Investigation the impact of smoking on salivary pH and the reasons behind smoking

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Abstract. Tobacco smoking is affecting fundamental aspects of human health. This preliminary study was set to investigate the effect of tobacco smoking on the salivary pH. The saliva is an essential part of healthy oral cavity, it is mostly made of water and also contains other substances that your body needs to digest food and keep your teeth strong. Smoking is expected to have an effect on salivary pH. The salivary pH levels were measured using digital pH meter in 100 voluntary participants in Baghdad-Iraq. The participants were divided into two groups of 50 subjects in each group: smokers and non-smokers. Along with that, the reasons behind tobacco smoking were also investigated in a separate group of 82 smokers using a prepared questioner for this purpose. The results showed decrease salivary pH average levels in the tobacco smokers compare to the non-smoker group (7.058 and 7.168 respectively), however, these differences did not reach the significant level. Regarding the investigation of the reasons behind tobacco smoking habit, seeking for fun, overcome psychiatric problem, anger, friendship, relieves stress and anxiety and work problems (29 (35.4%), 28(34.1%), 27(32.9%), 22(26.8%), 22(26.8%), 21(25.6%) respectively, were on the top of the listed reasons for smoking tobacco cigarettes stated by the questioned participants. Participants who think that cigarettes could help to relieve boredom (age average 35.3 yrs (17-55 yrs) smoke the largest number of cigarettes (30(20-60) compare to those who smoke for other reasons.

Keywords: [Tobacco smoking, Salivary pH, why you smoke]

Introduction

Smoking is one of greatest bad habit facing the developing countries; it generally has negative health effect because smoke inhalation poses dangerous to every single organ in the body and weaken the overall health. Studies also indicate that smoking is the major cause of lung, urinary bladder, renal pelvis,
oral cavity, pharynx, larynx, esophagus, lip, and pancreas cancers in humans (Jena et al., 2013). The reason of causing cancer is that chemical substances in cigarette damage the DNA in the body including key gene that maintain the body from cancer (Kane et al., 1999). Smoking is the major second cause of early preventable death in the world. Studies estimate that smoking kills 4.9 million people a year and if the smokers continue to increase the studies expected that smoking will be the major cause of death over the world by 2030 (Dunga et al., 2015).

Tobacco does not harm the smokers only, the non-smokers (also called secondhand smoke, involuntary smoke and passive smoke) suffer from mixture of two type of smoke “side-stream” smoke (smoke that result from burning of tobacco) and “mainstream” smoke (the smoke given off by smokers) (Kang et al., 2018). There are many types of smoking which include (cigarettes, hookah (water pipe), cigar, pipes) all of them based on burning off tobacco but the most common types are cigarette smoking and water pipe smoking.

Saliva is watery solution secreted by salivary glands in the mouth it is essential for maintaining the oral health. Saliva is formed primarily from the secretions of the three paired major salivary glands, the sub-mandibular, parotid and sublingual as shown in figure 2. While minor glands (labial, lingual, buccal and palatine), distributed around the oral cavity, produce the remaining saliva (<10%) (Bialek et al., 2006).

Human saliva comprising of 99% of water, also it contains glycoprotein, mucous epithelial cells and enzymes (such as amylase and lipase) (Carpenter, 2013). pH (potential of hydrogen) is numeric scale use to determine the acidity or basicity of an aqueous solution. It is the basic is measurement of hydrogen ions in the solution. Solutions with high concentration of hydrogen ions have low pH while those with low hydrogen ions have high pH. Salivary pH is a key factor in the balance between acid demineralization of the teeth and the remineralization of the initial caries lesion. Plaque pH decreases when acid accumulates in the plaque due to bacterial acid production after the consumption of fermentable carbohydrates – mainly sugars – in foods and drinks. On other hand, the pH increased when the acids are washed away or neutralized by saliva, which contains the important buffer, bicarbonate (Dawes et al., 2015).

Although most of the tobacco smokers knew the adverse heath effect of smoking, they have their reason for usually continuing this bad heath habit. These reasons include seeking for fun, tackling psychological issues, controlling anger, impact of friendship, work and economic problems and many other rationales (Buczkowski et al., 2014). This study was set to investigate the effect of smoking on salivary pH and reasons behind this habit in a small set of voluntary agreed to participate in Baghdad, Iraq.

**Materials and Methods**

**Subjects**

The study included 100 subjects, all of them are males and they divided into two subgroups of 50 smokers and 50 of nonsmokers who were voluntary agreed to participate in the study. Along with that, 82 smoker individuals were questioned about the reason behind their tobacco smoking. This was performed using a prepared questioner includes information about smoking history and multiple chose question about why you do smoke.
Saliva sampling

The protocol of saliva collecting and sampling was derived from WHO organization, International Agency for Research on Cancer “Common Minimal Technical Standards and Protocols”. Saliva samples were obtained as much as possible in the morning after overnight fast, otherwise the subjects ask not to eat or drink other than water for two hours. They should also to rinse their mouth well with distilled-water, 5 minutes after oral rinse the subject was asked to swallow the whole saliva in the mouth. The subjects were asked to abstain from talking and let the saliva run naturally in front of the mouth. They also asked them not to cough up mucous when saliva is collected. They spit into disposables terilized tube about (0.5 ml) then the specimens were transferred into a special tube for measuring the pH. The specimen was collected between 9:00 am and 12:00 pm.

The salivary pH was measured immediately in order to prevent any deterioration of the specimen.

Saliva analysis

The pH was directly measured using digital pH meter (checker pH meter model APH-20) as shown in figure 3. The pH meter was calibrated every day with buffer of pH 7, after this the tip of meter was dipped in distilled water before measuring the sample, then completely dry it using sterilized paper. After measuring the pH the tip of electrode was washed again with stream of distilled water.

![Figure (1): Digital pH meter (checker pH meter model APH-20)](image)

Results and Discussion

Tobacco smoking affects fundamental aspects of human health. Since saliva plays a critical role in homeostasis of oral cavity, and creates the balance in oral cavity ecosystem, this study was set to investigate the effect of tobacco smoking on salivary pH levels. The results showed decrease the salivary pH level in the tobacco smoke group compare to the non-smoker (7.058 and 7.168 respectively), however, the differences did reach the significant level (table 1). This could be due to the used pH meter was not sensitive enough to detect small differences the salivary pH. Furthermore, the relatively small number of the studied individuals might affect the obtained results.
Previous studies have shown adverse effects of tobacco smoking of saliva health parameter. This includes the decrease the levels salivary pH in smoker in comparison to non-smokers. In a study conducted by Singh and colleagues, the salivary pH mean levels were reduced from 7.10 in the non-smokers to 6.30 in the smokers group (Singh et al., 2015). Another study found that water-pipe smokers (Shisha) have lower salivary pH levels in comparison to the non-smokers (Khemiss et al., 2017). Similar findings were obtained by other studies of which researchers concluded that salivary pH levels were reduced in tobacco smokers than in individuals who do not smoke (Parmar et al., 2017, Grover et al., 2016).

| Table 1: Salivary pH levels between tobacco smokers and non-smokers studied groups. |
|-------------------------------------------------|
| Study group | Number | Mean of pH level | Variance | T-test |
| Smokers     | 50     | 7.058            | 0.327    | P = 0.318 |
| Non-smokers | 50     | 7.168            | 0.217    |          |

Regarding the investigation of the reasons behind tobacco smoking habit, the results showed that seeking for fun was on the top the list of reasons for smoking tobacco cigarettes (29 (35.4%), table 2) as stated by the questioned participants. This was followed by smoking for overcome psychiatric problem, anger, friendship, relieves stress and anxiety and work problems (28(34.1%), 27(32.9%), 22(26.8%), 22(26.8%), 21(25.6%) respectively, table 2). 19.6% of the participants believe that tobacco smoking could help to relieve boredom while 17.07% of them smoke because of pad economic situations. 14.6% of the studied individuals do smoke tobacco because they are not satisfied with their live (family problems, loss lovely person), whereas smoking for passing time account for 11% of the reasons in the present study. A fewer number of the questioned smokers believe that tobacco smoking could help with tension relieve, overcome fear and shying, and as self reward (8.5%, 7.3%, 3.7 and 1.2 respectively, table 2).

Participants who think that cigarettes could help to relieve boredom (age average 35.3 yrs (17-55 yrs) smoke the largest number of cigarettes (30(20-60 cigs/day) compare to those who smoke for other reasons. This resulted in significant differences the number of smoked cigarettes between them and those who smoke for fun and to overcome work problems (table 3).

| Table 2: Reason behind smoking habits among the investigated participants |
|-------------------------------------------------|
| Why do you smoke? | Participants positive answer (n%) |
| For fun | 29 (35.4%) |
| Psychiatric problem | 28 (34.1%) |
| Soothes anger | 27 (32.9%) |
| Friends | 22 (26.8%) |
| Relieves stress and anxiety | 22 (26.8%) |
| Work problems | 21(25.6%) |
| Relieves boredom | 16 (19.5%) |
| Pad economic status | 14(17.07%) |
| Not -satisfied with your life | 12(14.6%) |
| Smoking passes the time | 9(11%) |
Helps tension 7 (8.5)
Overcome fear and shyness 6 (7.3%)
Losing weight 3 (3.7%)
Smoking as a reward 1 (1.2%)

Table 3: The number of smoked cigarettes and age range for participants give positive answer in each category of smoking reason.

| Why do you smoke?                          | Age average (rang/ yrs) | Smoked Cigars Average (rang/ yrs) |
|-------------------------------------------|-------------------------|-----------------------------------|
| For fun (29)                              | 31-(19-50)              | 22.4(10-60)*                      |
| Psychiatric problem (28)                  | 32.4(18-60)             | 26.1(8-10)                        |
| Soothes anger (27)                        | 31.1(18-50)             | 28.3(10-60)                       |
| Friends(22)                               | 32.4(17-50)             | 23.4(10-60)                       |
| Relieves stress and anxiety (22)          | 32.1(22-55)             | 25.4 (10-50)                      |
| Work problems (21)                        | 30.4(19-52)             | 23.8(15-40)*                      |
| Relieves boredom (16)                    | 35.3(17-55)             | 30(20-60)*                        |
| Pad economic status (14)                  | 27.3(20-42)             | 27.8(10-50)                       |
| Not satisfied with your life (12)         | 29.9 (24-48)            | 28.2 (8-50)                       |
| Smoking passes the time(9)                | 30.5(17-45)             | 22.2(10-30)                       |
| Helps tension (7)                         | 29.1 (17-40)            | 24.3(20-40)                       |
| Overcome fear and shyness (6)             | 29.8(17-52)             | 25 (20-40)                        |
| Losing weight (3)                         | 29(17-37)               | 20                                |
| Smoking as a reward(1)                    | 25                     | 20                                |

* Significant differences (T-test, P= 0.047 and P=0.057 respectively)

Understanding why you smoke is a key factor to help when you decide quit smoking. This could add with choosing the suitable strategy of stopping tobacco smoking or even reducing the number of smoked cigarettes. The important of understanding why you smoke will help you identify whether habit, mood or certain social situations pose the greatest challenge for you. The more aware you are of your triggers, the more you can prepare and meet them head on by drawing up strategies to cope.

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