Salivary Flow Rate and Salivary pH in Patients with Respiratory Tract Allergies

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Summary:

Background: *Allergic respiratory diseases are highly prevalent conditions and epidemiological studies have shown that symptoms of allergic rhinitis and asthma coexist. Medications used for the treatment of allergy can reduce and alter saliva composition.*
Objective: *To investigate the effect of some medications taken to treat respiratory tract allergies (RTA) on the salivary flow rate (SFR) and the salivary pH.*
Subjects & methods: *this study was conducted on 260 patients having allergic rhinitis and/or asthma, their ages ranged from 5-19 years, and were attending the Allergy Institute in Baghdad. They were compared to a group of healthy individuals matching with age and sex. Stimulated mixed salivary samples were collected from each individual and the SFR and the salivary pH were recorded.*
Results: *A significantly reduced SFR was found among the total allergic patients in comparison to the total controls ($P<0.001$). Similarly the salivary pH was significantly higher in the total allergic patients compared to their healthy controls ($P<0.01$).*
Conclusion: *The results of the present study supports the hypothesis that the medications taken for the treatment of allergic rhinitis (Antihistamines) and asthma (Bronchodilators) can cause reduction in the SFR which might increase the risk for developing oral discuses among these patients.*

Introduction:

Allergic respiratory diseases are highly prevalent conditions and epidemiological studies have shown that symptoms of allergic rhinitis and asthma coexist (Busse et al, 1997). Medications used for the treatment of allergy can reduce the SFR and alter the salivary composition (Whelton. 1996).

Antihistamines (mainly used for the treatment of allergic rhinitis) by its anticholenergic effect can cause reduced salivation and result in dryness of the mouth (Aldous. 1964; Bahn. 1972; Goth & Shore, 1978; Trzeciakowski & Levi, 1983; Thylstrup & Fejerskov. 1994: Astor et al., 1999). McDonald et al. in (1994) reported that the minimum effective dose of antihistaminic drugs can reduce the SFR as much as 50%. Of the medications used for the management of asthma are B2- adrenergic agonists ,which are bronchodilators ,used in acute

Asthma (NHLBL ,1991; NHLBI, 1997 ,Rees & Kanabar, 2000).

Several authors studied the effect of these selective b2- agonists on the SFR and / or salivary composition in asthmatic patients. Some of them found no differences in the SFR between asthmatic patients and their controls (Hyyppa & Paunio. 1979; Hyyppa. 1981). Others reported a significant reduction in the SFR of these patients (Bjerkebom et al.. 1987: Laurikainen & Kuusisto, 1998; Lenander-Lumikari et al., 1998) as well as altering salivary composition including reduced total salivary proteins, amylase activity and secretary IgA (Ryberg et al., 1987; Ryberg et al., 1991).

The salivary pH of asthmatic patients was not affected as compared to their healthy controls (Ryberg et al.. 1987; Ryberg et al., 1991; Laurikainien & Kuusisto, 1998). However Kargul et al. (1998) demonstrated a decrease in salivary and plaque pH 30 minutes alter the use of inhaler medicaments among asthmatic children.

No previous studies in Iraq concerning the SFR and salivary pH of patients with RTA were reported.

Materials and Methods:

260 patients with RTA (asthma, allergic rhinitis or both) attending the Allergy Institute in Baghdad from November (1999) to March (2000) formed the study group. These were compared to a control group of healthy individuals without RTA matching with age and sex. and selected randomly from the primary and secondary schools in Baghdad. Eighteen patients refused to cooperate, one female wearing fixed orthodontic appliance as well as patients having other allergic conditions such as atopic dermatitis, eczema or any other systemic disease in addition to their respiratory allergy were excluded.

A questionnaire form was filled for each individual prior to oral examination. For patients with RTA, information including the type and severity of their allergy as well as the medications currently taken for it's treatment were recorded. Asthma severity was determined by the physicians based on a

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modification of the expert panel report of the NIILBI (1997). The severity of allergic rhinitis was classified based on the severity of symptoms and the type of medications needed to control it.

Arabic chewing gum lumps of equal size were used to stimulate salivary secretion and mixed salivary samples were collected from each subject at least 1 hr. after breakfast. Then the SFR and the salivary pH using a pi I indicating paper were recorded (McDonald et al.. 1994).

The individuals were classified into three groups according to the level of saliva secretion into three groups: hypo, low and normal salivation (Thylstrup & Fejerskov, 1994: Wefel & Dodds. 1995).

The data were analyzed using SPSS version 7.5 computer software with the help of a biostatistition.

Results:

Asthma affected (68.8%) of the total study group and (8.9%) had allergic rhinitis only (Fig. 1). The majority of these patients (65%) had mild allergy at the time of examination (Fig. 2). About three-quarters of the total allergic patients were taking [^-agonists, antihistamines were also widely used by these patients (61.2%). table 1.

A significantly higher percentage of allergic patients in the study group (60.8%) had hyposalivation as compared to (42.7%) of the total controls (PO.001) as demonstrated in figure 3. Also the salivary flow rate for the total study group was significantly lower (PO.001) than that of the total control group (Table 2).

The difference between the two groups in the mean salivars pi I was significant (P 0.05) in the second age as well as in total sample (Table 3). A very weak correlation between the SFR and the salivary pi I was found in the study group (r=+0.24) as well as in the control group (r=+().17), and these correlation's were statistically significant at (PO.01).

A multiple regression analysis with the SFR as the dependent variable showed that an increase in the severity of RTA is expected to reduce the SFR significantly (PO.001). yet the independent variables included in the model can explain only 7% of the variation in the SFR in the total sample (Table 4).

Fig. 1: Distribution of the study group according to the type of allergic disorder

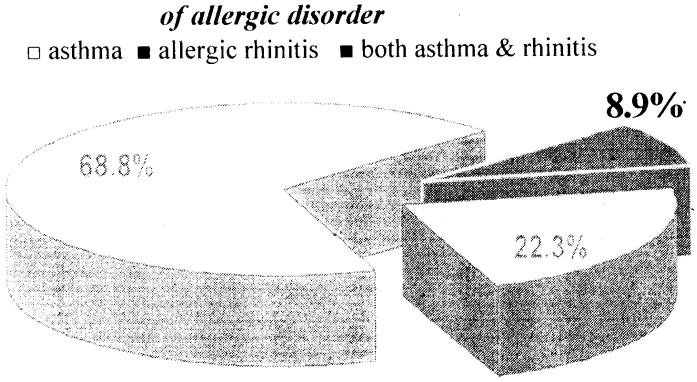


Fig. 2: Distribution of the study group according to the severity of allergic disorder

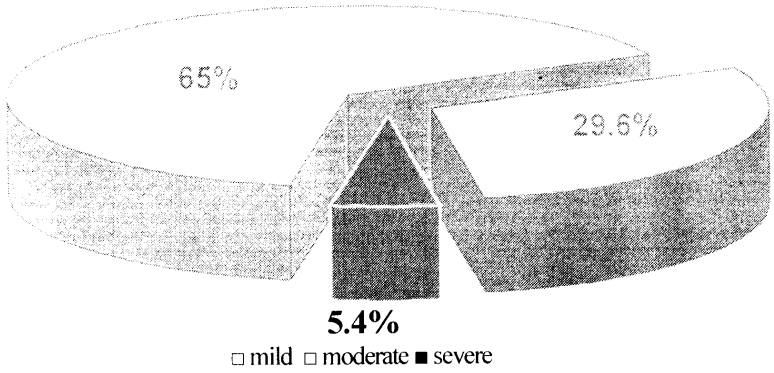
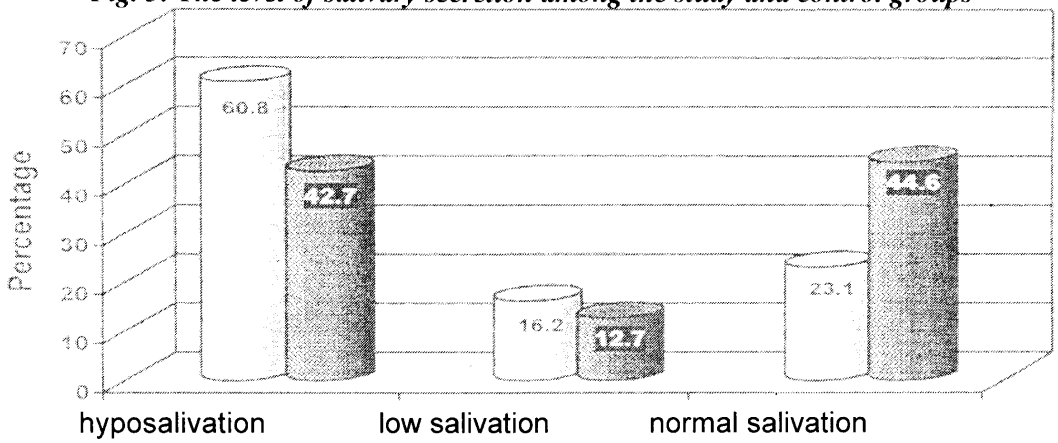


Fig. 3: The level of salivary secretion among the study and control groups



$X^2=27;d.f=2;P<0.001$

Table 1: Distribution of the study group by type of allergic disorder and type of treatment

Type of treatment	Asthma		Rhinitis		Both asthma and rhinitis		Total	
	No.	%	No.	%	No.	%	No.	%
Hypo-sensitization program	170	95	22	95.7	51	87.9	243	93.5
No medication	16	8.9		13	7	12.1	26	10
Anti-inflammatory drugs (Steroids)	29	16.2	0	0	7	12.1	36	13.8
Bronchodilators (pVagonists)	147	82.1		13	46	79.3	196	75.41
Methylxanthines	56	31.3	0	0	10	17.2	66	25.4 1
Antihistamines	91	50.8	20	87	48	82.8	159	61.2
Total	179	*	23	*	58	*	260	*

** Percentages do not add to 100% since a patient may take more than one type of medication.*

Table 2: The mean salivary flow rate among the study and control groups stratified by age and sex

Age group (Years)	Sex	Study group			Control group			Sig.
		Salivary flow rate (ml/min.)			Salivary flow rate (ml/min.)			
		No.	Mean	SD	No.	Mean	SD	
5-9	M	32	0.63	0.48	32	1.12	0.48	S***
	F	28	0.53	0.39	28	1.08	0.67	S***
	T	60	0.58	0.44	60	1.10	0.57	S***
10-14	M	85	0.71	0.47	85	1.02	0.59	S***
	F	36	0.54	0.33	36	0.68	0.28	N. S.
	T	121	0.66	0.44	121	0.92	0.55	S***
15-19	M	35	0.75	0.60	35	0.85	0.63	N. S.
	F	44	0.62	0.38	44	0.79	0.29	S*
	T	79	0.68	0.49	79	0.82	0.47	N. S.
Total	M	152	0.71	0.51	152	1.00	0.59	S***
	F	108	0.57	0.36	108	0.83	0.45	S***
	T	260	0.65	0.46	260	0.93	0.54	S***

**P<0.05; ***P<0.001*

Table 3: The salivary pH among the study and control groups stratified by and sex

Age group (Years)	Sex	Study group			Control group			Sig.
		Salivary pH			Salivary pH			
		No.	Mean	SD	No.	Mean	SD	
5-9	M	32	7.25	0.51	32	7.13	0.55	N. S.
	F	28	7.25	0.44	28	7.11	0.32	N. S.
	T	60	7.25	0.47	60	7.12	0.45	N. S.
10-14	M	85	7.35	0.53	85	7.2	0.46	S*
	F	36	7.19	0.47	36	7	0.48	N. S.
	T	121	7.31	0.51	121	7.14	0.47	S*
15-19	M	35	7.14	0.43	35	6.97	0.45	N. S.
	F	44	7.16	0.53	44	7.16	0.48	N. S.
	T	79	7.15	0.48	79	7.08	0.47	N. S.
Total	M	152	7.28	0.51	152	7.13	0.48	S**
	F	108	7.19	0.48	108	7.09	0.44	N. S.
	T	260	7.25	0.49	260	7.12	0.47	S**

**P<0.05 **P<0.1*

Table 4: Multiple regression model with salivary flow rate as the dependent variable

Independent variable	Multiple regression coefficient (p)	P value
1. Allergic disease of mild severity compared to controls.	-0.138 -	***
Allergic disease of moderate severity compared to controls. Severe allergic disease compared to controls.	0.276 - 0.414	*** ***
2. Age in years	-0.008 -	0.18 {NS} **
3. Female sex (compared to male)	0.14	

***P<0.01; ***P<0.001*
Model R^2=0.07; Model P value<0.001.

Discussion:

Patients with RTA (asthma, allergic rhinitis or both) who are following a hyposensitization program at the Allergy Institute in Baghdad still need medications to treat their allergy exacerbations on as-needed or daily bases since immuno-therapy does not eliminate the allergic symptoms (Zeiger & Schatz, 1998; Bigby & Wasserman, 1998: Kishiyama & Adelman, 1999). Of these medications, bronchodilators (p2- agonists) and antihistamines have some side effects that are important from the dental point of view, as they are reported to cause a reduction in the SFR and alter the salivary composition.

In this study, a large proportion of patients with RTA were taking \h- agonists (75.4%) and antihistamines (61.2%). This may explain the significantly higher percentages of the allergic patients in the study group having hypo- and low salivation than the control group. Similarly it may explain the significant reduction in the SFR in these patients compared to their healthy controls which is in agreement with a number of studies on asthmatic patients (Bjerkeborn et al.; 1987; Ryberg et al., 1987; Ryberg et al., 1990: Ryberg et al., 1991; Laurikainen & Kuusisto, 1998; Lenander-Lumikari et al., 1998) as well as a study on patients taking antihistaminic drugs (McDonald et al., 1994). Others found no differences in the SFR between asthmatic patients and their healthy controls and different age range included in those studies.

It was suggested by Ryberg et al. (1990) that (h-adrenoceptor agonists impair the salivary secretion in a dose-dependent pattern. This may explain the expected effect of the severity of RTA on the SFR due to the higher doses of the medications taken by the allergic patients as the severity of their allergic disorder increases. Also the expected reduction in the SFR in females compared to males in the total sample is in accordance with

other researchers (Parvinen & Larmas, 1982; Ben-Aryeh et al., 1984) relating this to the smaller si/.e of the salivary glands in females (Thylstrup & Fejerskov, 1994; Wefel & Dodds, 1995).

The multiple regression model explains only 7% of the variation in the SFR in the total sample, indicating that other factors not included in this model might have greater influence on the SFR such as the route of administration, the dose and the frequency of medication intake by the allergic patients, in addition to other factors that affects the S I R in general such as the gland size, smoking and unilateral stimulation (Dawes. 1996).

The significantly higher salivary pH found in allergic patients in comparison with their controls disagree with the results of Ryberg et al. in their longitudinal study (Ryberg et al., 1987; Ryberg et al., 1991) as well as with Laurikainen and Kuusisto (1998). This may be due to statistical factors relayed to the larger sample size in this study compared to the above mentioned ones.

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