SECRETION OF TOTAL SOLIDS (SOLUTES) IN THE SALIVA OF LONG-TERM TOBACCO USERS

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Background: It is generally believed that repeated exposure of a receptor to a stimulus results in inactivation (suppression or adaptation) of the receptor .Most of the methods of tobacco use are linked to the oral cavity where the taste receptors, a primary site for stimulation of salivary secretion, are constantly exposed to tobacco for long time. The present study was designed to document changes in salivary concentration of total solids in response to this effect in chronic tobacco users, if any. **Methods:** Subjects of the study were divided into smokers, pan (tobacco-betel-lime quid) chewers, *niswar* (moist oral snuff) dippers and non tobacco users as controls. The saliva of each subject was collected under resting condition and following application of crude nicotine and citric acid solutions to the tip of his tongue. **Results:** After stimulation with nicotine all groups showed a decrease in the total solids concentration but the decrease was not significant in any group. After stimulation with citric acid, further decrease was seen in all groups but it was also insignificant statistically. **Conclusion:** We conclude that the total solids concentration decreases with the increase in salivary flow rates (and vice versa) in long-term tobacco users, salivary reflex is not adversely affected by long-term use of tobacco and this observation is not much different from that in non users.

Keywords: Saliva, long-term tobacco users, total solids.

INTRODUCTION

Although long-term use of tobacco is linked to a variety of serious diseases ranging from coronary artery disease to lung cancer[1] but no population has given up one form of tobacco use without replacing it with another.[2] The traditional methods of its use are smoking, chewing, dipping and snuffing. Except snuffing, the other three methods are directly linked to the oral cavity. The solid matter (total solids or solutes) of saliva is about 0.7% which consists of organic (0.5%) and inorganic (0.2%) components.[3] Secretion of solids in saliva depends upon salivary flow rate in non-tobacco users and greater is the rate, lower is the concentration and vice versa[4] but the differences in the function of excretion and the role of excretory duct cells are currently unknown in salivary glands[5]. However, with the increase in salivary flow rate, the sodium concentration increases while that of potassium[6] and calcium[7] decreases in long-term tobacco users. Moreover the salivary flow rates in chronic tobacco users are not much different from that in non users.[8] But what happens to the total solids in the saliva of long-term tobacco users is still obscure. In long-term tobacco users the taste receptors, a primary site for salivary secretion, are repeatedly exposed to tobacco for long time thus presumably affecting the salivary reflex. Therefore the main purpose of the study was to document changes in salivary concentration of total solids as a whole in response to this effect in chronic tobacco users if any.

MATERIALS AND METHODS

The subjects were selected from the students of Basic Medical Sciences Institute (BMSI), Jinnah Post-graduate Medical Centre (JPMC) and the general population of Karachi. The subjects were divided into smokers, *pan* (tobacco-betel-lime quid) chewers, *niswar* (moist oral snuff) dippers and non-tobacco users as controls. Each group was comprised of 20 apparently healthy male adults. All the subjects were well matched with respect to age (25–30 years) and the duration of beginning tobacco use (5–7 years). Subjects in the habit of more than one type of tobacco use or bad orodental hygiene or with too little salivary secretion were not included in the study. Before sampling, each subject was briefed about the procedure and instructed to wash his mouth and gargle with plain water. The saliva of each subject was collected (for 10 minutes) under resting condition (without stimulation) and following application of crude nicotine solution (50 µl of 1% v/v) and citric acid solution (50 µl of 1% w/v) to the tip of his tongue. Crude nicotine was extracted from tobacco[9] and citric acid was obtained from the Physiology Department of BMSI, JPMC Karachi. Total solids were estimated by placing 5 ml of saliva in a test tube which was weighed in an electronic balance,

dried to constant weight at 105 ºC for 8 hours and then weighed again[10]. The data was statistically analyzed by Student's *t*-test.[11,12]

RESULTS

The concentration of total solids in the resting condition was 457.65±36.37 mg/100 ml in controls, 501.20±29.72 mg/100 ml in smokers, 447.70±15.82 mg/100 ml in *pan* chewers and 452.50±29.38 mg/100 ml in *niswar* dippers. No significant difference was seen when the tobacco users were compared with controls.

After stimulation with nicotine solution, the concentration was dropped to 433.25±36.49 mg/100 ml (5.38%) in controls, 486.55±29028 mg/100 ml (2.92%) in smokers, 412.85±15018 mg/100 ml (7.78%) in pan chewers and 429.65±28.79 mg/100 ml (4.96%) in *niswar* dippers. Neither of the decrease was statistically significant. Moreover, no significant difference was observed when the tobacco users were compared with controls.

After stimulation with citric acid solution, the concentration was further dropped to 406.50±35.90 mg/100 ml (11.77%) in controls, 466.95±29.20 mg/100 ml (6.83%) in smokers, 395.85±14.89 mg/100 ml (11.58%) in pan chewers and 409.20±28.16 mg/100 ml (9.47%) in *niswar* dippers. Again neither of the drops was statistically significant nor was any significant difference noted when the tobacco users were compared with controls.

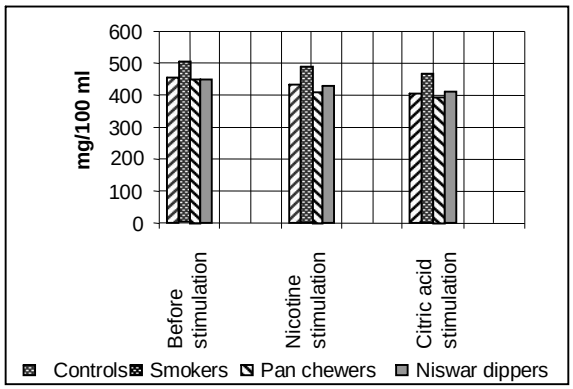

Figure-1: Changes in solute concentrations of controls, smokers, pan chewers and *niswar* dippers before and after stimulation with nicotine and citric acid stimulation

DISCUSSION

Saliva is the most easily accessible fluid in the human body and it is probable that it will provide an easy tool for non-invasive measurements of various body parameters in future. It has been discovered that smoking increases the activity of salivary glands and, indeed, this observation has been made by every one who begins smoking. It has also been observed that some tolerance develops to the salivatory effects of smoking because habitual smokers do not salivate as do novice smokers in response to smoking.[13] In normal individuals saliva is secreted in two stages; first, secretion occurs into the glandular acini which is approximately similar to extra cellular fluid (ECF) and then this primary secretion flows through the acinar ducts where reconditioning occurs, some substances are actively reabsorbed while some are actively secreted but during maximal salivation, there is not much time for the reconditioning process to occur and therefore, the total concentration of solids in saliva decreases.[4] Moreover, variations in salivary flow can be affected, reversibly or irreversibly, by numerous physiological and pathological factors.[14] The present study revealed that as the flow increases the solute concentration decreases but this also depends upon the nature (and probably on the amount) of the stimulating substance. However the changes were insignificant statistically. It was also observed that citric acid induces more saliva as compared to nicotine indicating that citric acid is more potent. There can be various possibilities for the decrease in the total solids concentration when the salivary flow increases; either more water is secreted into or less water and more amount of solute is reabsorbed from the common solution when it flows from the acini through its ducts or both effects occur simultaneously. It is a fact that the salivary flow rates in chronic tobacco users are not much different from that in non users,[8] therefore, there is a greater possibility that both effects occur at the same time. We do not know exactly how the organic constituents affect the process but we do know that the sodium concentration increases while that of potassium[6] and calcium[7] decreases in long-term tobacco users as the flow increases. Thus, these two processes (may be some more), nullify the effects of each other to some extent, resulting in the insignificant decrease in solute concentration. Therefore on the basis of our own work and the literature studied we conclude that the solute concentration in the saliva of long-term tobacco users decreases as the salivary flow increases (and vice versa) and this observation is not much different from that in non users. We also conclude that salivary reflex is not adversely affected by long-term use of tobacco.

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