THE EFFECTS, BOTH SEPARATE AND INTERACTIVE, OF SMOKING AND TEA CONSUMPTION ON URINARY FLUORIDE LEVELS

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ABSTRACT: The goal of this study was to investigate the effects of smoking and tea consumption on urinary fluoride ion (F) levels and whether any interactive effects occurred. Three hundred university students were recruited to provide urinary samples. An Orion 4-Star ion-meter, equipped with an ion selective electrode (ISE), was used for the measurements of the F levels in the urine samples. Initially, the urinary F values studied in the smoking and tea consumption groups were evaluated by t-test and ANOVA. After this stage, the relationship between smoking and tea consumption groups was analyzed by correlation, regression, and two-way ANOVA tests. A significant difference ($p<0.01$) was found in the urinary F data between the smoking and non-smoking groups. Significant differences ($p<0.001$) were also found among the tea beverage consumption groups. Significant positive correlations were present between the urinary F levels and both smoking and the quantity of tea consumption ($r=0.170$, $p=0.003$, and $r=0.424$, $p<0.001$, respectively). A significant relationship was observed between smoking and the quantity of tea consumption in their effect on the urinary F levels by means of regression analysis ($r^2=19.4\%$, $p<0.001$) and two-way ANOVA tests ($F=2.15$, $p<0.05$). Consequently, it appeared that the urinary F levels can be increased by smoking and tea consumption both together and separately and that there is an interaction between smoking and tea consumption in their effect on urinary F levels.

Keywords: Fluoride; Smoking; Tea consumption; Toxicity; Urinary fluoride.

INTRODUCTION

Although the fluoride ion (F) has an anticaries effect when applied topically to the teeth, fluorine is not an essential trace element and is not necessary for the development of healthy teeth and bones.[1] An excessive intake of F may cause numerous deleterious metabolic abnormalities of both soft and hard tissues in humans as well as in animals.[2-6] According to World Health Organization, F is the thirteenth most common mineral in the Earth's crust.[7] F tablets have been used systemically to promote bone mineralization and water fluoridation at a level of 0.7–1.0 ppm is used in some countries to give protection against dental caries.[8] Some authorities consider that the evidence suggests that a level of 1 mg F/L in drinking water does not have any known side effects on the human health apart from the development of dental fluorosis.[9] Nevertheless intake of high amounts of F may be toxic for biologic structures including plants.[2-5] The most important indicator of the F content in an organism is the urinary F level.[10-17]

Tobacco smoking is a common habit all over the world and its numerous adverse effects are well known[18-22] However, there is a paucity of research regarding the effect of tobacco smoking on F levels in humans.[23,24] Tobacco smoke has constituents that have numerous hazardous biochemical effects on the body.[20,23,24]

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For instance, poly-aromatic hydrocarbons are potential stimulators of drug metabolism and liver enzymes for the metabolism of phenazone, pentazocine, and theophylline. Research has also shown that smokers may impair F excretion which may lead to a higher serum F concentration.[25] In addition, tobacco smoking can alter anti-oxidative enzyme activities related to trace element metabolism and serum mineral concentrations in smokers.[23] Similarly, Özden et al.[24] reported that smoking induces an elevation of hair cadmium and lead levels in children with smoking mothers. Furthermore, Gomo[26] reported, as another deleterious effect of smoking, that the risk of atherosclerosis increases via an increase in serum lipids and apolipoproteins.

Kuo et al.[20] reported that smoking and the duration of smoking has deleterious effect on bone density in the lumbar spine and that this effect was cumulative with duration and quantity. In another study, Seeman[21] reported that tobacco and alcohol use affected bone mineral density and increased the risk of fractures. Also, Ward and Klesges[22] maintained that cigarette smoking is a risk factor for osteoporosis. However, the relationship between smoking, bone mass, and fracture risk is uncertain. It is also well known that F toxicity has adverse effects on bone health and tooth structure.[4,17,27]

Laisalmi et al.[25] investigated the relationship between smoking and F levels in the human body under anesthesia with enflurane, an anesthetic drug which causes the release of F in the organism. They observed that the serum F concentrations were significantly different between smokers or non-smokers.

The results of these various investigations suggest the need for further studies on understanding the relationship between cigarette smoking and body F.

Commercial tea products are produced by the leaves of the tea plant and these plants absorb F from soil and transport it to the leaves where the mineral is accumulated.[3,28] Tea consumption is widespread in Turkey and other countries in the region, particularly during leisure time.[28] A number of studies report that tea has high levels of F and can be considered as a potential F toxicant.[28-31] Some studies document increased urinary F levels after tea consumption.[16,32] However, studies also indicate that black tea extract has a protective effect against F toxicity.[33-35]

Previous studies have focused on the role of tea and smoking on F levels in the body. However smoking and tea consumption are common behaviours in today's society and there is an information gap on the relationship of smoking and tea consumption to the bodily F status.

Thereby, this investigation aimed to examine the effects of smoking and tea consumption on urinary F levels and whether any interactive effects occurred.

MATERIAL AND METHODS

Design: The study was approved by the Ethics Committee of the Faculty of Medicine, The University of Kafkas (Approval No. 80576354-050-99/109). The subjects for this investigation were 300 university students who were selected by simple random sampling from those who volunteered. A questionnaire on

demographics and tea drinking/smoking habits was filled in by all participants (Table 1).

Table 1. Questionnaire form given to volunteers

Subject number:	
How old are you?	
What is your gender?	
How many cigarettes do you smoke daily?	0 ( ) Between 1-5 ( ) Between 6-10 ( ) Between 11-15 ( ) Between 16-20 ( ) Between 21-upper ( )
How many cups of tea do you drink daily?	0 ( ) Between 2-4 ( ) Between 5-7 ( ) Between 8-10 ( ) Between 11- upper ( )

Urine samples were then collected. For the assessment of health status, measurements were made of various urinary (creatinine, urobilinogen, glucose, bilirubin, ketones, and specific gravity) and blood (protein, nitrite, and leukocytes) parameters. A commercial spectrophotometric kit (Archem Diagnostic, Turkey) was used for the creatinine measurements. Urine test strips (Cybow, DFI Co, South Korea) were used for the rest of the urinary analyses. All subjects were deemed healthy based on the results of their urinary laboratory examination.

According to the submitted responses, the subjects were stratified based on their levels of smoking and tea consumption. The participants in the smoking group were designated according to the number of cigarettes consumed per day: group 0: non-smokers, group 1: 1–5 cigarettes smoked per day (CSPD), group 2: 6–10 CSPD, group 3: 11–15 CSPD, group 4: 16–20 CSPD, and group 5: 21 or more CSPD. The participants in the tea consumption group were designated according to the number of cups of tea consumed per day: group 1: 2–4 cups of tea per day (TPD), group 2: 5–7 TPD, group 3: 8–10 TPD, and group 4: 11or more TPD.

Detection of urine F levels: The urinary F levels were measured by the fluoride ion selective electrode method described below. The F content of urine was corrected to the normal specific gravity (1.024 g/mL) as reported by Czarnowki and Krechniak[11] and Inkielewicz and Krechniak.[13]

Detection of F levels of drinking water consumed by contributors: The mean F levels (mean±SEM) of the drinking water at various places within the university campus and the city was 0.23±0.09 mg F/L. The mean F level of the bottled water brand which was most commonly consumed in the investigation area was 0.19±0.07 mg F/L. These water sources were also used for meal preparation by most of the participants.[4]

Detection of F levels of tea samples consumed by contributors: It has been reported that the range of F levels in tea prepared for drinking is 1–3 mg F/L.[28,36] Ready-to-drink tea samples were collected from university's cafés and were evaluated for their F content. The mean±SEM F content of the tea samples was 2.47±0.06 mg F/L tea with the values (mg F/L tea) for the various cafés within the university being: Veterinary Science 2.65, Medical Science 2.45, Economy and Administration Science 2.69, Education 2.36, Science and Letters 2.16, Engineering and Architecture 2.48, Theology 2.23, Nursing 2.65, Kars Vocational School of Higher Education 2.49, and AHS Vocational School of Higher Education 2.56 mg F/L tea.

The best-selling commercial dried tea brands were purchased from the surrounding markets in Kars city for evaluation of their F content. The drinking water, described in the above section, was used for the preparation of the tea using the method by Kalaycı and Somer.[36] Two grams of dried tea were added to boiling water and left for 20 min at 80ºC. The tea was then sieved to remove particles and a 2 mL aliquot was mixed with 2 mL of TISAB II solution, and analyzed with a F specific ISE, as described below. The mean±SEM F content of the tea was 2.74±0.14 mg F/L tea with the values (mg F/L tea) for the various commercial brands being: (Çaykur 2.63, Doğuş 2.88, Lipton 3.46, Berk 2.51, Çaykur Tomurcuk 2.73, Çaykur (tea-bag) 2.68, Doğuş (tea-bag) 2.34, Lipton (tea-bag) 3.28, and Berk (tea-bag) 2.16 mg F/L tea.

Apparatus and chemicals: An Orion 4-Star portable ion meter equipped with a F ion-selective electrode (ISE) (Orion 9609BNWP) was used for the F measurements. The ISE was combined with a reference filling solution (Orion 900061). The device was calibrated at 4 points (0.1, 1, 10, and 20 mg/L) with a 0.1 mol F standard solution (Orion 940906). Deionized water was used for all the standard dilutions and the calibrations of the device were renewed daily. TISAB II with CDTA (Orion 940909) was used as the ion buffer solution for analyses in a ratio of 1:1 with the samples. All the chemicals and devices were obtained from Thermo Electron Cooperation Inc., USA. The volumetric flasks, baker, mortar, and other lab-ware used were made of polypropylene.

The technical precision of the device was assured by using previously prepared known-level F solutions (0.1, 1, 10, and 20 mg/L). The F levels for these solutions were evaluated by the ISE for each 10 sample measurements during the analyses. These results were used for the calculation of the coefficient of variation (CV). The CV results, for assessing the technical precision of the device, were; 0.1 mg/L: 10.7%, 1 mg/L: 4.22%, 10 mg/L: 3.46%, and 20 mg/L: 2.53%.[37,38]

Statistical analysis: The distribution of the values of the fluoride concentration in the urine were checked using the method of Tabachnick and Fidell[39] who reported

that the Skewness and Kurtosis values for the data normality test must be in the range of +1.5 to –1.5. In the present study, the Skewness and Kurtosis values for the urinary F concentrations data were found to be 1.016±0.14 and 0.584±0.28, respectively. According to these results, a normal distribution of urinary F values in this study was present and parametric tests, including t-test and two-way ANOVA, were used for the statistical analyses of the data.

For the statistical evaluation of the differences between groups of smokers and non-smokers, the t-test was used. A correlation test was performed for the estimation of the correlation between the urinary F levels, and the smoking, and tea consumption data. Regression analyses were used to analyze the effects of smoking and tea consumption on urinary F levels.

The effects on the urinary F concentration of tea and/or cigarette consumption, and the interaction between them, were analyzed by means of two-way ANOVA.

RESULTS

The age and gender assessment of the volunteers are summarized in Table 2.

Table 2. Ages (yr) of volunteers according to gender

Gender	Number (%)	Mean age±SEM (yr)	Median age (yr)	Minimum age (yr)	Maximum age (yr)
Male	179 (59.67)	21.52±0.14	21	18	27
Female	121 (40.33)	20.09±0.18	20	18	29
Total	300 (100)	20.94±0.12	21	18	29

Approximately 60% of the subjects were male and 40% female. The mean age of all the subjects was approximately 21 yr and mean ages of the two genders were statistically similar. The minimum age was 18 yr in both gender groups and maximum ages were 27 yr in the males and 29 yr in the females.

The urinary F concentrations (mean±SEM) were significantly higher (p=0.004) in the smokers compared to the non-smoking group (0.85±0.04 mg F/L and 0.70±0.04 mg F/L, respectively) (Figure 1).

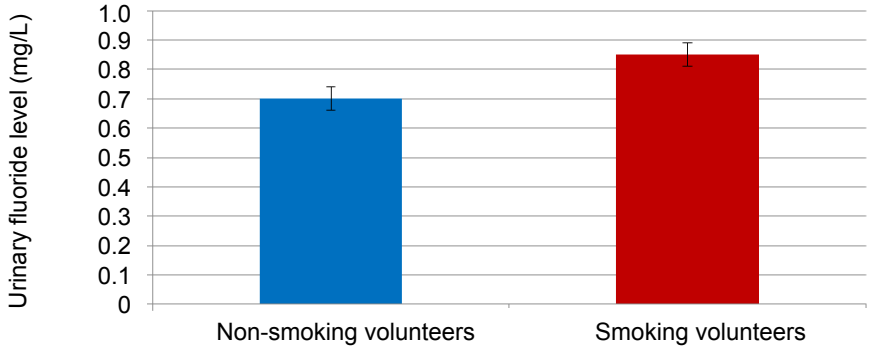

Figure 1. Urinary fluoride levels of the non-smoking (n=143) and smoking (n=157) volunteers. There was a significant difference between these groups (p=0.004).

A significant difference (p=0.038) in the urinary fluoride was observed between smoking groups 0 and 3 but not between the other smoking groups (Table 3, Figure 2).

Table 3. Mean urinary fluoride levels (mean±SEM, mg F/L) according to the level of smoking

Smoking group	Level of smoking in group (number of cigarettes per day)	Number (%)	Urinary fluoride (mean±SEM, mg F/L)
0	0	143 (47.67)	0.70 ± 0.04^{b}
1	1–5	31 (10.33)	0.74 ± 0.05^{ab}
2	6–10	37 (12.33)	0.82 ± 0.07^{ab}
3	11–15	51 (17.00)	0.99 ± 0.07^{a}
4	16–20	31 (10.33)	0.80 ± 0.08^{ab}
5	21 or more	7 (2.33)	0.80 ± 0.11^{ab}

A statistically significant difference was found between the values without a common letter ($p<0.05$).

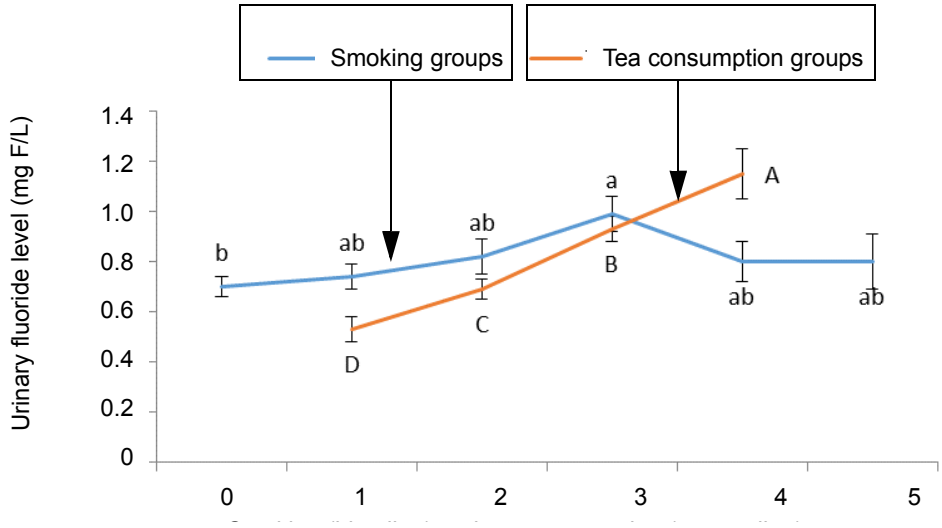

Figure 2. The mean urinary fluoride levels in the smoking and tea consumption groups. The error bars show the standard error of the mean. There was no statistical difference between groups having a common lower case (a or b) or upper case letter (A, B, C, or D). When no common lower case letter (a or b) was present: $p<0.05$. When no common upper case letter (A, B, C, or D) was present: $p<0.001$.

A linear increasing trend in urinary F levels was observed in the tea consumption groups and all the mean urinary F levels in these groups were significantly different from one other ($p<0.001$) (Table 4, Figures 2 and 3).

Table 4. Mean urinary fluoride levels (mean±SEM, mg F/L) according to the level of tea consumption

Tea consumption group	Level of tea consumption in group (number of cups of tea per day)	Number (%)	Urinary fluoride (mean±SEM, mg F/L)
1	2–4	67 (22.33)	0.53 ± 0.05^{D}
2	5–7	102 (34)	0.69 ± 0.04^{C}
3	8–10	100 (33.33)	0.93 ± 0.05^{B}
4	11 or more	31 (10.33)	1.15 ± 0.10^{A}

A statistically significant difference was found between the values without a common letter ($p<0.001$).

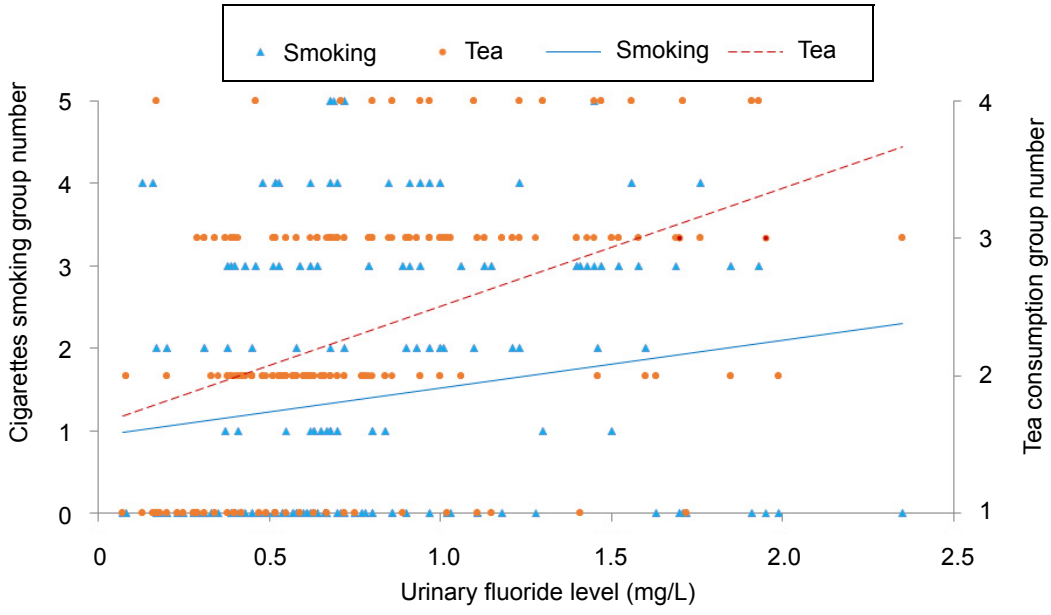

Figure 3. Urinary fluoride levels (mg/L) of 300 volunteers according to their cigarette smoking group (number of cigarettes smoked/day in the groups: group 0=0, group 1=1–5, group 2=6–10, group 3=11–15, group 4=16–20, and group 5=≥21) and their tea consumption group (number of cups of tea consumed/day in the groups: group 1=2–4, group 2=5–7, group 3=8–10, and group 4=≥11)). Blue triangles: cigarette smoking group number for each of the 300 volunteers; orange circles: tea consumption group number for each of the 300 volunteers; continuous blue line: best-fit linear regression line for urinary fluoride level and the cigarette smoking group number; and intermittent orange line: best-fit linear regression line for urinary fluoride level and the tea consumption group number.

Positive correlations were found between tea consumption, cigarette smoking, and urinary F levels (Table 5). In addition, a non-significant correlation was found between tea consumption and cigarette smoking for persons smoking 1 or more cigarettes/day (smoking groups 1–5, $r = 0.108$, $p = 0.179$) (Table 6).

Table 5. Pearson correlation test results (r and p values) for all the volunteers (n=300) for the number of cigarettes smoked/day, the number of cups of tea consumed/day, and the urinary fluoride levels (mg/L)

Parameter	Parameter	
	Urinary fluoride level in mg/L (n=300)	Number of cups of tea consumed/day (n=300)
	[Pearson correlation coefficient, r, and (p value)]	
Number of cigarettes smoked/day (n=300)	0.170 (p = 0.003)	0.254 (p<0.001)
Number of cups of tea consumed/day (n=300)	0.424 (p<0.001)	–

Table 6. Pearson correlation test result (r and p values) for the volunteers who smoked 1 or more cigarettes/day (n=157) for the number of cigarettes smoked/day and the number of cups of tea consumed/day

Parameter	Parameter
	Number of cups of tea consumed/day (n=157)
	[Pearson correlation coefficient, r, and (p value)]
Number of cigarettes smoked/day (n=157)	0.108 (p = 0.179, not significant)

Regression analysis showed that the urinary F levels were significantly affected by both tea consumption and the level of smoking as shown by the equation:

$$\text{Urinary F level (mg/L)} = 0.290 + 0.200 \times \text{No of cups of tea consumed/day} + 0.01195 \times \text{No of cigarettes smoked per day}$$

$r^2 = 19.4\%$, $p<0.001$

According to the two-way ANOVA test results, a significant interaction was present between the number of cigarettes smoked and the level of tea consumption in their effects on the urinary F levels ($F = 2.15$, $p = 0.012$) (Figures 2 and 3).

DISCUSSION

The present study primarily investigated how smoking and tea consumption affected the urinary F concentration, both separately and interactively. There is a very limited information about this subject in the literature. In this study, according to the

two-way ANOVA test result, an important interaction between smoking and tea consumption was present in their effects on the urinary F concentration ($F=2.15$, $p<0.012$) (Figures 2 and 3). The regression analysis findings also supported this result.

$$\text{Urinary F level (mg/L)} = 0.290 + 0.200 \times \text{No of cups of tea consumed/day} + 0.01195 \times \text{No of cigarettes smoked per day}$$

$r^2 = 19.4\%$, $p<0.001$

Statistical differences were found in the urinary F levels between the smoking (n=157) and non-smoking (n=143) volunteers (0.85±0.04 mg F/L and 0.70±0.04 mg F/L, respectively) (Figure 1). The raised F level in the smokers is consistent with the finding by Khandare et al. of significantly higher rates of dental and skeletal fluorosis in smokers.[19] Similarly, Laisalmi et al. found that regular smoking was associated with an increase in the serum inorganic F level after anaesthesia with enflurane.[25]

When all 300 volunteers were considered, the mean urinary F level increased significantly ($r=0.17$, $p=0.003$) as the level of smoking in the groups increased (Tables 3 and 5, Figures 2 and 3). However there was a significant difference in the group means for urinary F level between only smoking groups 0 and 3. This may reflect the relatively smaller number of subjects in the groups (7–143, Table 3).

Tea consumption had a greater effect on the urinary F concentration than did smoking (Table 4, Figures 2 and 3). The value of the Pearson correlation coefficient was higher between tea consumption and the urinary F level than between the number of cigarettes smoked and the urinary F level ($r=0.424$, $p<0.001$ and $r=0.170$, $p=0.003$, respectively) (Table 5).

In the subjects who smoked 1 or more cigarettes a day (n=157), a non-significant correlation was found between cigarette smoking and tea consumption ($r=0.108$, $p=0.179$) showing that as the rate of smoking increased the amount of tea consumption did not increase. This negates any doubts that a greater tea consumption among smokers may have caused the increase in urinary fluoride levels seen with higher levels of cigarette smoking (Table 6).

There has been only limited research on the interaction between smoking and F levels. Khandare et al.[19] performed a study to determine effect of tamarind and the use of aluminum (Al) cooking utensils and smoking on dental and skeletal fluorosis in a F-endemic area. They observed that smoking enhanced the toxic effects of F. In the present study area, the Kars province of Turkey, there have been no reports of F toxicity. According to our findings, there is no evidence to suggest that F toxicity is common due to the use of drinking water from local sources. The F levels in the city water and in the commercial brands of drinking water were 0.23±0.09 mg F/L and 0.19±0.07 mg F/L, respectively. These drinking water levels are less than those reported to be toxic. Khandare et al.[19] reported that a drinking water F level of 3.6 mg F/L can cause F toxicity and that the affected individuals may show signs of dental mottling, abdominal pain, bodily pain, bamboo spine, neck rigidity, kyphosis, genu valgum/genu varum, anterior bowing of the legs, and bone fracture. These symptoms

were more common in people who smoked while living in a F toxicity endemic area. Thus Khandare et al.[19] found that smoking increased the effects of F toxicity. Although our study area was not in an endemic fluorosis area with high levels of F in the drinking water, we found that as the smoking rate increased, so did the urinary F levels (Table 3, Figures 1, 2, and 3).

Laisalmi et al.[25] reported that the metabolism of enflurane, an anesthetic agent, released inorganic F. They compared the F levels after enflurane anaesthesia between smokers and non-smokers and found that regular smoking was associated with a significant increase in the serum F concentration. In addition, they reported that the cause of this condition may be due to enflurane being mostly metabolized to inorganic F in the liver by means of the cytochrome P450 2E1 isoform,[40] and that tobacco smoking possibly increased this enzyme's activity. Thus, the transformation of enflurane to inorganic F was increased. However this theory may be insufficient and this issue needs further investigation.[25]

The interaction between tea consumption and the F levels in humans and animals is complicated. The literature shows that the tea plant accumulates F and that tea consumption is a potential F toxicant for animals and humans.[16,29,31,32] Yet some authors state that tea can be used for mitigation or the amelioration of F toxicity.[27,34,35,41] The urinary F level is a good indicator of the F content in an organism.[10-17] Our study results showed that the urinary F levels increased when tea consumption rose. The increasing trend shows a nearly linear course and there were significant differences present between all 4 tea-consumption groups ($p<0.001$) (Table 4 and Figures 2 and 3).

Cao et al.[32] reported that brick tea has a large amount of F. Ordinary green and black teas contain 15–50 mg F/kg while brick tea contains more than 550 mg F/kg. They indicated that fluorosis from brick-tea is a public health problem and that brick-tea consumption causes dental fluorosis in children (50–88%) and skeletal fluorosis in adults (83%). In their study, the range of the urinary F levels was 2–11 mg F/L.

Opydo-Szymaczek and Borysewicz[16] found that tea consumption caused an increase in the urinary F level in both pregnant and non-pregnant women. Their study was conducted on pregnant and non-pregnant women in Poznan–Poland with drinking water F levels of 0.4–0.8 mg F/L. The urinary F levels were classified according to a questionnaire item on the volume of tea consumed daily (≤0.4 L/day or >0.4 L/day). They found a significant increase in the urinary F levels in the high tea consumption groups for the control non-pregnant women and for the pregnant women at the 33rd week of pregnancy but not at the 28th week.

Johnson et al.[31] reported that an excessive intake of tea could sclerotic bones or elevated bone density. They described 4 patients, with chronic F exposure due to excessive tea drinking, with elevated spinal bone mineral density, of whom three had a toxic serum F level of >15 μmol/L (0.285 mg F/L, normal range approximately 0.02–0.05 mg/L). Other clinical features included gastrointestinal symptoms such as nausea, vomiting, and weight loss; lower extremity pain sometimes associated with stress fractures of the lower extremities; renal insufficiency; and elevated alkaline

phosphatase levels. They considered that F excess should be considered in all patients with a history of excessive tea consumption, especially due to its insidious nature and the non-specific clinical presentation.

It is reported that tea contains several polyphenols such as biflavonols, theaflavins (TF) and thearubigins. They have numerous benefits for human and animal organisms, including a protective effect on arresting the progression of cancer and heart diseases, and mitigating effects on F-induced oxidative stress in the cerebral hemisphere, cerebellum and medulla oblongata regions in the brains of mice. They also have anti-oxidative, antitumor, anti-mutagenic, and anti-carcinogenic functions. In addition, polyphenols in tea may cause the inducement of apoptosis.[27]

Trivedi et al.[41] investigated the effect of a black tea extract on Swiss albino male mice with F toxicity. They showed that black tea extract had a mitigating effect on the enzymatic and non-enzymatic parameters of F-induced oxidative stress in the cerebral hemisphere, cerebellum, and medulla oblongata in the brains of mice.

In another study, Trivedi et al.[34] found that tea consumption had an ameliorative effect on transaminase activity elevations in F-induced liver and kidney toxicity. El-lethey and Kamel[33] found that F inhibited of motor activities of rats and that black tea mitigates this harmful effect of F intoxication.

In the present study, although there was a correlation between smoking and the urinary F level ($r=0.170$ and $p=0.003$), there was a stronger correlation between urinary F concentration and tea consumption and the urinary F level ($r=0.424$ and $p<0.001$) (Table 5). A correlation was also present between smoking and tea consumption ($r=0.254$, $p<0.001$). As the tea consumption increased, so also did the level of cigarette smoking. This correlation is supported by the university student smoking areas, including cafes, night clubs, parks, and cafeterias, also serving tea and other similar drinks. Although the regression equation showed that cigarette smoking and tea consumption both strongly affected the urinary F levels, tea consumption had a much larger effect, nearly seventeen times than of that of smoking.

$$\text{Urinary F level (mg/L)} = 0.290 + 0.200 \times \underset{\text{consumed/day}}{\text{No of cups of tea}} + 0.01195 \times \underset{\text{smoked per day}}{\text{No of cigarettes}}$$

$$r^2 = 19.4\%,\ p<0.001,\ \frac{0.200}{0.01195} = 16.74$$

CONCLUSIONS

The study results show that cigarette smoking and tea consumption increase urinary F levels, both separately and together. An interactive effect, between smoking and tea consumption, on the urinary F levels was shown by the correlation, regression, and two-way ANOVA tests. Positive correlations were present between smoking and the urinary F levels ($r=0.170$, $p=0.003$) and between tea consumption and the urinary F levels ($r=0.424$, $p<0.001$). The regression and two-way ANOVA analyses results were as $r^2=19.4\%$, $p<0.001$ and $F=2.15$, $p<0.05$, respectively.

Therefore, individuals, who are also exposed to other sources of F, e.g., living in a F-endemic area due to industrial or volcanic activity, taking F-containing drugs, etc, should always keep in mind that they have a significant risk of F toxicity when consuming cigarettes and/or tea.

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