Comparison of salivary total antioxidant levels in male smokers and non-smokers according to their personality types

Porównanie całkowitej zdolności antyoksydacyjnej śliny u palących i niepalących mężczyzn w odniesieniu do ich typów osobowości

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Abstract

Background. Cigarette smoking is a major global health problem, associated with various oral diseases, such as oral cancers. Salivary antioxidants may play an important role in fighting against radicals and the oxidative components of cigarettes, which can cause DNA damage. Furthermore, psychological stress, which occurs more often in individuals with type A personality, affects plasma antioxidant levels.

Objectives. The objective of this study was to compare the levels of salivary total antioxidant capacity (TAC) between smokers and non-smokers according to their personality types.

Material and methods. In this descriptive cross-sectional study, saliva samples were collected from 40 male smokers (with ≥ 0.1 pack-years) and 40 male non-smokers. After centrifugation, the samples were assessed using an enzyme-linked immunosorbent assay (ELISA) kit. Pearson's correlation, Welch's *t*-test and the one-way analysis of variance (ANOVA) test were used for statistical analyses.

Results. The TAC of saliva in smokers was significantly lower than in non-smokers ($p = 0.019$). Type A and type B smokers showed no significant decrease in TAC ($p > 0.05$ and $p = 0.05$, respectively) as compared to type A and type B non-smokers, respectively. Type A smokers reported a higher number of cigarettes smoked per day as compared to smokers with type B personality ($p = 0.043$).

Conclusions. Smoking cigarettes was associated with a significant decrease in salivary TAC. However, the personality type did not affect salivary TAC in the present study.

Key words: personality, antioxidants, saliva, antioxidant, smoking tobacco

Słowa kluczowe: osobowość, antyoksydanty, ślina, antyoksydacyjny, palenie tytoniu

Introduction

Smoking has various negative effects on oral health. Also, it is considered as a major risk factor for oral cancers.^{1,2} Furthermore, smoking tobacco is positively associated with buccal cell mutations,³ periodontal diseases⁴ and premalignant lesions.⁵

Reactive oxygen species, reactive nitrogen species as well as radicals are amongst the numerous toxic components found in cigarette smoke.⁶ These oxidants and radicals can lead to oxidative DNA damage, the damage of cellular components, the inhibition of apoptosis, and increased angiogenesis. Hence, they are related to oral cancer initiation, promotion and progression.^{7,8}

The disproportion between the levels of oxidative components (e.g., reactive oxygen species and free radicals) and antioxidants may be associated with several oral pathologies.⁹ As a biological fluid, saliva contains antioxidant molecules, such as glutathione and uric acid, and enzymes, such as superoxide dismutase (SOD), guaiacol peroxidase (GP) and glutathione peroxidase (GSH-PX).¹⁰ Cigarette smoke may interfere with the antioxidants in saliva. A previous study showed that smoking a single cigarette induced a significant reduction in the concentration of glutathione in saliva.¹¹ Also, another study demonstrated that salivary TAC levels were significantly lower in smokers as compared to non-smokers.¹²

It has been shown that psychological stress can increase DNA oxidation and lipid peroxidation, and decrease the total antioxidant capacity (TAC) of plasma in university students.¹³ Another study showed increased peroxidation levels and decreased TAC levels of plasma in patients with depression.¹⁴ Both psychological stress and depression occur with a higher incidence in persons with type A personality. These individuals are more impatient, more competitive and more aggressive. Also, they tend to exhibit addictive behaviors, such as cigarette smoking.¹⁵

The current lack of evidence has led us to design this descriptive cross-sectional study to measure and compare the TAC levels of saliva in smokers and non-smokers according to their personality types.

Material and methods

This descriptive cross-sectional study was conducted between 2016 and 2018. It was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences in Tehran, Iran (IR.SBMU.RIDS.REC.1395.350).

The sample size required to identify differences between the 2 groups, as stated in a previous similar study,¹⁰ was 20 subjects in each group, assuming a nondirectional alpha risk of 0.05 and a power of 0.8. Forty male smokers and 40 male non-smokers were selected using a simple non-randomized sampling method. Each group had equally 20 individuals with type A or type B personality.

The groups consisted of patients attending the Department of Oral Medicine at the School of Dentistry of Shahid Beheshti University of Medical Sciences in Tehran, Iran.

Individuals with a history of ≥ 0.1 pack-years are considered as smokers.¹⁶ The inclusion criteria contained the following: the ability to fill out the questionnaire; no consumption of alcohol; age under 60 years; the absence of pregnancy; no presence of oral lesions or systemic diseases, such as diabetes mellitus, leukemia, thalassemia, or rheumatoid arthritis; and not taking medications during the previous 6 months at least.

All individuals signed informed consent. The investigator requested the participants not to eat or drink 2 h before the collection of saliva. In addition, smokers were prohibited from smoking 1 h before the collection of saliva. After mouth washing with water and waiting for 2 min, 5 mL of saliva was sampled in an upright resting position between 9 am and 12 am. The samples were immediately placed in ice, and then moved to the laboratory. They were centrifuged at 1,000 g at 4°C for 10 min. After removing debris, the samples were preserved at a temperature of -80°C. The exact duration of the saliva collection was also recorded to calculate the salivary flow.¹⁷ A blinded technician measured the TAC levels using an enzyme-linked immunosorbent assay (ELISA) kit (ZellBio GmbH, Rostock, Germany). This kit was able to detect 0.1 mM of TAC, using ascorbic acid as a standard.^{18,19} The DANA-3200® ELISA reader (Garni Medical Eng. Co., Tehran, Iran) was used to read the results.

To determine the type of personality, we used the self-administered 14-item Bortner questionnaire in the Persian language with total scores ranging from 0 to 140, assuming 70 as a borderline.¹⁸ Results with scores less or more than 70 are considered as type B or type A personality, respectively. The reliability and validity of the Persian version of the Bortner questionnaire were assessed and confirmed in previous separate studies.^{19,20}

The analyses were carried out using the IBM SPSS Statistics for Windows software, v. 21 (IBM Corp., Armonk, USA). The comparison of different brands of cigarettes was made using the χ^2 test. Welch's *t*-test was used to compare smoking years, the number of cigarettes smoked per day and age between the groups. To compare the levels of TAC between the groups, the one-way analysis of variance (ANOVA) test was implemented. The statistical significance level of the present study was set at 5%.

Results

The mean age of the participants was 39.6 ± 7.32 years. There was no significant difference in terms of age between the groups ($p > 0.05$).

Table 1 shows that the levels of TAC in smokers were significantly lower than in non-smokers ($p = 0.019$). There

was no significant difference in the levels of TAC between type A smokers and type A non-smokers ($p > 0.05$), but this difference was at the borderline for the type B group ($p = 0.05$). Furthermore, there was no significant difference in the TAC levels between smokers with regard to their personality types ($p > 0.05$). According to Table 2, the number of cigarettes smoked per day for the type A group was significantly greater than for the type B group ($p = 0.043$). However, the difference in smoking years between the 2 groups was not significant ($p > 0.05$).

The salivary flow of smokers was lower than that of non-smokers, but the difference was not statistically significant ($p > 0.05$).

Table 1. Comparison of the total antioxidant capacity (TAC) levels between the groups

Group	Sample size (n)	TAC [U/L]	p-value
Type A smokers	20	0.34 ± 0.19	0.840
Type A non-smokers	20	0.39 ± 0.19	
Type B smokers	20	0.24 ± 0.15	0.050**
Type B non-smokers	20	0.39 ± 0.17	
Type A and type B smokers	40	0.29 ± 0.17	0.019*
Type A and type B non-smokers	40	0.39 ± 0.18	
Type A smokers	20	0.34 ± 0.19	0.323
Type B smokers	20	0.24 ± 0.15	

Data presented as mean ± standard deviation ($M \pm SD$).

* statistically significant; ** at the borderline of statistical significance.

Table 2. Factors associated with cigarette smoking in each smoker group

Factor	Type A smokers (n = 20)	Type B smokers (n = 20)	p-value
Mean duration of cigarette smoking [years]	18.35	18.00	0.897
Mean number of cigarettes smoked per day	12.40	8.65	0.043*

* statistically significant.

Discussion

The maximum prevalence of cigarette smoking is seen between the age of 30 and 49.^{21,22} Similarly to previous studies,^{2,10} the mean age of participants in this study was in the aforesaid range.

It has been shown that the levels of TAC are significantly higher in males.²³ For this reason and to eliminate the possible effect of sex, we only included male participants in the present study.

The measurement of TAC is better than the measurement of all known antioxidants separately, as it requires less time, and takes into account the activity of unknown antioxidants as well as the positive or negative interactions between different antioxidants.¹¹

In the present study, salivary TAC in smokers was significantly lower than in non-smokers. This outcome was similar to those of some previous studies, reporting lower

levels of TAC or SOD, GP and GSH-PX separately.^{2,10} Nevertheless, some other studies showed no significant difference in salivary TAC between smokers and non-smokers.²⁴ Conversely, previous research showed significantly higher levels of TAC in smokers as compared to non-smokers.²⁵ These controversies may be related to the differences in the study design, inclusion and exclusion criteria, sample size, saliva sampling methods, intensity and duration of the smoking habit, and antioxidant measurement methods.

Although some studies reported a significantly lower salivary flow for smokers, our results showed no significant difference in the salivary flow between the 2 groups, confirming the outcomes of previous research.²⁴

Individuals with type A or type B personality exhibit different psychological states; however, our findings showed no significant difference between the 2 types in the duration of cigarette smoking, although participants with type A personality reported a significantly higher number of cigarettes smoked per day as compared to participants with type B personality. These findings are parallel to prior evidence and can indicate that smoking is more common among people with type A personality than in the case of type B personality.²⁶

Individuals with type A personality were smoking more cigarettes per day as compared to type B individuals, but they did not have lower levels of TAC. This result is similar to that of a previous study, which showed no significant difference in nicotine intake between the 2 different personality types. However, that study reported similar smoking behaviors in type A and type B smokers.²⁷ Our findings with different smoking behaviors (more cigarettes per day in the type A personality group) are in line with the findings of the aforementioned study with similar smoking behaviors in the 2 groups. Maybe other factors, such as the number of puffs per cigarette or the duration of each puff, influence this controversy.

Another study demonstrated that the administration of nicotine caused a significant change in the plasma lipid profile, promoting lipid peroxidation in plasma. This increase in peroxidation decreases the levels of SOD, catalase and GSH-PX in plasma.²⁸

What can be regarded as a limitation of this study is the fact that we did not measure some of the known smoking behavior indicators, such as the number of puffs per cigarette and the duration of each puff.

The personality type affects more than a single smoking behavior that can lead to an alteration in salivary TAC levels; therefore, assessing other factors, such as differences in the diet, working conditions and socioeconomic situation, is recommended for further studies.

This study lays an important foundation for future research; more studies on the possible relation between personality types and the TAC levels are needed with a higher sample size and different methods used. Due to a large number of people involved, even if the effect of personality

types on the TAC levels is generally small, such studies may provide important information that can be used to modify prevention policies and cessation programs.

The smoker's personality profile is considered as an important obstacle to cessation.²⁹ In addition, smoking tobacco is an important risk factor for oral cancers. Therefore, properly planned prevention policies and cessation programs, in order to be efficacious, should take into account the aspect of personality.¹

Conclusions

The results of this study suggest that smoking cigarettes is associated with a significant decrease in salivary TAC. However, there was no significant difference in salivary TAC levels between type A and type B smokers.

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