

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 used 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 for age and sex. Stimulated mixed saliva samples were collected from each individual and the SFR and the salivary pH were recorded.

Results: A significantly reduced SFR was found among all allergic patients in comparison to all the controls ($P=0.001$). Similarly the salivary pH was significantly higher in all the allergic patients compared to their healthy controls ($P<0.01$).

Conclusion: The results of the present study support 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 diseases among these patients.

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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 anticholinergic 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 by as much as 50%. Of the medications used for the management of asthma are β_2 -adrenergic agonists, which are bronchodilators and used in acute asthma (NHLBI, 1991; NHLBI, 1997; Rees & Kanabar, 2000). Several authors studied the effect of selective β_2 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 (Hyypä & Paunio, 1979; Hyypä, 1981). Others reported a significant reduction in the SFR of these patients (Bjerkebohm 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 secretory 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; Laurikainen & Kuusisto, 1998). However Kargul et al. (1998) demonstrated a decrease in salivary and plaque pH 30 minutes after the use of inhaler medicaments among asthmatic children.

No previous studies in Iraq on 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 and the others have other allergic conditions such as atopic dermatitis, eczema, or a systemic disease in addition to their respiratory allergy.

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 its treatment were recorded. Asthma severity was determined by the physicians based on a modification of the expert

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panel report of the NHLBI (1997). The severity of allergic rhinitis was classified according to 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 samples were collected from each subject at least 1 hr. after breakfast. Then the SFR and the salivary pH using a pH indicating paper were recorded (McDonald et al., 1994).

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

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

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 β_2 -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 ($P < 0.001$) as demonstrated in figure 3. Also the salivary flow rate for the total study group was significantly lower ($P < 0.001$) than that of the total control group (Table 2).

The difference between the two groups in the mean salivary pH was significant ($P < 0.05$) in the second age group as well as in total sample (Table 3). A very weak correlation between the SFR and the salivary pH was found in the study group ($r = +0.24$) as well as in the control group ($r = +0.17$), and correlation was statistically significant at ($P < 0.01$).

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 ($P < 0.001$) but the independent variables included in the model can explain only 7% of the variation in the SFR in the total sample (Table 4).

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 (β_2 -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 (β_2 -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 (β_2 -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 size 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 dose taken by the allergic patients, in addition to other factors that affects the SFR 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 (Ryberget al., 1987; Ryberg et al., 1991) as well as with Laurikainen and Kuusisto (1998). This may be due to statistical factors related to the larger sample size in this study compared to the above mentioned ones.

References:

1. Aldous J. A.: *Induced Xerostomia and its relation to dental caries. J. Dent. Child.* (1964); 31: 160-162.
2. Astor F. C., Hanft K. L. and Ciocon J. O.: *Xerostomia: A prevalent condition in the elderly. Ear-Nose-Throat-J.* (1999); 78 (7): 476-479. (Medline Abstract).
3. Bahn S. L.: *Drug-related dental destruction. Oral surg.* (1972); 33: 49-54.
4. Ben-Aryeh H., Miron D., Szargel R., and Gutman D.: *Whole-saliva secretion rates in old and young healthy subjects. J. Dent. Res.* (1984); 63 (9): 1147-1148.

5. Bigby T. D. and Wasserman S. L.: *Asthma*. In *Internal Medicine* (1998). Editor- in-chief Stein J. H., 5th ed, chapter 188. Mosby company, USA. Pp., 1185-1193.
6. Bjerkeborn K., Dahllof G., Hedlin G., Lindell M. and Modeet T.: *Effect of disease severity and pharmacotherapy of asthma on oral health in asthmatic children*. *Scand. J. Dent. Res.* (1987); 95: 159-164.
7. Dawes C.: *Factors influencing salivary flow rate and composition*. In *Saliva and Oral Health* (1996). Edited by Edgar W. M. and O'Mullane D. M, 2nd ed. chapter 3. British Dental Association, London.
8. Goth A. and Shore P. A.: *Antihistaminic drugs*. In *Medical Pharmacology* (1978): *Principles and Concepts*. 9th ed, chapter 20. C. V. Mosby company, St. Louis.
9. Hyyppa T.: *Studies on immunologic and inflammatory factors in saliva in patients with asthma and in patients with periodontitis*. *J. Clin. Periodontol.* (1981); 8: 500-507.
10. Hyyppa T. and Paunio K.: *Oral health and salivary factors in children with asthma*. *Proceedings of the Finnish Dental Society* (1979); 75: 7-10. [Cited by Hyyppa T.: *Salivary immunoglobulins in children with asthma*. *J. Periodont. Res.* (1980); 15:227-231].
11. Kargul B., Tanboga L., Ergeneli S., Karakoc F. and Dagli E.: *Inhaler medicament effects on saliva and plaque pH in asthmatic children*. *J. Clin. Pediatr. Dent.* (1998); 22 (2): 137-140.
12. Kishiyama T. L. and Adelman D. C.: *Allergic and Immunologic diseases*. In *Current Medical Diagnosis and Treatment* (1999). Edited by Tierney L. M., Jr., McPhee S. J. and Papadakis M. A., 38th ed, chapter 19. Appleton and Lange. USA.
13. Laurikainen K. and Kuusisto P.: *Comparison of the oral health status and salivary flow rate of asthmatic patients with those of non-asthmatic adults-results of a pilot study*. *Allergy* (1998); 53: 316-319.
14. H. Lenander - Lumikari M., Laurikainen K., Kuusisto P., and Vilja P.: *Stimulated salivary flow rate and composition in asthmatic and non-asthmatic adults*. *Archs. Oral Biol.* (1998); 43:151-156.
15. McDonald R. E., Avery D. R. and Stookey G. K.: *Dental Caries in Child and Adolescent* (1994). Edited by McDonald R. E. and Avery D. R., 6th ed. Chapter 10. Mosby, USA. Pp., 248-255.
16. National Heart, Lung and Blood Institute: *Executive summary: Guidelines for the diagnosis and management of asthma* (1991). National Asthma Education Program, expert panel reports. Bethesda, Md., National Institutes of Health Publication no. 91-3042A.
17. National Heart, Lung and Blood Institute: *Clinical practice guidelines: Practical guide for the diagnosis and management of asthma* (1997). National Asthma Education Program, expert panel reports 2. Bethesda, Md., National Institutes of Health Publication no. 97-4051.
18. Parvinen T. and Larmas M.: *Age dependency of stimulated salivary flow rate, pH, lactobacillus and yeasts concentrations*. *J. Dent. Res.* (1982); 61:1052-1055.
19. Rees J. and Kanabar D.: *ABC of ASTHMA*. (2000), 4th ed, BMJ Books.
20. Ryberg M., Moller C. and Ericson T.: *Effect of (P2- adrenoceptor agonists on saliva proteins and dental caries in asthmatic children*. *J. Dent. Res.* (1987); 66(8): 1404-1406.
21. Ryberg ML, Moller C. and Ericson T.: *Saliva composition in asthmatic patients after treatment with two dose levels of a beta 2- adrenoceptor agonist*. *Arch. Oral Biol.* (1990); 35(12): 945-948.
22. Ryberg ML, Moller C. and Ericson T.: *Saliva composition and caries development in asthmatic patients treated with P2- adrenoceptor agonists: a 4-year follow-up study*. *Scand. J. Dent. Res.* (1991); 99: 212-218.
23. Thylstrup A. and Fejerskov O.: *Textbook of Clinical Cariology* (1994). 2nd ed., chapter 1 and 2. Munksgaard. Copenhagen.
24. Trzeciakowski J. P. and Levi R.: *Antihistamines*. In *Allergy Principles and Practice* (1983) vol. (1). Edited by Middleton E. Jr., Reed C. E. and Ellis E. F.. 2nd ed., chapter 28. C. V. Mosby, company St. Louis.
25. Wefel J. S. and Dodds M. W. Jr.: *Oral biologic defenses and the demineralization and remineralization of teeth*. In *Primary Preventive Dentistry* (1995). Edited by Harris N. O. and Christen A. G., 4th ed., chapter 11. Appleton and Lange, USA. Pp: 259-264.
26. Whelton H.: *Introduction: The anatomy and physiology of salivary glands*. In *Saliva and Oral Health* (1996). Edited by Edgar W. M. and O'Mullane D. M., 2nd ed., chapter 1. British Dental Association, London.
27. Zeiger R. S. and Schatz M.: *Rhinitis*. In *Internal Medicine* (1998). (Editor-in-chief Stein J. H., 5th ed., chapter 187. Mosby company. USA. Pp., 1180-1185.