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Impact of covid-19 pandemic on the consumption of herbal products and its effect on oral and dental health: A cross-sectional study in Saudi Arabia

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ABSTRACT

Objective: The purpose of the study was to investigate, assess and explore the impact of herbal products and their effects on oral and dental health in Saudi Arabia. **Materials and methods:** It is a cross-sectional analytical study conducted in Saudi Arabia. Data were collected from laypeople in Saudi Arabia using a convenient sampling technique distributed electronically. A total of 20 questions were entered, including demographic variables, the usage of herbal products, and possible effects of oral and dental health. Data were analyzed using the SPSS statistical software version 23, and results with a p-value of equal or less than a level of 0.05 were considered significant. **Results:** 282 females and 103 males have filled the questionnaire in a total of 385. It was observed that about two-thirds of participants 69.9% and 66.8% used lemon and orange. Most of the participants used the herbal immune boosters less than one month 41.8% and 80.5% used these products one time per day. The majority of the participants 94.0% continued dental hygiene practices. **Conclusion:** COVID-19 pandemic made people try to enhance their immunity by consuming herbal immune boosters' products that may have some consequences on their oral health and dental well-being.

Keywords: COVID-19, Oral Health, Dental Health, Dental Esthetics, Tooth Shade, Immunity, Herbal Immune Boosters

1. INTRODUCTION

In December 2019 coronavirus disease has emerged, abbreviated COVID-19, which is a contagious disease with unfamiliar etiology identified by severe pneumonia that has been first seen in Wuhan, China (Naser et al., 2021). In March 12, 2020, the World Health Organization declared that the COVID-19 disease is a pandemic (WHO, 2020). COVID-19 was a motivation for many people to find ways to protect themselves by following the preventive measures to intercept getting infected by the virus. These preventive measures

were either physical such as wearing masks, gloves and using alcohol antiseptic solutions, or by enhancing the immune system by improving sleeping habits, being physically active, or more importantly introducing natural immune boosters to their diets (Alyami et al., 2020). Many scientists suggest the sufficient intake of vitamins, minerals, and herbal products to supply the immune system with resources to lower the risk and severity of infections including COVID-19 (Jayawardena et al., 2020; Nilashi et al., 2020; Panyod et al., 2020).

One study conducted by Iftikhar Ahmad et al., (2020) found that 57.6% of participants used herbal foods for boosting the immune system during COVID-19 pandemic. The use of specific foods and drinks for their benefits or health-related influences may have an impact on both oral health and dental health since the oral cavity is the first path to our digestive system. Oral health might be affected differently from one consumer to another by these herbal immune boosters these affects included burning sensation, dryness, ulcers and changes in taste. While dental health can be affected on different aspects such as teeth roughness, teeth sensitivity and teeth pigmentation that could results from the usage of these herbal immune boosters. Diet generally considered as extrinsic source of staining which contributes to teeth staining that affect the esthetic appearance of teeth (Veeraganta et al., 2015).

In our present time, esthetics became a significant concern to most communities, and people have become more aware of their appearance in every aspect of their lives. Nowadays, dentistry has a considerable impact on people's semblance in aesthetics due to its development throughout the years (Manipal et al., 2014). Dental esthetics is considered a complicated multifactorial subject; for instance, shape, size, and shade are the main factors that impact dental esthetic (Lombardi, 1973). Generally, laypeople's perspective of dental esthetics is based on dental shade. It was found that the majority of the patients 55.1% with previous dental treatments were concerned about their restorations' color the most (Akarslan et al., 2009). In another study, they discussed patients' self-perception of tooth shade to professionally objective evaluation. They found out that patients assessed their teeth as darker than clinician assessment, and 83.4% were planning to bleach their teeth (Samorodnitzky et al., 2010).

Dental shade could be changed throughout people's life due to staining, either intrinsic, extrinsic, or both. Herbal immune boosters are an example of extrinsic staining source, and in this study, we aim to investigate the effect of herbal immune boosters during COVID-19 pandemic on oral and dental health. To our knowledge, there is no published evidence on the usage of herbal products and their relation to oral and dental health among the population of Saudi Arabia, which indicates room for more evidence. Our goal is to understand better the usage of herbal foods and their manifestation to oral and dental health in Saudi Arabia. In the long term, we hope to draw recommendations that help the population be aware of their decisions about using herbal foods and their effects on oral and dental health.

2. MATERIALS AND METHODS

The present study is a cross-sectional analytical study conducted to assess the impact of the COVID-19 pandemic on the consumption of herbal products and their effects on oral and dental health in Saudi Arabia. The research was reviewed and approved under reference #NRC21R/091/03 from the Institutional Review Board (IRB) of the King Abdullah International Medical Research Center (MRC) before the commencement of the study. Self-administered informed consent and questionnaire were obtained from all individual participants included in the study. Data were collected from laypeople in Saudi Arabia from December 2020 to April 2021. Convenient sampling technique to draw a sample from Saudi Arabia residents that matched inclusion criteria which were participants aged 18 years old and above, herbal products users during the COVID-19 pandemic, and Saudi Arabian residents, while the exclusion criteria were participants younger than 18 years old, herbal product non-users during the COVID-19 pandemic, and non-Saudi Arabian residents.

The literature review was done before finding important questions and areas of importance. Then, a self-structured self-administered survey was given to all the study participants to evaluate the impact of the COVID-19 pandemic on the consumption of herbal products and their effects on oral and dental health in Saudi Arabia. The authors declare that they have no conflict of interest. A total of 20 questions were included in the questionnaire, which was divided into three main categories. They were demographic variables, the usage of herbal products, and possible effects of oral and dental health. The self-structured questionnaire went through a validation process. It included piloting the survey with a group of participants and *Cronbach's Alpha* test =0.805 to verify the questionnaire's reliability. Besides, the participants reported that the survey was detailed and easy to follow.

The self-administered questionnaire was distributed electronically. It was an online-based questionnaire that was distributed via social media and communication applications through Google Forms. Data were analyzed using the *SPSS* statistical software version 23. Frequency distribution of the different demographic characteristics (e.g., age, gender, level of education), the usage of herbal products (e.g., prevalence and frequency), and possible effects of oral and dental health (e.g., discoloration, surface roughing,

and sensitivity) were analyzed. Results with a p-value of equal or less than a level of 0.05 were considered significant. To determine the association of possible effects of oral and dental health with variables, a correlation coefficient test was performed to evaluate the influence of demographic characteristics, the consumption of herbal products, and the possible effects of oral and dental health.

3. RESULTS

Two hundred eighty-two females and a hundred and three males have filled a total of 385 questionnaires, of whom 21.6% were diagnosed with COVID-19 and 78.4% were not diagnosed with COVID-19. As illustrated in table 1, demographic results distribution percentage of socio-demographic of the studied participants. It was observed that about three-quarters of the participants 73.3% were females and 26.7% were males, along with other socio-demographic data.

Table 1 The number and percentage of Socio-demographic characteristics of the studied participants

Socio-demographic characteristics	The studied participant (n=385)	
	No.	%
Gender		
Male	103	26.7
Female	282	73.3
Age in years		
18 - 24	119	30.9
25 - 39	91	23.6
40 - 59	145	37.7
≥ 60	30	7.8
Marital status		
Single	150	38.9
Married	210	54.6
Divorced	19	4.9
Widow	6	1.6
Nationality		
Saudi	377	97.9
Non-Saudi	8	2.1
Educational level		
Lower than secondary degree	20	5.2
Secondary degree or diploma	94	24.4
Bachelor's degree	233	60.5
Higher education	38	9.9
Occupation		
Student	113	29.3
Employee	122	31.7
Retired / Housewife	117	30.4
Unemployed	33	8.6

In the chart 1, regarding herbal immune booster products consumption, it was observed that about two-thirds of participants 69.9% and 66.8% used lemon and orange respectively, more than half of them 56.0 % used ginger, one-third of them 34.4% used turmeric, and less than one-quarter of them 23.0% used myrrh. Also, it was noticed 17.8% of the participants used cinnamon.

In table 2, most of the participants used the herbal immune boosters for less than one month 41.8% concerning the duration of usage. Also, most of the participants 80.5% used these products one time per day in response to the frequency of usage. Moreover, it was noticed that most of the participants 82.8% were drinking these products to boost their immunity.

■ Orange ■ Lemon ■ Turmeric ■ Ginger
 ■ Myrrh ■ Cinnamon ■ Others

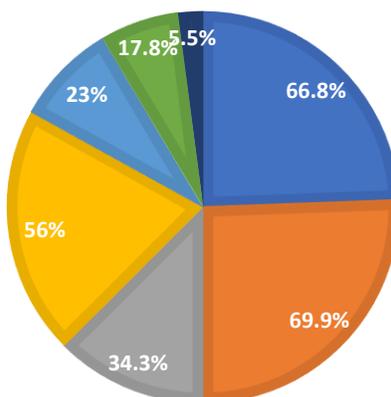


Chart 1 The percentage of herbal products usage to boost immunity during COVID-19 pandemic among studied participants

Table 2 The number and percentage of duration of using products to boost the immunity in the studied participants

Questions	The studied participant (n=385)	
	No.	%
Duration of using products to boost the immunity:		
Less than 1 month	161	41.8
1 – 2 months	104	27.0
2 – 3 months	25	6.5
More than 3 months	95	24.7
How many times the use of the product?		
One times / day	310	80.5
Two times / day	55	14.3
Three times / day	17	4.4
More than three times / day	3	0.8
Method of using the products:		
Gargling	63	16.5
Rinsing	20	5.2
Drinking	319	82.8
Eating	156	40.8

In table 3, it was noticed that more than three-quarters of the participant 76.3% did not see any changes in their oral health, while 23.7% of them noticed oral health changes during the usage of the herbal immune booster. Among those who saw changes in their oral health, 37.4%, 32.9% and 31.9% noticed dry mouth, changes of taste, and burning sensation in the mouth, respectively, and 18.9% of them complained from an oral ulcer. Also, it was observed that most of the participants 84.9% did not notice any changes in their dental health, while 15.1% of them noticed teeth changes during the consumption of these products to boost their immunity. Among those who saw changes in their dental health, about two-thirds of them 63.8% noticed dental staining, less than half 48.3% of them noticed dental sensitivity, and 15.5% them complained about dental roughness.

Table 3 the number and percentage of dental health changes in the studied participants

	No.	%
Dental health changes:	58	15.1
Pigmentation teeth	37	63.8
Roughness of the teeth	9	15.5
Tooth sensitivity	28	48.3
Oral health changes:	91	23.7
Mouth ulcer	17	18.9
Burning sensation in the mouth	29	31.9
Change in taste	30	32.9
Dry mouth	34	37.4
Stop using dental hygiene equipment		
Yes	23	6.0
No	362	94.0
Teeth whitening or planning to during the pandemic		
Yes	76	19.8
No	309	80.2
If yes, the causes of whiten your teeth	(n=76)	(19.8 %)
Planned before the pandemic	32	42.1
Pigmentation of the teeth became noticeable during the period of the pandemic	29	38.2
Suggestion from the dentist	15	19.7

It was observed that the majority of the participant 94.0% did not stop using dental hygiene equipment, toothbrush, and dental floss, during the period of using the product to boost their immunity, while 6.0% of them stopped using dental hygiene equipment during the period of using these products. Furthermore, it was noticed that most of the participants 80.2% did not whiten their teeth or planned to whiten them during the COVID-19 pandemic, while 19.8% of them whiten their teeth or plan to whiten them during the pandemic. Among those who whitened their teeth or planned to whiten them, less than half of them 42.1% planned to whiten their teeth before the pandemic, more than one third 38.2% of them whiten their teeth due to pigmentation of the teeth became noticeable during the period of the pandemic and 19.7% of them was because of a suggestion from their dentists to whiten their teeth.

There was a negative correlation with statistically significant differences between age and using lemon $r = -0.141$ with $p = 0.006$, turmeric $r = -0.336$ with $p = 0.0001$, ginger $r = -0.133$ with $p = 0.001$, and myrrh $r = -0.110$ with $p = 0.031$. It was observed that negative correlation with statistically significant differences between educational level and using orange $r = -0.127$ with $p = 0.013$ and lemon $r = -0.123$ with $p = 0.016$. It was noticed that negative correlation with statistically significant differences between occupation and using lemon $r = -0.114$ with $p = 0.026$, turmeric $r = -0.311$ with $p = 0.0001$, ginger $r = -0.115$ with $p = 0.025$ and myrrh $r = -0.188$ with $p = 0.0001$. It was observed that positive correlation with statistically significant differences between oral health changes and using turmeric $r = 0.101$ with $p = 0.049$ and cinnamon $r = 0.125$ with $p = 0.014$. It was observed that positive correlation with statistically significant differences between change in taste and ginger $r = 0.107$ with $p = 0.046$ and burning sensation in the mouth and myrrh $r = 0.101$ with $p = 0.049$. It was observed that positive correlation with statistically significant differences between teeth changes and using myrrh $r = 0.167$ with $p = 0.001$ and negative correlation with statistically significant differences when using lemon $r = -0.199$ with $p = 0.0001$.

It was observed a negative correlation with statistically significant differences between the roughness of the teeth and orange $r = -0.116$ with $p = 0.031$. It was observed that negative correlation with statistically significant differences between whitening teeth or planning to and using lemon $r = -0.116$ with $p = 0.023$, turmeric $r = -0.208$ with $p = 0.0001$, and ginger $r = -0.113$ with $p = 0.027$. It was observed a positive correlation without statistically significant differences between stop using dental hygiene equipment and whitening teeth or planning to $r = 0.039$ with $p = 0.444$. A positive correlation was observed with statistically significant differences between stop using dental hygiene equipment and teeth changes $r = 0.108$ with $p = 0.036$.

4. DISCUSSION

The presented self-administrated survey-based study was conducted to assess the impact of the COVID-19 pandemic on the consumption of herbal products and their effects on oral and dental health in Saudi Arabia. The results showed that females 73.3% used herbal products more when compared to males 26.7%, which could have an impact on the results of the study. This can be attributed to the findings of Alyami et al., (2020) where they found better knowledge of COVID-19 preventive measures among females. On the other hand, Naser et al. found no significant difference between gender and knowledge of the COVID-19 pandemic (Naser et al., 2021).

Bornkessel et al., (2014) found that 96% of their participants were highly aware of the benefits of vitamin C. This can be translated to our findings 69.9% and 66.8% of participants who used lemon and orange to enhance their immunity during the pandemic. Barry et al., (2018) found that most participants believed natural health products are safe to use with minor side effects that translated into the belief of 47.2% using Vitamin C as a safer and higher quality health product. Another finding in our study was orange consumers during the pandemic who noticed roughness in their teeth were 8.57% among those who felt dental changes; this finding is also supported by the results of the in-vitro study, which was conducted by Ren et al., (2009) who found that orange juice increased enamel roughness along with decreased enamel hardness. Lemon was the most used immune booster product consumed among the participants, which had a negative correlation with teeth whitening or planning to and this could be interpreted by the finding of Grando et al., (1996) who found enamel color changed to a whiter shade with lemon incubation, such changes was explained as results of acid attacks on dental enamel. These findings highlight the effect of lemon acidity in leading the participants not to whiten their teeth.

Moreover, it was noticed that more than half of the participants 56.0 % used ginger as an immune booster during the pandemic, 37.9% among those who felt oral changes had felt dry mouth and change in taste. Similar results were found by EL Alami et al., (2020) who found that 66% used ginger as a preventive medicinal plant during COVID-19. To add, one-third of the participants 34.4% used turmeric as herbal immune promoter, 28.2% among those who felt oral changes had felt burning mouth sensation. A comparable finding was observed by EL Alami et al., (2020) which was 50% used turmeric as precautionary herbal medicine during the COVID-19 outbreak.

Furthermore, less than one-quarter of the participants 23.0% used myrrh as a natural way to improve immunity, similar to the findings of Alyafei et al., (2020) who noticed 29% used myrrh as a preventative measure during the COVID-19 pandemic. Among our study participants who have used myrrh n=88, eleven of them noticed a burning mouth sensation, which positively correlated with a statistically significant difference in our study results. At the same time, Alotaibi et al., (2020) found different results participants felt burning mouth sensation with myrrh. Furthermore, Alotaibi et al., (2020) found 7% of their study participants had altered taste among myrrh users. Similar findings to our study results 10.2% of our study participants had a change in taste with the use of myrrh. Moreover, Alotaibi et al., (2020) found dental staining in 5% of their study participants using myrrh.

Similarly, comparable findings in our study results were 11.4% of the study participants had dental staining with the consumption of myrrh. Also, it was noticed 17.8% of the participants used cinnamon to boost their immunity which is less when compared to Arsaath et al., (2020) findings found that 50% used cinnamon as an immune booster during the COVID-19 pandemic. All in all, herbal products are used widely worldwide, especially in Asian and Arabian countries. Multiple studies have shown the benefits of these herbal products and their role in the immune system. Besides that, the involvement of these products and their effects on oral and dental health has been established.

5. CONCLUSION

COVID-19 pandemic was a motive of many people to improve their immunity to protect themselves by using different herbal immune boosters. Many herbs were identified as immune promoters, and people consumed these products for different duration and frequencies to improve their immune system. People's consumption methods of these herbal immune boosters varied from drinking, eating, and gargling to rinsing. However, all these consumption methods share the same pathway to enter the body, which is the oral cavity. This shared pathway of consumption can be susceptible to different challenges on both oral health and dental well-being. These challenges affect the consumers' quality of life from oral ulcers, taste change, burning mouth sensation to dry mouth. Moreover, teeth are a vulnerable part of the oral cavity. When it comes to direct contact with herbal immune boosters that could harm the health and esthetics of teeth, so, to conclude, the COVID-19 pandemic made people try to enhance their immunity to avoid getting the virus by all means. Still, the consumption of herbal immune boosters has some consequences on their oral health and dental well-being.

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We thank the participants who were all contributed samples to the study.

Author Contributions

All authors contributed equally to the manuscript

Ethical approval

This research was reviewed and approved under reference #NRC21R/091/03 from the Institutional Review Board (IRB) of the King Abdullah International Medical Research Center (MRC) before the commencement of the study.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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