every 250 deaths worldwide, when uncontrolled, asthma can affect daily life and is sometimes fatal [1]. Saliva has been described as the mirror of the body. In a world of soaring healthcare costs and an environment where rapid diagnosis may be critical to a positive patient outcome, saliva is emerging as a viable alternative to blood sampling [2]. Allergic patients were found to have a higher caries-experience in comparison to their controls [3], which may be due to the reduction in salivary flow rate among those patients [4,5].

Yet no pervious Iraqi study was found regarding the relation between S-IgA with oral diseases among asthmatic patients. So this study was carried out to investigate the effects of asthma on the caries experience and results obtained may call the physician's attention to the possibility of dental side effects associated with asthma and medication used in treatment as well as the dentist's attention to develop intensified preventive measures for those patients.

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MATERIALS AND METHODS

The sample included a study group of 30 male asthmatic patients with an age range (20-24) years under Ventolin inhaler and a control group of 30 healthy looking subjects matching in age and gender. Each participant was submitted to an oral examination at the dental clinic under standardized conditions according to the basic methods of oral health surveys of the WHO, 1997[6]. General information's were recorded prior the examination included name, age, area of residency and duration of inhaler use. Diagnoses of dental caries by DMFS index according to the criteria of WHO [6] and plaque index of Silness and Loe [7] were performed. Stimulated salivary samples were collected under standard condition and following instruction cited by Tenovuo and Lagerlof [8]. Each salivary sample was centrifuged at 3500 r.p.m for 15 minutes. The clear supernatant was separated by micropipette and placed in sterile plastic Eppendorff tubes (1 ml), then stored and frozen at -20 ºC. The salivary flow rate calculated (to be expressed by ml/min) as the volume of the collected sample divided by the time required for collection.

S-IgA was determined by ELISA [9] and salivary elements concentrations Ca, Na and K and were determined by flame photometry [10], While PO_4 was determined by spectrophotometer [11]. Data processing and analysis were carried out using SPSS package version 17, Student's t-test and Pearson correlation coefficients were applied.

The confidence limit was accepted at 95% ($P<0.05$).

RESULTS

Table 1 demonstrates that the mean value of dental caries (DMFS) and plaque index (Pl I) were found to be higher among study group compared to control group with statistically significant difference for Pl I while not significant difference was observed for DMFS. As shown in Table 2 the salivary flow rate, Ca, PO_4 , Na and K ions concentrations were found to be lower among asthmatic patients, with no statistically significant difference, except for Ca and K ions the differences were statistically significant. While S-IgA in the study group was higher than the control group and the difference was not significant.

In the study group, weak negative non significant correlations between DMFS and (flow rate, PO_4 , Na and K ions) and weak positive non significant correlations with Ca, while for S-IgA there was a weak positive significant correlations. In the control group, weak positive non significant correlations were found between DMFS and (Ca and S-IgA), and weak negative non significant correlations with (flow rate, PO_4 , Na and K ions) (Table 3). For Pl index a weak negative non significant correlations were observed with (flow rate, Ca, Na, K and S-IgA) while weak positive non significant correlations was observed with PO_4 in study group. Regarding the control group ,weak negative non significant correlations were observed with (flow rate, PO_4, Na, K and S-IgA) while a significant weak positive correlation was present with Ca (Table 4).

Table 5 demonstrates a significant weak negative correlation between the duration of drug intake and (Na, Ca and K ions) and significant weak positive correlation with PO_4,while non significant weak positive correlations were observed with (S-IgA, Pl I and DMFS) and non significant weak negative correlation was observed with flow rate.

DISCUSSION

The present study was found a higher DMFS values among asthmatic patients compared to control group, although the difference was statistically not significant. This difference in caries prevalence was in agreement with several studies [3,12-15]. While opposite results were found by other studies [16-18]. McDerra et al [12] explains the increased caries incidence among asthmatic patients with the negative influence of the inhaled drugs on salivary quantity and functions, and with increased plaque quantity. In addition, the reduction in flow rate among asthmatic patients has been linked to the higher frequency of mouth breathing, this could explain the result of this study as weak negative correlation coefficient between salivary flow rate and caries experience was found among both groups although it was not significant.

This study also revealed the presence of a weak positive non significant correlation coefficient between calcium and caries experience among both groups, also revealed presence of weak negative non significant correlation between phosphate and caries experience. Electrolytes in saliva especially calcium and phosphorus are necessary to maintain the integrity of teeth and considered to be an important variables explaining the difference in caries-experience, also phosphate is the main buffer in unstimulated saliva [19,20]. So the negative correlation of phosphate with caries experience may be the reason of higher DMFS among asthmatic patients, also weak negative non significant correlation coefficient was found between potassium and caries experience among both groups. This in lines with other studies [21-23], but disagree with the others [24,25]. A weak negative correlation was found between sodium and caries experience among both groups, although these correlations were not significant, this result coincide with previous studies [20,22,23]. The role of sodium and potassium in relation to dental caries is not well substantiated as some studies recorded either a presence of a negative, positive or no correlation with dental caries at all [27-29].

The present study was the first study in Iraq that concerned with the measurement of S-IgA in asthmatic patients. The role of S-IgA in the development of dental caries is determined by the ability of such antibodies to impede plaque microorganisms' colonization on the enamel surface by selective connection. Thus they oppose all other mechanisms of microbe adhesion and interfere during formation of plaque biofilm [30]. The present study revealed that there was a weak positive significant correlation between S-IgA and caries experience in the study group, while weak positive non significant correlations in the control group between S-IgA and caries experience. This result disagrees with Rashkova et al [31] who found no dependence between the secretory immunity and dental caries in asthmatic children.

The Pl was higher in asthmatic than control group. There is a significant difference observed for the Pl I between asthmatics and control group. Dental plaque is considered the main etiological factors for gingivitis [32]. The present study also showed a weak negative non significant correlation between Pl I and salivary flow rate

among both groups. The higher frequency of mouth breathing, as well as various immunological factors in asthmatics has been linked to more plaque in both children and adults with asthma [21,33]. However, weak negative non significant correlations were found between Pl I with sodium and potassium among both groups. Statistically, a significant weak positive correlation was present only with calcium in the control group, while a weak negative non significant correlation between Pl I and calcium in study group, this is in line with Ryberg et al [34] who reported decreased levels of calcium in stimulated saliva.

S-IgA in the present study showed a weak negative non significant correlation with Pl I in asthmatic group, this in disagreement with other investigation which found that secretory immunity does not influence plaque accumulation and periodontal health [31].

Saliva through its flow rate and constituents play an essential role in maintaining the integrity of soft and hard tissues in the oral cavity [35]. Salivary flow rate may be affected by asthmatic medication (Ventolin inhaler) and this may be attributed to the adrenergic effect of this drug that stimulates the sympathetic nervous system causing a reduction in salivary flow rate [34]. The present study revealed a reduction in flow rate among study groups compared to the control one, however the difference was statistically not significant. Studies found statistically significant difference in saliva secretion between asthmatics and controls [13,15,35], while Ghulam [17] found no significant difference in saliva secretion between individuals with asthma and healthy individuals.

Salivary constituents concentration (Na, PO_4, Ca and K) were found to be lower in asthmatic compared to the control one but with no statistical significant difference, except for Ca and K ions the difference were statistically significant. As reduced salivary flow is accompanied by concomitant decreased in salivary constituents, it is not unlikely that this particular change among asthmatic people may be one of the major contributing factors in the noted increased dental caries [34].Previous Iraqi study [17] found a slightly lower salivary calcium but with higher phosphate ions concentration among asthmatic patients.

It is clear that S-IgA plays an important role in oral homeostasis and it is an important indicator of the defensive status of the oral cavity, where the oral microbiota has antigenic potential and can stimulate secretory antibodies [36]. In the present study S-IgA in study group was higher than control group but with no significant difference, this result agree with Rashkova et al [31] and disagree with study by Seemann et al [37] that showed a reduction of S-IgA level in saliva of asthmatic patients.

Significant weak negative correlations were observed between the duration of drug intake and (Na, Ca and K), while significant weak positive correlation was observed with PO_4. Weak negative non-significant correlations were observed between the duration of drug intake and S-IgA. This result is in agreement with study by Ryberg et al [34] as they found an impaired level of total protein, lysozyme, S-IgA and potassium after inhalation with B_2-agonists in the saliva of asthmatic individuals. While weak positive non significant correlations was observed between the duration of drug intake with Pl I. Ghulam[17] also reported a positive correlation between the duration of drug intake and gingival index but it was not significant. However, the chronic treatment with B_2-agonist may increase dental plaque, as it cause alteration in salivary protein of amylase and lower the output/min of the antibacterial components, these favors both colonization and plaque growth [36]. Weak positive non significant correlation was observed between the duration of drug intake and DMFS. This is in the line with Milano et al [38] where they found a significant relationship between increased frequency of asthma medication and incidence of dental caries. Weak negative non significant correlation was observed between the duration of drug intake and salivary flow rate. This is in line with Ersin et al [4] was they found negative correlation between increased frequency of asthma medication and flow rate.

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Table 1: DMFS and Pl I indices among study and control groups.

Indices	Study group		Control group		t-value	p-value
	Mean	±SD	Mean	±SD		
DMFS	6.10	5.72	5.93	4.54	0.12	0.89
Pl I	1.08	0.20	0.95	0.26	2.12*	0.03

*** Significant (P<0.05)**

Table 2: Salivary variables among study and control groups.

Salivary Variables	Study group		Control group		t-value	p-value
	Mean	±SD	Mean	±SD		
Flow rate (ml\min)	0.90	0.12	0.95	0.14	1.37	0.17
Calcium (mmol/l)	1.70	0.48	1.93	0.36	-2.10*	0.03
Phosphate (mmol/l)	4.94	1.83	5.27	1.19	-0.82	0.41
Sodium (mmol/l)	11.46	3.16	12.49	3.94	-1.11	0.26
Potassium (mmol/l)	14.55	2.23	15.77	1.72	-2.38*	0.02
S-IgA (mg/ml)	63.82	28.63	62.37	21.78	0.06	0.94

*** Significant (P<0.05)**

Table 3: Correlation coefficient between caries experience and salivary variables among study and control groups.

Salivary Variable	Study group		Control group	
	r	P	r	P
Flow rate (ml\min)	-0.24	0.19	-0.07	0.68
Calcium (mmol/l)	0.22	0.22	0.03	0.83
Phosphate (mmol/l)	-0.11	0.53	-0.19	0.29
Sodium (mmol/l)	-0.19	0.29	-0.15	0.42
Potassium (mmol/l)	-0.16	0.38	-0.01	0.95
S-IgA (mg/ml)	0.37*	0.03	0.08	0.67

*** Significant (P<0.05)**

Table 4: Correlation coefficient between Pl I and salivary variables.

Salivary Variable	Study group		Control group	
	r	P	r	P
Flow rate (ml\min)	-0.13	0.48	-0.10	0.57
Ca (mmol/l)	-0.04	0.81	0.42*	0.01
PO_4 (mmol/l)	0.14	0.43	-0.11	0.54
Na (mmol/l)	-0.04	0.81	-0.24	0.19
K (mmol/l)	-0.002	0.99	-0.25	0.17
S-IgA (mg/ml)	-0.08	0.67	-0.07	0.67

*** Significant (P<0.05)**

Table 5: Correlation coefficient between duration of inhaler intake and other variables.

Variable	r	P
Flow rate	-0.23	0.22
Ca	-0.44*	0.01
PO_4	0.36*	0.04
Na	-0.37*	0.03
K	-0.39*	0.03
S-IgA	0.21	0.24
DMFS	0.17	0.35
Pl I	0.05	0.78

*** Significant (P<0.05)**