

## The effect of coronavirus disease 2019 pandemic on oral health behavior of Turkish society

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Coronavirus disease 2019 (COVID-19) has caused widespread public health concerns and has recently been declared a pandemic by the World Health Organization (WHO). Understanding behavioral responses and other precautionary behaviors related to the pandemic may help to improve public oral health behavior and information about community health risks. Studies are largely reliant on the monitoring of COVID-19 outcomes in clinical settings and health behavior responses to pandemics, but no research has sought to examine how individuals' oral health behaviors are affected during the pandemic. In this context, the aim of this research is to determine whether Turkish individuals' oral health behaviors changed during the pandemic.

**METHODS:** This population-based study was conducted in Usak, Turkey. A representative sample of individuals were recruited through third stage cluster sampling method. It was designed to assess the public's oral health response during the COVID-19 pandemic by using a three-part online questionnaire that contained 15 questions. The first part measured demographic data, the second part identified oral health behaviors, and the last part evaluated precautionary behaviors.

**RESULTS:** A total of 2589 individuals, 1584 (61.2%) women and 1005 (38.8%) men were included. The rate of individuals who brushed their teeth twice or more daily before the COVID-19 pandemic was 41.0%, and this proportion increased to 48.4% during the pandemic. The frequency of toothbrushing increased significantly during the pandemic ( $P < 0.05$ , chi-square test). A total of 600 (58.1%) smokers decreased smoking per day during the pandemic.

**CONCLUSION:** Within the limitations of this study, our results suggest that the COVID-19 pandemic is associated with beneficial changes in toothbrushing and smoking behaviors.

**KEYWORDS:** COVID-19; Oral Health; Toothbrushing

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Coronavirus disease 2019 (COVID-19) has caused widespread public health concerns and has recently been declared a pandemic by the World Health Organization (WHO).<sup>1</sup> COVID-19 is nearly twice as contagious as the seasonal flu and has symptoms ranging from a common cold to more severe respiratory problems which can lead to death.<sup>2</sup> COVID-19 can be transmitted from human to human via contact with respiratory droplets.<sup>3</sup> There is no vaccination for COVID-19 yet. Oxygen supplementation, antiviral agents, corticosteroids, and antibodies are supportive care options for symptomatic treatment.<sup>4</sup> The

control of the spread of COVID-19 is largely dependent on precautionary behaviors, which include washing hands, avoiding public gatherings, wearing masks, and maintaining distance from others.<sup>5</sup>

Protecting, maintaining, and promoting health assists in eliminating the spread of infection because human behaviors drive pandemics. Perceived personal exposure and perceived severity of a health threat contribute to risk perception.<sup>6</sup> During a pandemic, changes in health behaviors are reported because people modify their behavior to reduce their perceived risk of infection.<sup>7</sup> Behavioral changes are also associated with fear of getting

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infected and feelings of desperation and distress.<sup>8</sup> These changes give very different dynamics from predicted simple actions,<sup>7</sup> and detecting the behavioral responses of the general population to an outbreak plays an important role in understanding post-pandemic health behaviors.<sup>9,10</sup>

Understanding behavioral responses related to the pandemic may help to improve public health behaviors and information about community health risks.<sup>11</sup> Studies are largely reliant on the monitoring of COVID-19 outcomes in clinical settings and health behavior responses to pandemics, but no research has examined how individuals' oral health behaviors are affected during the pandemic. In this context, the purpose of this study is to determine whether individuals' oral health behaviors change during the pandemic.

## Methods

2589 individuals (1584 women and 1005 men) were included. The study was conducted according to the Declaration of Helsinki, and ethical permission was obtained from the local Ethics Committee of Usak University, Usak, Turkey, and Republic of Turkey Ministry of Health (registration number: 11-16-40/2020).

**Study design:** The study was designed to assess the public's oral health response during the COVID-19 pandemic and consisted of an online questionnaire to minimize face-to-face interaction in compliance with official recommendations. There was no quarantine in the country within the timeframe of the study and the preventive infection measures taken by the government were dependent on voluntary avoidance behaviors.

This population-based study was conducted in Usak. A representative sample of individuals were recruited through three stage cluster sampling multistage cluster sampling method. In first stage of sampling, two districts (Merkez and Banaz) were randomly selected from a total of six districts of Usak (Merkez, Banaz, Ulubey, Eşme, Sivaslı, and Karahallı). In the second stage of sampling, one neighborhood/town was randomly selected from each of the two districts chosen in the first stage. In third

stage, individuals were randomly invited to take part in this study.

**Questionnaire:** A closed-ended questionnaire was developed by the researchers with the help of the existing literature.<sup>5,8,12</sup> The questionnaire was used to collect information about normal health behaviors in the days before March 11, 2020, when the first COVID-19 case was detected in Turkey, and then in the following weeks. The questionnaire contained 15 questions and was divided into three parts. The first part measured demographic data (age, gender, and education level), the second part identified oral health behaviors (toothbrushing frequency, visiting dentist, and smoking), and the last part evaluated precautionary behaviors (handwashing and avoiding gatherings).

**Sample size calculation:** T-test was used in G\*Power 3.1 program to determine sample size. Type 1 error ( $\alpha$ ) = 0.05, effect size = 0.50, and test power ( $1-\beta$ ) = 0.80 were calculated. The sample size was determined to be a minimum of 438 individuals.<sup>13</sup>

Data analysis was performed using the SPSS software (version 17, SPSS Inc., Chicago, IL, USA), and the statistical significance level was set at 0.05. Test-retest reliability of the questionnaire was assessed by calculating intraclass correlation coefficients (ICC). Demographic information was evaluated using descriptive statistical analysis. A chi-square test was used to compare individuals' toothbrushing frequency before and during the pandemic.

**Reliability of the questionnaire:** Test-retest reliability was determined by calculating the measurement error in the repeated answers on the questionnaire given to 256 individuals twice within five days. Test-retest reliability was found to be positive, high, and statistically significant ( $r = 0.935$ ,  $P < 0.01$ ).

## Results

A total of 2589 individuals, 1584 (61.2%) women and 1005 (38.8%) men, participated in the study. Age, gender, and educational level of the individuals are given in table 1.

**Table 1.** Age, gender, and educational level of individuals

Demographic data	Gender [n (%)]			Education level [n (%)]					
	Women	Men	Total	Primary school	Secondary school	High school	University	Total	
Age groups (year)	18-29	673 (62.4)	404 (37.6)	1077	103 (9.5)	67 (6.2)	214 (19.8)	693 (64.5)	1077
	30-39	485 (60.3)	319 (39.7)	804	77 (9.5)	50 (6.1)	159 (19.3)	518 (65.1)	804
	40-49	287 (60.1)	190 (39.9)	477	53 (11.1)	33 (6.9)	107 (22.4)	284 (59.6)	477
	50-59	105 (60.3)	69 (39.7)	174	13 (7.4)	8 (4.5)	28 (16.1)	125 (72.0)	174
	60-69	25 (59.5)	17 (40.5)	42	11 (26.1)	8 (19.0)	13 (30.9)	10 (24.0)	42
	70-79	7 (58.3)	5 (41.7)	12	3 (25.0)	4 (33.3)	3 (25.0)	2 (16.7)	12
	80-89	2 (66.6)	1 (33.4)	3	1 (33.3)	1 (33.3)	1 (33.4)	0 (0)	3

The rate of individuals who brushed their teeth twice or more daily before the COVID-19 pandemic was 41.0%, and this proportion increased to 48.4% during the pandemic. A total of 1485 (57.3%) individuals stated that their frequency of brushing teeth increased during the pandemic. Of these individuals, 702 (47.3%) increased their frequency of toothbrushing because they thought having good oral hygiene would reduce the risk of COVID-19 infection. In contrast, 424 (16.3%) individuals stated that their frequency of brushing teeth decreased during the pandemic. Of these, 253 (59.6%) thought that they did not need to brush their teeth because they were avoiding the

community by staying at home (Table 2).

When the brushing frequencies of individuals before and during the pandemic were compared, it was observed that the frequency of toothbrushing increased significantly during the pandemic ( $P < 0.05$ , chi-square test) (Table 3).

Regarding dental treatment, 2037 (78.7%) individuals thought that having any dental treatment during the pandemic would increase the risk of infection. Although 1137 (43.9%) individuals stated that they would go to the dentist if they had a severe toothache, 858 (33.1%) stated that they would not go to the dentist even in the case of severe pain.

**Table 2.** Toothbrushing behavior of individuals before and during the pandemic

Toothbrushing	Women [n (%)]	Men [n (%)]	Total [n (%)]	
How often did you brush your teeth before the COVID-19 pandemic?	Twice or more daily	753 (47.5)	309 (30.7)	1062 (41.0)
	Once daily	684 (43.2)	483 (48.1)	1167 (45.1)
	Once every three or four days	81 (5.1)	78 (7.8)	159 (6.1)
	Once a week	45 (2.8)	87 (8.7)	132 (5.1)
	No brushing	21 (1.4)	48 (4.7)	69 (2.7)
How often are you brushing your teeth during the COVID-19 pandemic?	Twice or more daily	909 (57.4)	345 (34.3)	1254 (48.4)
	Once daily	540 (34.1)	441 (43.8)	981 (37.9)
	Once every three or four days	84 (5.3)	84 (8.4)	168 (6.5)
	Once a week	21 (1.3)	84 (8.4)	105 (4.1)
	No brushing	30 (1.9)	51 (5.1)	81 (3.1)
My frequency of toothbrushing decreased during the pandemic because	I do not have a brush or paste because I cannot get out.	27 (16.4)	10 (3.8)	37 (8.7)
	I do not need to brush because I am not meeting anyone.	88 (53.6)	165 (63.4)	253 (59.6)
	I forget.	49 (30.0)	85 (32.8)	134 (31.7)
My frequency of toothbrushing increased during the pandemic because	I think there is a connection between COVID-19 infection and oral health.	474 (49.8)	228 (42.7)	702 (47.3)
	I have more time to brush my teeth because I am at home.	186 (19.6)	171 (32.0)	357 (24.0)
	I am afraid my oral health will deteriorate because I cannot go to the dentist.	291 (30.6)	135 (25.3)	426 (28.7)

COVID-19: Coronavirus disease 2019

A total of 1242 (48.0%) individuals stated that they expected to feel concerned about COVID-19 infection when they went to the dentist after the pandemic, while 1071 (41.4%) stated that they would not feel concerned (Table 4).

The importance given to hand and body hygiene increased in 2214 (85.52%) individuals during the pandemic. In fact, 591 (22.8%) individuals stated that they had not been out after the outbreak started in their country (Table 4).

A total of 1032 (39.8%) individuals were smokers. Of these, 600 (58.1%) smokers stated that they decreased the number of cigarettes smoked per day during the pandemic. Concern about this fact that COVID-19 infection affects the lungs was the reason that 52.5% of these individuals gave for reducing their smoking. However, 308 (29.8%) smokers stated that they increased the number of cigarettes smoked per day during the pandemic, and 58.5% of these individuals stated that stress due to the pandemic was the reason (Table 5).

## Discussion

In the face of the outbreak, most research is focusing on clinical characteristics, epidemiology, and control measures of COVID-19. However, health behaviors caused by people's risk perceptions and fear of infection should not be ignored.<sup>14</sup> Although human behaviors change in response to the risk of acquiring an infectious disease, understanding the present situation is helpful in predicting future oral health behaviors.<sup>15,16</sup> We, therefore, sought to investigate the impact of COVID-19 on people's oral health behavior, and this study aimed to provide new evidence of people's oral health behavioral responses to an outbreak.

Toothbrushing is the simplest and most effective method of promoting oral hygiene and preventing dental diseases. Brushing teeth twice a day is the current clinical recommendation.<sup>17</sup> According to this study, the toothbrushing frequency of individuals

during the pandemic was statistically higher than before the pandemic. The reason for the increase in the frequency of toothbrushing during the pandemic is mostly because individuals think that there is a relationship between COVID-19 infection and oral hygiene and that having good oral hygiene will decrease the risk of infection. These results are an important addition to previous literature for several reasons. First, the findings suggest that toothbrushing behavior is a multidimensional phenomenon influenced by perceived risks and benefits. Second, individuals engaged in inconvenient precautionary behavior that is not mentioned as an infection control method or documented in the literature to cope with a novel disease. Third, the perceived risk of COVID-19 is positively associated with a favorable response to toothbrushing behavior. Fourth, individuals' toothbrushing behavior changed rapidly and dramatically during the outbreak stage. Fifth, oral health care has not been separated from general health care during the pandemic, and oral health is truly to be seen as a component of general health. Sixth, the pandemic may contribute to awareness of the importance of oral health.

The reasons that individuals change their toothbrushing behavior during a pandemic can be explained by threat perceptions, which depend on the severity of the health threat and the individual's perception of vulnerability.<sup>18</sup> Individuals in this study engaged in toothbrushing activities that were not in line with recommended protective behavior because they were concerned about the higher risk of a novel threat, might not have felt in control of the risk, and were trying to alleviate the health threat. In addition, fear of COVID-19 infection drives coping strategies and behaviors that may lead to self-protective health responses to manage the problem.<sup>19</sup> Finally, given that the concept of health is ongoing, flexible, and dynamic, individuals' orientation toward solving problems and their ability to cope with stress can help explain this behavior.<sup>20</sup>

**Table 3.** Toothbrushing frequencies of individuals before and during the pandemic

Toothbrushing			Twice or more daily	Once daily	Once every three or four days	Once a week	No brushing		
How often did you brush your teeth before the COVID-19 pandemic?	Twice or more daily	n	957	96	6	0	3	Monte Carlo	0.001*
		Row percent	90.1	9.0	0.6	0	0.3		
		Column percent	76.3	9.8	3.6	0	3.7		
	Once daily	n	279	801	60	21	6		
		Row percent	23.9	68.6	5.1	1.8	0.5		
		Column percent	22.2	81.7	35.7	20.0	7.4		
	Once every three or four days	n	6	54	93	6	0		
		Row percent	3.8	34.0	58.5	3.8	0		
		Column percent	0.5	5.5	55.4	5.7	0		
	Once a week	n	12	21	9	75	15		
		Row percent	9.1	15.9	6.8	56.8	11.4		
		Column percent	1.0	2.1	5.4	71.4	18.5		
No brushing	n	0	9	0	3	57			
	Row percent	0	13.0	0	4.3	82.6			
	Column percent	0	0.9	0	2.9	70.4			

\*P < 0.05  
 COVID-19: Coronavirus disease 2019



**Table 4.** Oral and precautionary behaviours of individuals

Questions	Answers	Individuals		
		Women [n (%)]	Men [n (%)]	Total [n (%)]
Do you think that dental treatment during the pandemic will increase the risk of disease transmission?	Yes	1299 (82.0)	738 (73.4)	2037 (78.7)
	No	90 (5.7)	87 (8.7)	177 (6.8)
	No idea	195 (12.3)	180 (17.9)	375 (14.5)
If you had a severe toothache, would you go to the dentist during the pandemic?	Yes	594 (37.5)	543 (54.0)	1137 (43.9)
	No	558 (35.2)	300 (29.9)	858 (33.2)
	No idea	432 (27.3)	162 (16.1)	594 (22.9)
Do you feel concerned about infection when you go to the dentist after the pandemic?	Yes	876 (55.3)	366 (36.4)	1242 (48.0)
	No	555 (35.0)	516 (51.4)	1071 (41.4)
	No idea	153 (9.7)	123 (12.2)	276 (10.6)
How has the importance you ascribe to your hand and body hygiene changed during the pandemic?	Increased	1365 (86.2)	849 (84.5)	2214 (85.5)
	Decreased	6 (0.4)	12 (1.2)	18 (0.7)
	No change	213 (13.4)	144 (14.3)	357 (13.8)
	Never	489 (30.9)	102 (10.1)	591 (22.8)
How often did you leave home after the outbreak started?	Twice or more daily	81 (5.1)	210 (20.9)	291 (11.2)
	Once a daily	159 (10.0)	267 (26.6)	426 (16.5)
	Once every three or four days	255 (16.1)	234 (23.3)	489 (18.9)
	Once a week	600 (37.9)	192 (19.1)	792 (30.6)

Although the frequency of toothbrushing increased statistically during the pandemic, some individuals' toothbrushing frequency decreased. The biggest reason that individuals (59.6%) reduced their frequency of toothbrushing was that they were not participating in society. According to these findings, social influence and the desire to create a positive self-image motivate toothbrushing behavior more than health. This modification in behavior can be clarified by normative beliefs connected to the perception of how other people think an individual should behave. During a pandemic, change in external variables that influence attitudes and thus behaviors can negatively affect an individual's health intentions.<sup>21</sup>

Regarding dental treatment, 78.7% of

individuals thought that having such treatment during the pandemic would improve transmission risk. Individuals thought this because dental procedures using drills or ultrasonic devices create large amounts of droplets and aerosol mixed with patients' saliva. Inhalation of airborne microorganisms is the most significant source of COVID-19 transmission. As a result, 33.2% of individuals would not consider going to the dentist during the pandemic even to treat a severe toothache. During the pandemic, health authorities suggested suspending general non-emergency dental treatments and treating only dental emergencies.<sup>20</sup> Nevertheless, fear of rapid transmission of COVID-19 made people indisposed to go outside and unwilling to go to dentists even in the case of pain.<sup>22</sup>

**Table 5.** Smoking behavior of smokers

Questions	Answers	Smokers		
		Women [n (%)]	Men [n (%)]	Total [n (%)]
During the pandemic, the number of cigarettes I smoke per day has decreased because	I could not get out.	21 (7.5)	42 (13.1)	63 (10.5)
	I want to protect myself because the COVID-19 infection affects the lungs.	183 (65.6)	132 (41.1)	315 (52.5)
	I could not smoke at home because it disturbs my family.	75 (26.9)	147 (45.8)	222 (37.0)
During the pandemic, the number of cigarettes I smoke per day has increased because	I feel stressed because of the pandemic.	96 (75.6)	84 (46.4)	180 (58.5)
	I have a lot of free time.	31 (24.4)	97 (53.6)	128 (41.5)

COVID-19: Coronavirus disease 2019

After the pandemic, 48.0% of individuals expected to feel concerned about infection when they visited the dentist. This result can provide a reference point for monitoring people's perceptions in the post-pandemic period and indicates that pandemic effects on psychobehavioral responses will continue. This high level of concern may be due to the novelty of COVID-19 infection and because no vaccine has been developed so far.<sup>23</sup>

Smoking is a major risk factor for periodontal disease and tooth loss.<sup>24</sup> Reducing or quitting smoking is closely associated with developing better oral health.<sup>25-27</sup> Although smoking has a negative impact on lung health, is detrimental to the immune system, and makes smokers more vulnerable to infectious diseases, no significant association has been found between smoking and the severity of COVID-19.<sup>28,29</sup> Nevertheless, 58.1% of smokers stated that they decreased smoking during the pandemic. Of these individuals, 52.5% decreased their smoking because COVID-19 infection affects the lungs and causes pneumonia-like respiratory problems. This can be explained by individuals' tendency to reduce possible risks and strong avoidance orientation to COVID-19 infection.<sup>30</sup> This result indicates that there is speculation about the effects of smoking on COVID-19 and that there is a trend toward reducing smoking. According to this study, we can hypothesize that higher levels of perceived health risk would predict beneficial changes in smoking behaviors.

Although more individuals decreased the number of cigarettes smoked per day, 29.8% of smokers increased the number of cigarettes smoked per day during the pandemic. Of these, 58.5% stated that the reason for the increase was stress due to the pandemic. This behavior can be related to the way in which they perceived and interpreted the problem. Individuals with negative problem orientation and high levels of fear are likely to report more negative defensive responses.<sup>31</sup>

Authorities recommend regular handwashing and going to crowded places as little as possible as the primary protective

behaviors.<sup>12</sup> In accordance with previous studies, it was observed that individuals complied with these simple but effective precautionary behaviors.<sup>32,33</sup>

This study has several limitations. First, we asked individuals to recall some of their behavior in the days before March 11, 2020, and their answers might suffer from recall bias. Second, this study was conducted only a few weeks after the first COVID-19 cases were reported, and individuals' behaviors and knowledge are not static and may evolve over time, depending on a number of factors, including the severity of the pandemic. Third, the effects of cultural differences or experience with a previous outbreak remain unclear. Fourth, this study was based on a self-administered online questionnaire and included a small number of individuals from one community.

### Conclusion

This research of toothbrushing behavior during the COVID-19 pandemic shows that people are highly adaptive and engage in appropriate protective behavioral responses during a pandemic. Within the limitations of this study, our results suggest that the COVID-19 pandemic is associated with beneficial changes in smoking and toothbrushing behaviors. However, there should be further studies about risk perceptions and other behavioral determinants influenced by the COVID-19 pandemic.

Investigating the situations that may cause individuals to change their oral health attitudes positively is very important for improving public oral health. The relationship between the reflexes and psychological attitudes developed by individuals to protect their own health should be examined in detail.

### Conflict of Interests

Authors have no conflict of interest.

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