

Original Research

Assessment of commitment to healthy daily habits and diets, preventive measures, and beliefs about natural products utilization during COVID-19 pandemic in certain population in Egypt and Saudi Arabia

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Abstract

Objective: The purpose of this research is to assess the commitment of participants in Saudi Arabia and Egypt towards healthy daily habits, preventive measures, healthy food habits, and beliefs about natural products as immunostimulants during COVID-19 pandemic. **Method:** A cross-sectional questionnaire-based study was conducted in Saudi Arabia (mainly Riyadh and Jeddah) and Egypt (mainly Cairo). The questionnaire instrument was created based on an extensive literature review on the COVID-19 pandemic, including its spreading and transmission methods, preventive measures, healthy lifestyle, and diets that increase human immunity against viral infections and the use of natural products and drinks. The questionnaire was created by Microsoft 365® office forms, participants were invited through emails and other social media. The questionnaire includes a demographic section (gender, nationality, residency country, city, age, marital status, educational level, employment status, chronic disease history, under anxiety or stress, have a temper or irritable person, were infected/currently infected and in contact to COVID-19 patient) and (23) questions arranged under five domains; Domain I daily habits (4), Domain II keeping preventive measures (4), Domain III healthy eating habits (9), Domain IV for participants currently or previously infected, or in contact with a patient (4) Domain V for assessment of participants' beliefs towards the use of natural products to elevate immunity during COVID-19 pandemic (2), beside 4 choice questions (stimulant drinks, natural drinks, natural products, and zinc-rich food). SPSS® was used to analyze the results using Student' t-test, ANOVA, and Tukey's HSD tests. **Result:** 510 individuals with various demographic characteristics participated in the study. This study revealed that the participants belief in healthy foods, natural drinks (mainly ginger, lemon, and cinnamon), natural products (mainly honey, olive oil, and black seed), healthy habits, and preventive measures as sanitizers, social distance, and exercise. Only 13% of all participants were infected with COVID-19, although 31% of them were in contact with COVID -19 patients, about 93% were under stress, and 22% were with chronic diseases. Participants who are married, not in contact with patients and not previously infected by COVID-19 are more adhered to preventive measures while those previously or currently infected are more committed to healthy lifestyle and diet habits. Qualification level seems to make no significant difference in any domain. 78.6% of the participants beliefs in the benefits of utilizing natural products in preventing infection with corona virus or reducing the period of treatment in case of infection. About 95.7% of the infected persons had no need of hospitalization and about 50% are cured within two weeks of infection. The questionnaire revealed that Nescafe and black tea were the most used stimulant drinks among the participants, particularly the students and who were always under stress. Most of the participants agreed with the utilization of Zn-rich food, particularly Egyptians, which may help in boosting their immunity. **Conclusion:** Natural products selected in the present study can be used in combination with the existing clinical standards of care that have the potential to serve as prophylactic agents in populations that are at risk to develop COVID-19 infection.

Keywords: coronavirus; COVID-19; questionnaire; natural food and drinks; Egypt; Saudi Arabia

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INTRODUCTION

Herbal medicine is of great value for treating different diseases from minor scratches and burns to serious cases like cancer and other persistent illnesses¹ and others. Herbal products, such as herbal extracts, essential oils, and herbal teas, are available in food shops, grocery stores, and hypermarkets, so the patient can purchase them directly without prescription. Herbal medicine is becoming more popular than conventional medicine for its availability and affordable by the consumer. For example, the presence of phenolics,² flavonoids,³ procyanidins,⁴ triterpenes,⁵ fatty acids,⁶ polyphenols⁷ and alkaloids.⁸

COVID-19 is an infectious disease that occurs by various severities of respiratory syndrome, it caused by SARS-CoV-2.⁹ As known, the disease was first reported in December 2019 in Wuhan city in China, and according to the WHO regulations, COVID-19 is considered as a pandemic and spreads rapidly around the world. SARS-CoV-2 is a virus mainly infects the respiratory system but may cause damages to the digestive system, urogenital system, central nervous system, and circulatory system.¹⁰ Physicians began directing their advice to their patients towards plant-based diets, especially those over 60 or suffering from problems in their health like cardiovascular disorders, diabetes, respiratory disease, cancer, or obese. We all must keep in our minds that the body immune system's response is the only way that can fight the COVID-19 and to stand against the disease. Previous study on drugs known to be used in Covid 19 treatment like ribavirin, chloroquine, hydroxychloroquine, azithromycin, and atazanavir reported their severe side effects that cause diseases on their body systems like cardiovascular system, immune system, respiratory system or urinary system.¹¹

Due to the deficiency of therapy options for COVID-19 till now, numerous concerns have raised between populations worldwide, to find other choices, beside immunization, to stop the transference of the disease or to increase and to prevent transmission to other individuals. The use of natural products and herbal extracts aimed to increase immunity and decrease the probability of getting infected.^{12,13}

Many researchers found that the consumption of herbs or their products as immunomodulators showed a positive effect on decreasing the symptoms of COVID-19 attack. The utilization of traditional Chinese medicine (TCM) either in combined formulae or single herbal medicine were successfully used for the treatment as antipyretic, expectorant, cough-suppressing, and other painful symptoms of COVID-19.¹⁴ Other research discussed the old traditional herbs to overcome the pandemic.¹⁵ Traditional food with antiviral and immune-boosting characteristics, which have bioactive constituents, good antiviral effects against different viruses, and immune-boosting mechanisms similar to the antiviral drugs of COVID-19, homologous SARS (Severe Acute Respiratory Syndrome Coronavirus) and MERS (Middle East Respiratory Syndrome Coronavirus). A previous study¹⁶ was carried out in Saudi Arabia about the use of natural products through the

COVID-19 pandemic, most of the participants were Saudi aged less than 49 years old, and the study did not focus on several demographic variations.

In the present investigation, there is a policy for the control and implementation of COVID-19, global pandemic that ferociously attacks the world through the study of the continuous administration of different types of common drinks and food that are available in most of our oriental houses as traditional herbs.

Although all unsatisfactory consequences caused by this COVID-19 pandemic struck the whole world, the use of herbs and natural products traditionally daily in the oriental houses has revealed a great control on this virus spread.

Our goal is to assess the commitment of a certain populations of the Arab region specially Kingdom of Saudi Arabia (KSA) and Egypt, to COVID-19 preventive measures in addition to their beliefs in the drugs under study and their effectiveness in raising the efficiency of the human body to a level that helps resist the symptoms of COVID 19. This is measured by collecting different answers to the questionnaire between different samples of people through different social media and email and their analysis. The aim of the research was always clarified to the participants upon sending the link of the survey either by email or several social media. The researchers did clarify the relation of survey sections and current pandemic state to participants. The study did not include a comparative study with control or the degree of effectiveness of these measures.

METHODS

Study design and study population

A cross-sectional study using an online questionnaire was conducted in Saudi Arabia (mainly Riyadh and Jeddah) and Egypt (mainly Cairo) between August 6th, 2021 and March 2nd, 2022. The questionnaire instrument was created based on an extensive literature review on the COVID-19 pandemic, including its spreading and transmission methods, preventive measures, healthy lifestyle, and diet that increase human immunity to viral infections and the use of natural products.^{17,18} Five Likert scale was used; strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5) for all items except those for assessment of keeping healthy eating diet, Five Likert scale was; never (1), rarely (2), sometimes (3), often (4) and always (5). The questionnaire was reviewed by a group of expertise researchers in the field to evaluate the appropriateness, relevancy, clarity, and adequacy of the questions, followed by a pilot study on 50 participants to test the reliability and validity of the questionnaire using Cronbach's alpha test and Pearson Product Moment Correlation test, respectively. The results of the pilot study were not included in our results. The questionnaire includes a part of 15 questions about socio-demographic characteristics (including gender, nationality, residency, country and city, age, marital status, education level, employment, having a history of chronic diseases and being currently/previously infected or



being in contact with a patient with COVID-19). In addition to 23 questions arranged under five domains; beside 4 questions giving the participants to choose from a set of choices (stimulant drinks, natural drinks, natural products, and zinc-rich food), for these four questions it was allowed to choose more than a choice. Domain I is about daily habits, including 4 five-Likert scale questions including habits such as smoking, exercise, sleep sufficiency, and exposure to adequate sun rays. Domain II is about keeping preventive measures including 4 five-Likert scale questions about hand washing, social distancing, and using both hand and surface sanitizers. Domain III is about healthy eating habits comprising 9 five-Likert scale questions including habits such as drinking sufficient water, natural drinks, stimulant drinks, eating vegetables and fruits, homemade and take-away foods, zinc containing food, natural products and food supplements. Domain IV is particularly for participants currently or previously infected, or in contact with a patient and includes three yes or no questions (usage of natural products to support treatment, home, and hospital treatment) and a question about the duration of the disease in case of infected patients. Domain V is to finally assess the beliefs of the participants towards the use of natural products to elevate immunity during COVID-19 pandemic, and it includes 2 five-Likert scale questions.

Sampling strategy

A sample of participants was invited to participate in the study through e-mail contact and social media (Facebook, Twitter, Instagram, and WhatsApp). All participants voluntarily participated in the study and were thus considered exempt from written informed consent. The study aims and objectives were clearly explained at the beginning of the questionnaire. The inclusion criteria were a) participants aged 18 years above and b) currently living in Saudi Arabia or Egypt. Participants were excluded if they were: a) below 18 years of age; and b) unable to understand the Arabic language. The participants were requested to cover the time from the beginning of COVID-19 pandemic in 11 March 2020 till time of surveying.

The information will only be used to achieve the goal of scientific study in complete secrecy. The questionnaire is provided at its beginning by the statement "Your answer at the questionnaire is an acknowledgement of acceptance to participate in the study with sincere thanks and appreciation".

Sample size

It was determined by using a Raosoft sample size calculator (<http://www.raosoft.com/samplesize.html>) with a margin of error of 5% a confidence level of 95% and response distribution 50%. According to the latest official records, the population is 9840591, 8216284 and 3975999 persons in Cairo, Riyadh and Jeddah, respectively.^{19,20} The required sample size was 385 participants. To minimize inaccurate findings and to increase study reliability, the target sample size was established at 510 participants.

Statistical analysis

Data were analyzed using Statistical Package for Social Sciences

(SPSS software, version 25 for windows, IBM Corp, Armonk, NY, USA). Continuous variables were reported as mean (\pm standard deviation [SD]), while categorical variables were reported as frequency and percentages. The Kolmogorov–Smirnov and Shapiro Wilk tests were used to check the normality of the data. Student t-test and one-way ANOVA test were used to compare the mean of the responses between different demographic groups. Tukey's HSD post hoc test was conducted to identify the source of significant variation within each group. A confidence interval of 95% ($p < 0.05$) was applied to represent the statistical significance of the results, and the level of significance was predetermined as 5%.

Ethical consideration

This study was approved by the Research Ethics Committee in Faculty of Pharmacy, King Abdulaziz University, Jeddah, Saudi Arabia; with Reference No "PH-1442-78".

RESULTS

Characteristics of study participants (Table 1)

A total of 510 individuals participated in the study. The female represented 51.6% ($n = 263$) of the sample. About 69.3% of the participants were Saudi ($n = 352$), most of the participants lived in Saudi Arabia (76.4%, $n = 389$). About half of the participants lived in Jeddah (47%, $n = 239$), around two-thirds of the participants aged 31- 70 years (67.6%, $n = 344$). 58.3% of the participants were married ($n = 297$), 75% of them earned a bachelor's degree ($n = 382$), and 43% were employed ($n = 219$). Less than quarter of the participants had a chronic disease history (22.4%, $n = 114$). More than half of the participants were sometimes under anxiety or stress (51.1%, $n = 260$) and 60%, $n = 305$ were sometimes have a temper or irritable. About third of the participants were in contact with a COVID-19 patient (31.2%, $n = 159$) and 13.4% were previously or currently infected by COVID-19, $n = 69$.

Characteristics	Frequency (%)
<u>Gender</u>	
Male	247 (48.4)
Female	263 (51.6)
<u>Nationality</u>	
Saudi	352 (69.3)
Egyptian	127 (25)
Other	29 (5.7)
<u>Residency country</u>	
Saudi Arabia	389 (76.4)
Egypt	114 (22.4)
Other	6 (1.2)
<u>Residency city</u>	



Jeddah	239 (47)
Riyadh	82 (16.1)
Cairo	117 (23)
Other	71 (13.9)
Age	
18- 30 years	165 (32.4)
31- 50 years	237 (46.6)
51- 70 years	107 (21)
Marital status	
Married	297 (58.3)
Single	183 (36)
Other	29 (5.7)
Education level	
Primary school	22 (4.3)
Preparatory school	46 (9)
Secondary school	143 (28)
Bachelor's degree	252 (49.4)
Other	47 (9.2)
Employment status	
Student	112 (22)
Employee	219 (43)
Retired	56 (11)
Other	122 (24)
Chronic disease history	
Under anxiety or stress	114 (22.4)
Under anxiety or stress	
Always	214 (42)
Sometimes	260 (51.1)
Have a temper or irritable person	
Always	100 (19.6)
Sometimes	305 (59.9)
Were infected/currently infected	
Yes	69 (13.4)
In contact to a COVID-19 patient	
Yes	159 (31.2)

Participants' responses to the five domains (Table 2)

Participants' daily habits

Participants showed a high level of adherence to good healthy habits (Total domain score 3.14), in terms of exercise (mean of 3.8, SD 1.03), getting enough sleep (mean of 3.76, SD 1.05), exposing to enough sun rays for vitamin D supplementation (mean 3.32, SD 1.07). In addition, most participants disagreed about smoking habits (mean 1.80, SD 1.20).

(In a supplementary table) There is a difference in participant's responses to healthy habits questions (Domain I). The Tukey HSD test confirmed that male participants and those aged 31-50 years, married, employed, and those who live in Jeddah are

more adhered to smoking habits. Married, retired, and those whose currently or previously infected with COVID-19 are more committed to light exercise. Participants from Jeddah and Cairo; aged 31- 70 years, married, employed or retired and rarely exposed to anxiety or stress are committed to getting enough sleep at night and exposing to the sun daily to provide the body with vitamin D. In addition to male, Egyptian participants and who are living in Egypt were also the main sources of significant variation between groups in Q4.

Participants' keeping preventive measures

Participants showed great commitment to preventive measures (Total domain score, 4.28), in terms of handwashing (mean 4.47, SD 0.69), social distancing (4.35, SD 0.68), using hand sanitizers (4.27, SD 0.84) and using surface sanitizers (mean 4.03, SD 0.93). In a supplementary table, there is a difference in the participant's responses to preventive measures questions (Domain II). The Tukey HSD test confirmed that participants aged 51- 70 years, married, retired, and those who were not in contact with COVID-19 patients are more committed to washing hands as a preventive measure. Married participants, those with chronic disease history and both not infected or in contact with a patient, are more adhered to the social distancing preventive measures. Participants who are under anxiety or stress and those never in contact with COVID-19 patients are more adhered to using hand sanitizers. Female participants, 51- 70 years old, married, retired, and those who have chronic disease are more adhered to the using of surface sanitizers.

Participants' adherence to healthy lifestyle and diet habits

Participants showed great commitment to keep healthy eating habits (Total domain score, 3.21), in terms of drinking sufficient daily amount of water (mean 3.89, SD 1.02), eating of zinc rich food sources (mean 3.68, SD 0.9), vitamin D rich food supplements (mean 3.45, SD 1.14), vegetables, fruits and nuts (mean 3.97, SD 0.96). Although the participants often prefer homemade meals (mean 4.26, SD 0.84), they are stated that sometimes prefer takeaway meals, because they still use takeaway meals (mean 2.73, SD 1.03).

Participants often use stimulant drinks (mean 3.45, SD 1.16), as well as natural products and drinks as protective measures against diseases (mean 3.85, SD 0.95).

In a supplementary table, there is a difference between participants demographic groups; males, who live in Jeddah, aged 51- 70 years, married, employed, rarely under stress, and those rarely irritable are more committed to drink enough water daily. Students and who are always under stress are more stoked to stimulant drinks. Tukey HSD test confirmed that participants who live in Cairo, 31- 70 years old, married, employee or retired, those with chronic disease history, those are sometimes or rarely irritable, and those who are previously or currently infected by COVID-19 are more adhered to homemade meals and eating zinc-rich food sources; while participants who are single, student, those with no chronic disease history and those who are always under anxiety or stress



Table 2. Results of participants' responses to the five domains				
Variable			Mean (SD)	
I- Daily Habits				
Q1	Do smoke cigarettes or shisha		1.8 (1.20)	
Q2	I do some light exercise like walking, biking, others		3.8 (1.03)	
Q3	I get enough sleep at night		3.76 (1.05)	
Q4	I make sure to be exposed to sun daily to provide the body with vitamin D		3.32 (1.07)	
Total score of domain 1			3.17	
II- Keeping preventive measures				
Q5	I wash my hands well to reduce the chances of infection		4.47 (0.69)	
Q6	I take care of social distancing measures		4.35 (0.68)	
Q7	I am careful of using hand sanitizers		4.27 (0.84)	
Q8	I am careful of using surface sanitizers		4.03 (0.93)	
Total score of domain 2			4.28	
III- Keeping healthy eating habits				
Q9	I make sure to drink 1.5 liter (large bottle) of water a day		3.89 (1.02)	
Q10	I stick to stimulant drinks		3.45 (1.16)	
Q11	I keep drinking natural drinks		3.62 (1.06)	
Q12	I prefer homemade meals		4.26 (0.84)	
Q13	I prefer takeaway meals		2.73 (1.03)	
Q14	I make sure to administer natural products to prevent diseases		3.85 (0.95)	
Q15	I keep eating zinc rich food sources		3.68 (0.90)	
Q16	I make sure to eat vitamin D rich food supplements		3.45 (1.14)	
Q17	I make sure to eat vegetables, fruits and nuts that are beneficial for immunity		3.97 (0.96)	
Total score of domain 3			3.21	
IV- In case of currently or previously infected, or in contact with a patient			Yes	No
Frequency (%)				
Q18	In case of being infected, did you continue to use the natural products to support the treatment		49 (71)	20 (29)
Q19	In case of infection by Corona virus, how long (in weeks) you have ill	1	2	3
		Frequency (%)		
		22 (31.9)	29 (42.0)	18 (26.1)
Frequency (%)			Yes	No
Q20	In case of infection, did you need to enter a hospital?		3 (4.3)	66 (95.7)
Q21	In case of infection or being in contact with a patient, have you taken isolation measures with treatment in the home?		172 (75.43)	34 (14.91)
V- Beliefs towards natural products				
Q22	Natural products have a benefit in preventing infection with corona virus or reducing the period of treatment in case of infection		3.94 (0.91)	
Q23	I support the use of various forms of herbal products in hospitals as a good tool to raise human immunity		3.91 (0.91)	
Total score of domain 5			3.93	

are preferring takeaway meals. Moreover, also, Tukey HSD test demonstrated that participants who are married, employee, or retired and with chronic disease history and not in contact with COVID-19 patients are making sure to eat vitamin D rich food supplements, vegetables, fruits and nuts to support immunity. Qualification level did not significantly affect the participants' adherence to healthy lifestyle and diet habits.

Participants currently or previously infected, or in contact with a patient

Sixty-nine (13.4%) of the total participants are previously or currently infected by COVID-19 and 159 participants (31.2%) are previously or currently in contact with a COVID-19 patient.

In case of infection or being in contact with a patient, the



participants agreed (frequency 172, 75.43%) that they have taken isolation measures for treatment at home and use natural products with support treatment (frequency 49, 71%). Most of the infected participants (n= 66, 95.7%) did not need to enter a hospital for treatment. Currently infected with COVID-19 needed a variable period for recovery ranging from one week (n= 22, 31.9%) to three weeks (n= 18, 26.1%). Both in Egypt and Saudi Arabia, as in most countries, hospitalization is for infected patients that need special medical support. But those with mild to moderate symptoms and could be managing themselves, they took the treatment protocol and advised to isolate themselves in home. For contacts in SA, there is a governmental mobile application (Table 3) that could track those in contact to be avoided if they did not isolate themselves.

Natural drink	Participants who are previously /currently infected by COVID-19		Participants who are in contact to COVID-19 patients	
	Frequency	Percentage of participants	Frequency	Percentage of participants
Ginger	27	39.13	53	33.33
Karkadeh	15	21.73	25	15.72
Cinnamon	15	21.73	36	22.64
Liquorice	1	1.45	2	1.26
Ginger and lemon	26	37.68	63	39.62
Fennel	6	8.70	20	12.58
Others	29	42.02	52	32.70
Not applicable	9	13.04	33	20.75
Natural products				
Honey	59	85.51	109	68.55
Blueberry	5	7.25	6	3.77
Mushroom	3	4.35	6	3.77
Echinacea	0	0	0	0
Thyme	16	23.19	46	28.93
Olive Oil	37	53.62	78	49.06
Basil	5	7.25	9	5.66
Ginseng	2	2.90	4	2.52
Curcuma	27	39.13	52	32.70
Black Seed	36	52.17	71	44.65
Others	16	23.19	38	23.90
Stimulant drinks				
Black tea	31	44.93	80	50.31
Green Tea	29	42.02	48	30.19
Turkish coffee	23	33.33	45	28.30
Arabic coffee	16	23.19	54	33.96
Nescafe and similar	34	49.28	91	57.23

Zinc-rich food				
Beef meat	25	36.23	55	34.59
Fish	47	68.12	89	55.97
Egg	46	66.67	111	69.81
Dairy products	47	68.12	107	67.30

*No significance difference between groups, Z-test at $\alpha = 0.05$

Beliefs of the participants towards the use of natural products

Generally, participants showed high level of beliefs towards natural products (Total domain score, 3.93). Participants believe in the prophylactic effect of natural products on COVID-19 (mean 3.91, SD 0.91) regardless the demographic characteristics. Married participants, those with a history of chronic diseases, COVID-19 infected, and participants living in Cairo are the main causes for the significant mean difference (at $p > 0.05$) between groups, as shown by the Tukey HSD test (supplementary table)

Top natural products commonly in use by the participants

In the questionnaire tools, the participants could choose from a set of choices including stimulant drinks, natural drinks, natural products, and zinc-rich food (According to what is issued by the Ministry of Health in Egypt and Saudi Arabia, as well as various advertisements during COVID 19 pandemic, there are awareness brochures for the importance of some vitamins and zinc containing foods), for these four questions it was permitted to choose more than a choice. Figure 1 shows that Nescafe and similar drinks are the main stimulant drinks used by the participants (n= 280, 28%), followed by black tea (n=247, 25%) and Arabic coffee (n= 186, 19%), green tea and Turkish coffee are also used (n=156, 15% and n=131, 13%, respectively). Figure 2 shows that ginger and lemon (n= 195, 24%) is the most used natural drink, followed by ginger (n= 175, 21%) and cinnamon (n= 132, 16%), karkadeh, fennel and liquorice are used with less extent (n= 81, 10%, n= 63, 8% and n= 8, 1%, respectively). In figure 3, honey is the most widely used natural product by the participants (n= 368, 25%), followed by olive oil (n= 294, 20%), black seed (n= 223, 15%) and curcuma (n= 165, 11%), while other natural products were chosen by the participants as shown in Figure 3. Figure 4 shows that egg is the most used zinc-rich product (n= 361, 31%), followed by dairy products (n= 337, 29%), fish (n= 295, 25%) and beef meat (n= 171, 15%).

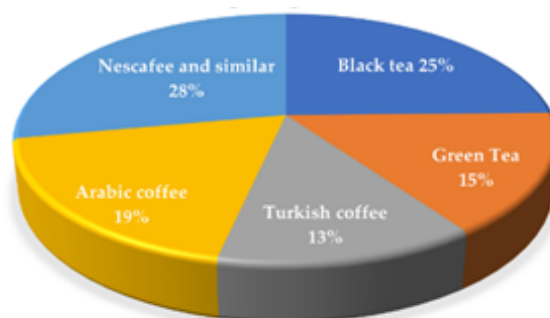


Figure 1. Percentage distribution of stimulant drinks used by the participants

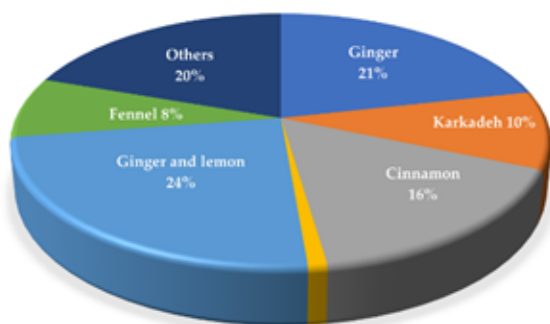


Figure 2. Percentage distribution of natural drinks used by the participants

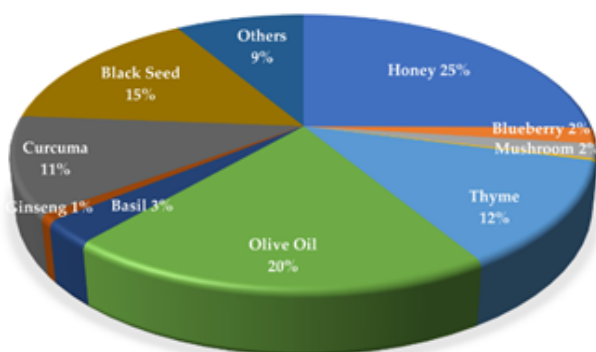


Figure 3. Percentage distribution of natural products used by the participants

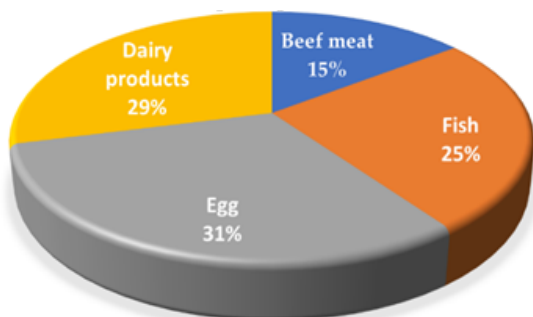


Figure 4. Percentage distribution of zinc-rich food used by the participants

Among participants who are previously/currently infected by COVID-19 (Table 3); ginger is the most used natural drink (n= 27, 39.13%), followed by ginger and lemon (n= 26, 37.68%) while ginger and lemon are the most used natural drinks among participants who are in contact with COVID-19 patients (n= 63, 39.62%) followed by ginger (n= 53, 33.33%). Honey is the most widely used natural product among participants who are previously/currently infected with COVID-19 and who are in contact with COVID-19 patients (n= 59, 109 and percentage 85.51, 68.55, respectively). Honey is followed by olive oil, n= 37, 78 and percentage 53.62, 49.06 in participants who are previously/currently infected with COVID-19 and who are in contact with COVID-19 patients, respectively.

These results proved that participants believe in natural products to elevate their immunity during COVID-19 pandemic, especially ginger and lemon, ginger, cinnamon, honey, olive oil, and black seed (24, 21, 16, 25, 20 and 15%, respectively). Upon being in contact with a patient, the participants showed more belief in these natural products as the results showed a higher percentage of using ginger and lemon, ginger, cinnamon, honey, olive oil, and black seed (40, 33, 23, 68, 49 and 44%, respectively). Results proved that participants who are currently/previously infected relied more on natural products, especially ginger, ginger and lemon, cinnamon, karkadeh, honey, olive oil, and black seed (39, 38, 22, 22, 86, 54 and 52%, respectively).

Nescafe and similar drinks are the most used stimulant drinks among participants who are previously/currently infected with COVID-19 and who are in contact with COVID-19 patients, n= 34, 91 percentage 49.28, 57.23, respectively. Black tea (n= 31, 80 percentage 44.93, 50.31) is the second choice among participants who are previously/currently infected with COVID-19 and who are in contact with COVID-19 patients, respectively.

Fish and dairy products are the highest used zinc-rich food among participants who are previously/currently infected with COVID-19 (n= 47, 68.12%), while eggs (n= 111, 69.81%) followed by dairy products (*n= 107, 67.30%) are the most used zinc-rich food among participants who are in contact with COVID-19 patients.

Z-test analysis using excel Microsoft at $\alpha = 0.05$, proved that no significant difference between the beliefs of participants who are previously /currently infected by COVID-19 and those in contact to COVID-19 patients towards using different natural drinks, natural products, stimulant drinks, and zinc-rich foods as preventive measures against COVID-19.

DISCUSSION

The great distribution of COVID-19 and the increased number of deaths associated with it could be due to improper lifestyles that weaken the immune system and may be accompanied with low-grade inflammation that increases the viability of infections and the risk of developing their complications.²¹ That is because, in healthy subjects and after being infected with COVID -19, the virus multiplies in the body within the first week, then the immune system is stimulated with the release of cytokines.²² However, in subjects with a compromised immune system, the infection is severe and can lead to aggressive uncontrolled inflammation, a condition known as cytokine release syndrome (CRS) or a cytokine storm (CS),²³ that is characterized by increased levels of inflammatory cytokine, adhesion molecules and chemokines including tumor necrosis factor (TNF)- α , interleukin- (IL)-6, IL-1 beta, IL-4, IL-7, IL-8, interferon γ (IFN- γ), interferon-inducible protein 10 (IP-10), monocyte chemoattractant protein 1 (MCP-1), and macrophage inflammatory protein 1- α .²⁴ Overproduction of these cytokines

and chemokines contribute to the progression, severity, and poor prognosis of the disease.²⁵ This condition leads to further complications, including sepsis, pneumonitis, acute respiratory failure, pulmonary fibrosis, multiorgan failure, and potentially death.²⁴⁻²⁶

Importantly, preventive measures to control the spread of COVID-19 pandemic are essential and should be followed precisely, particularly by subjects with high risk to complications such as obese subjects, those having chronic diseases, and the elderly; all have a higher state of inflammation.^{27,28} The recommended standards include washing hands regularly with water and soap or sanitizers containing 70% ethanol/isopropanol to stop viral infection.²⁹ Environmental surfaces must be cleaned regularly with detergent or bleach such as a solution of sodium hypochlorite. Avoiding crowds, close contact with symptomatic individuals, and touching the eyes, nose, and mouth. Social distancing between two individuals should be maintained to prevent infection. Social distancing necessitates maintaining at least 2 m distance between individuals to avoid respiratory droplet transmission. Covering the mouth and nose with a tissue during cough or sneeze and disposing of the used tissues. In case of infection or test positive for COVID-19, man should self-isolate until recovery.³⁰

Collectively, consideration of healthy lifestyle and food habits for the duration of the COVID-19 pandemic can assist to strengthen the immune system to prevent infection or to combat disease progression, relieve symptoms and prevent serious complications in infected persons. Follow preventive measures it is important to avoid infection, particularly in people with a high-risk factor such as aging, obesity, or chronic disease.

Cairo is the largest city in Arab region with the most population density, while Riyadh and Jeddah are considered the third and tenth cities in Arab region. According to the latest official records, the population is 9840591, 8216284 and 3975999 persons in Cairo, Riyadh and Jeddah, respectively.^{19,20}

The selected regions (Cairo, Riyadh, and Jeddah) are the top civilized regions in Egypt and Saudi Arabia. These cities are characterized by a high percentage of highly qualified people where a lot of governmental universities are available besides several private universities. The governmental education is nearly free in Egypt and students are awarded for high education in SA. That is why a high percentage of the participants are with a bachelor's degree and represent the sample population. On this basis, it was found that a high percent of the participants is cared to follow healthy daily habits and preventive measures and they strongly belief in healthy food, natural drinks, and natural products.

The high level of education for most of the participants may reflect this awareness during the pandemic. In the present study, although 31% of participants were in contact with COVID-19 patients, approximately 93% are always or sometimes under stress and 22% had chronic diseases including diabetes, heart disease, stress, obesity, high blood pressure, and high

cholesterol, but only 13% of all participants were infected with COVID-19. This low percent of infection could be related to the care of most participants to follow preventive measures, e.g., using hand and surface sanitizers, social distance, frequent washing of their hands in addition to their proper daily habits including no smoking or shisha, taking enough periods of sleep, exercise, adequate exposure to sun light in addition to the use of stimulant and natural drinks and products that reduce the inflammation and boost the immunity as will be discussed below. Among the infected persons, about 95.7 % had no need of hospitalization and about 50% are cured within one to two weeks of infection. This could be also as a consequence of healthy lifestyle and continuing drinking and eating natural products and Zn-rich food.^{31,32}

A wide range of medicinal herbs have been reported for their potential to cure diseases and used in the area under study. These herbs function as immunomodulatory, anti-inflammatory, antiviral and anti-microbial.³³ In addition, various in vitro studies have shown that medicinal plants like *Allium sativum*,³⁴ *Glycyrrhiza glabra*,³⁵ *Zingiber officinale*³⁶ are potent antiviral against SARS-CoV, because of the inhibition of protein replication of SARS-CoV. These herbs may also inhibit SARS-CoV2. In the Arab community, herbal medicines are frequently used by many people. In this study, we highlighted several herbal medicines, dietary supplements, and home-made treatments that contain diverse phytochemicals with antiviral, antioxidant, anti-inflammatory, and immunomodulatory activities. These, when used in combination, might have a synergistic effect as prophylactic or supportive agents to lessen certain clinical symptoms observed in COVID-19- patients.

Stimulant drinks contain several antioxidant, anti-inflammatory, and alkaloids such as caffeine and theophylline with documented immunostimulant effects in humans.³⁷⁻³⁹ In the current study, Nescafe and black tea are the most used stimulant drinks among the participants, particularly the students and who are always under stress. Indeed, tea plays an important role in nutritional immunity, being rich in micronutrients, polyphenols and vitamins which are critical to stimulate the immunity⁴⁰ and to resist the infection, by modulating immune regulation; this might have a strong implication in controlling COVID-19 specifically for cytokine storms.³³ Epigallocatechin-3-gallate (EGCG) and theaflavin (TF), the main polyphenols in green tea and black tea, were found to suppress various inflammatory pathways leading to a decrease of the inflammatory cytokines production.³⁷ In addition, EGCG can induce IFN- λ 1, an antiviral interferon against hepatitis C virus⁴¹ which is an RNA virus similar to SARS-CoV-2 and shares the same action regarding impairing interferons.³³ Natural killer (NK) cells were reported to deplete in COVID-19 patients, indicating the weakening immune effect at the early stage of SARS-CoV-2 infection.⁴² Polyphenols have been found to increase the NK in upper airway inflammation, and they may have the same implication on COVID-19 patients and may play a role in the early stage of viral infection. Tea and Nescafe contain caffeine which has a functional role in the inhibition of monocyte chemotaxis, TNF-alpha, and other proinflammatory cytokines.^{38,39} Tea and Nescafe also contain



theophylline which is a bronchodilator and can control the production of inflammatory cytokines.⁴³

Micronutrients and vitamins are an essential component in the diet for an effective innate immune response and their insufficiency leads to a general weakening of the innate immune response.⁴⁴ Previous studies recognized that zinc (Zn), is associated with adverse clinical consequences in patients of infectious diseases.⁴⁵ Zn is participating in the regulation of innate and adaptive immune responses and production of immune cells.⁴⁶ The inhibitory action of Zn on the replication of SARS-coronavirus is determined.⁴⁷ Zn deficiency resulted in an increase in proinflammatory cytokines that induce CS in COVID-19, including IL-6, IL-8, and TNF- α .⁴⁴ In the elderly, low zinc condition doubles the mortality rate, due to pneumonia.⁴⁸ As COVID-19 affects people with low immune systems, particularly those of over age, supplementation with Zn-rich food is pivotal and critical. In this study, a great percent of participants agreed with the utilization of Zn-rich food, particularly Egyptians, and those with history of chronic disease, which may help in boosting their immunity.

Vitamin D reduced the danger of viral infection and the associated mortality.⁴⁹ Vitamin D enhances cellular innate immunity, minimizes rotavirus replication, decrease the production of proinflammatory cytokines, e.g., TNF α and IFN- γ , and increase the production of anti-inflammatory cytokines.^{49,50} The major source of vitamin D for humans is sunlight. Foods naturally containing vitamin D involved (from the richest food): cod liver oil; oily fish, especially mackerel, herring, tuna, and salmon; egg yolk; mushrooms (which is the only vegetable source of vitamin D).²¹ Participants showed a high level of adherence to exposure to sunlight to provide the body with vitamin D or to eat a vitamin D-rich diet. Participants at age 31-70 and those with chronic disease history are often eating vitamin D rich food supplements which with Zn-rich diet intensify their immunity. The immunomodulatory responses which is significantly decreased the stressful and exhausting business accompanied by heavy burdens and. To overcome these effects, man needs enough, deep, and good sleep and to use healthy natural drinks and food in his diet.

Subjects included in the present study depend mainly on their traditions and inherited habits in using herbals. They believe in natural drinks and products like ginger, lemon, honey, olive oil, curcuma, and thyme rather than mushrooms, Echinacea, black berry, and ginseng that the latter groups of plants are not highly familiar between the public and a certain sector of people is familiar with these plants and can regularly eat them for protection or as a treatment.

Among the natural drinks in the questionnaire, ginger and lemon are the most used natural drinks by the participants. Ginger (*Zingiber officinale*) has antiviral, antioxidant, and anti-inflammatory effects.⁵⁰ In addition, it has therapeutic properties against pulmonary fibrosis, pneumonia, acute respiratory distress syndrome (ARDS), sepsis, and acute kidney injury;⁵¹ all are accompanied with COVID-19 infection. These

effects are attributed to the bioactive components including zingerone, shogaol, gingerols, paradols, wickstromol, and carinol.⁵² In clinical studies, ginger lowered serum levels of IL-1, IL6, and TNF- α . Furthermore, a significant improvement in oxygenation was observed.⁵³ Importantly, ginger has reported for its antiplatelet and anticoagulant effects due to 6-gingerol and 6-shogaol.⁵⁴

Lemon (*Citrus limon*) has been therapeutically used to lessen cough, sore throat, and as expectorant in bronchitis.⁵⁵ It also has anti-inflammatory properties³ and improves pulmonary fibrosis, pneumonia, ARDS, sepsis, acute lung, kidney, and liver injury. Lemons contain vitamin C, which is an antifibrotic, antioxidant, as well as an immunomodulator. It is also documented to be protective against respiratory infections.^{56,57} Many studies⁵⁸⁻⁶⁰ indicate that vitamin C could have promising therapeutic effects in individuals with pulmonary fibrosis, pneumonia, ARDS, sepsis, acute lung injury, and multiple organ dysfunction, all of which are detected in advanced COVID-19 patients.

The third commonly used drink by our participants is cinnamon. Cinnamon (*Cinnamomum verum* or *C. zeylanicum*) along with its main active compounds, cinnamaldehyde, eugenol, and linalool, has potent antiviral, antioxidant and anti-inflammatory effects.^{61,62} The antiviral activity against SARS-CoV is documented and could probably be due to the inhibition of viral replication and interference with viral endocytic pathways.⁶³ Proteolytic activation of SARS-CoV-2 spike protein by the host cell proteases is necessary for infection. Studies have shown the role of trypsin in the cleavage and activation of spike protein during the SARS-CoV infection.⁶⁴ In this context, cinnamon as a trypsin inhibitor^{2,4} could have a therapeutic role against SARS-CoV-2 infection in COVID-19. Overall, these studies indicate promising therapeutic roles of cinnamon against SARS-CoV-2 infection in COVID-19.

The current study revealed that honey is the most natural product used by the participants. Honey is a natural immune stimulator and an excellent antiviral.^{65,66} Bioactive components of honey including flavonoids, polyphenols, minerals, and vitamins contribute to the antioxidant, antimicrobial, antiviral, and anti-inflammatory properties of honey.^{65,66} Honey also contains potassium,⁶⁷ which is recently shown to provide a better chance of recovery for COVID-19 patients.⁶⁸ Reduced acute respiratory distress symptoms have been observed when honey is eaten daily.⁶⁹ A new study demonstrated that honey may inhibit SARS-CoV-2 proteases and certain components of honey may be able to bind SARS-CoV-2 protease.⁷⁰ Methylglyoxal is a component of Manuka honey that can inhibit enveloped virus growth.⁶⁶ Based on previous studies, honey could be beneficial for COVID-19 infected patients through many mechanisms such as direct virucidal properties, boosting the immune system, and/or acting as a preventive mean against hyper-inflammation produced by Covid-19.⁷¹

Olive oil is the second most used natural product among participants. It is a common element among the Mediterranean



countries. Olive oil and its several bioactive compounds like oleanolic acid, oleuropein, oleocanthal, and hydroxytyrosol are known for their anti-inflammatory and immunomodulatory properties and are implicated in many immune-inflammatory diseases.⁷²⁻⁷⁵ Olive oil can modulate different processes associated with ageing and age-related diseases related to a common chronic low-grade inflammation. Recently, phytochemicals of olive oil have indicated as a potential candidate to act against SARS-CoV-2.⁷⁶ Results showed that polyunsaturated fatty acids and oleic acid present in olive oil were correlated with a reduced risk of current asthma.⁶

Next to honey and olive oil, black seed (*Nigella sativa* L) is the third commonly used natural product among the participants. Black seed possesses antiviral, antioxidant, anti-inflammatory, anticoagulant, immunomodulatory, bronchodilator, antihistaminic, antitussive, antipyretic and analgesic effects,^{77,78} therefore, it would be a potential herbal candidate as prophylactic or therapeutic target against COVID-19. In addition, it has also antihypertensive, anti-obesity, anti-diabetic, anti-hyperlipidemic, and antineoplastic activities which would benefit the COVID-19 patients with comorbid conditions.⁷⁷ These activities are due to several active ingredients as well as thymoquinone, p-cymene, carvacrol, 4-terpineol, and longifoline. Additionally, the active components of black seed including nigellidine and α -hederin have been recognized as potential inhibitors of SARS CoV-2.⁷⁹

Turmeric (*Curcuma longa*) followed by thyme are the next natural products commonly used by the participants in this study. Curcumin, the bioactive component in turmeric, has been proved to have anti-inflammatory and immunomodulatory activities.^{80,81} Curcumin suppressed the inflammatory cytokines such as TNF- α , IL-6, IFN- γ , ameliorates pulmonary inflammation and fibrosis^{82,83} and increases the arterial partial pressure of oxygen in the lungs.⁸⁴ Importantly, curcumin is a powerful immunomodulator and can adjust the function of dendritic cells, natural killer (NK) cells, neutrophils, macrophages, T cells, and B cells, as well as inflammatory cytokines.⁸⁵ All above findings strongly implicate turmeric as an agent that can enhance lung function and protect against acute lung injury noted in COVID-19 patients. Concerning the leaves and aerial parts of thyme (*Thymus vulgaris*), it is documented to cure cough associated with cold, laryngitis, and tonsillitis, relief of respiratory symptoms through an anti-inflammatory effect^{86,87} which is related to thymol, the major component of the essential oil. It also contains phenolic acids (rosmarinic, ferulic, syringic, coumaric acids), tannins (gallic and protocatechuic acids), flavonoids (mainly luteolin, apigenin, cirsilin, thymonin).^{88,89} An aqueous extract of *T. vulgaris* displayed in vitro antiviral effect.⁹⁰

Among participants who are previously/currently infected by COVID-19; and who are in contact with COVID-19 patients, ginger alone and ginger and lemon are the most used natural drinks, while honey and olive oil are the most used natural products. Nescafe and black tea are the most used stimulant drinks among participants who are previously/currently

infected with COVID-19 and who are in contact with COVID-19 patients. Utilization of all these natural products may help keep them safe from infection (in case of those in contact with COVID-19 patients) and/or from hospitalization or poor prognosis for those who are previously/currently infected by COVID-19). Those participants kept eating zinc-rich food, particularly fish, egg, and dairy products, which also participate in protection and good prognosis.

CONCLUSIONS

The study proved that 72.5% of participants showed a high level of adherence to good healthy habits and 85.6% of them are committed to preventive measures for COVID-19. In addition, to 77% of the participants adhered to healthy lifestyle and diet habits. Although 85.2% of the participants prefer homemade meals, 54.6% still prefer take-away meals. Among the infected persons, about 95.7% had no need of hospitalization and about 50% are cured within one to two weeks of infection. This could be a consequence of healthy lifestyle and continuing drinking and eating natural products (69%) and Zn-rich food (73.6%). Participants showed a high level of adherence to exposure to sunlight to provide the body with vitamin D (66.4%) or to eat a vitamin D-rich diet (96%). 78.8% of the participants believe that natural products have a benefit in preventing infection with Corona virus or reducing the period of treatment in case of infection.

Our study highlights the potential of the natural products to serve as inexpensive, easily accessible, and prophylactic agents against COVID-19 especially for elderly individuals, and those suffering from chronic diseases. Natural products are highly tolerated with no side effects and can be used in combination with the existing clinical standards of care. In addition, in symptomatic patients, natural product supplementation can halt the progression of the infection, mitigate its complications, and reduce mortality.

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INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by Research Ethics Committee of Faculty of Pharmacy, King Abdulaziz University (protocol code “PH-1442-78” and date of approval 8/7/2021).

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.



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Supplementary table 1. Tukey HSD significant mean difference at the 0.05 level (Domain I)				
Demographic character (A-B)	MD (SE)*			
	Q1	Q2	Q3	Q4
Gender (Male- Female)	0.78 (0.14)	-	-	0.44 (0.12)
Nationality (Egyptian- Saudi)	-	-	-	0.51 (0.11)
Residence country (Egypt- Saudi Arabia)	-	-	-	0.47 (0.11)
Residence city Jeddah- Riyadh	0.56 (0.15)	-	0.43 (0.13)	-
Jeddah- Cairo	0.48 (0.13)	-	-	-0.43 (0.12)
Cairo- Riyadh	-	-	0.56 (0.15)	0.73 (0.15)
Age (31- 50 years)- (18- 30 years)	0.45 (0.12)	-	0.42 (0.1)	0.58 (0.1)
(51- 70 years)- (18- 30 years)	-	-	0.68 (0.13)	0.78 (0.13)
Marital status Married- Single	0.39 (0.11)	0.25 (0.1)	0.48 (0.1)	0.67 (0.1)
Employment Employee- Student	0.55 (0.14)	-	0.67 (0.12)	0.80 (0.12)
Retired- Students	-	0.46 (0.17)	0.84 (0.16)	1.00 (0.16)
Under anxiety or stress: Sometimes- Always	-	-	0.32 (0.1)	0.34 (0.1)
Rarely- Always	-	-	0.56 (0.19)	0.64 (0.19)
Currently or previous infected Yes- No	-	0.28 (0.13)	-	-

(A-B): Groups that cause the significant difference.

No significant difference MD: Mean difference.

SE: Standard error.

*: Significance at the level of 0.05.



Supplementary table 2. Tukey HSD significant mean difference at the 0.05 level (Domain II)				
Demographic character (A-B)	MD (SE)*			
	Q5	Q6	Q7	Q8
Gender: (Female- Male)	-	-	-	0.24 (0.11)
Age: (51-70 years)- (18- 30 years)	0.39 (0.08)	-	-	0.32 (0.12)
(51-70 years)- (31- 50 years)	0.24 (0.08)	-	-	-
Marital status: (Married- Single)	0.22 (0.06)	0.17 (0.06)	-	0.34 (0.09)
Employment: (Retired- Students)	0.43 (0.11)	-	-	0.42 (0.15)
Chronic disease history: (Yes- No)	0.21 (0.07)	0.27 (0.07)	-	0.22 (0.1)
Under anxiety or stress: Always- Sometimes	-	-	0.2 (0.08)	-
Always- Rarely	-	-	0.4 (0.15)	-
Were infected/currently infected: (No- Yes)	-	0.25 (0.09)	-	-
In contact with a patient: (No- Yes)	0.21 (0.07)	0.26 (0.06)	0.18 (0.08)	-

(A-B): Groups that cause the significant difference -: No significant difference

MD: Mean difference

SE: Standard error

Supplementary table 3. Tukey HSD significant mean difference at the 0.05 level (Domain III)									
Demographic character (A-B)	MD (SE)*								
	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
Gender Male- Female	0.42 (0.12)	-	-	-	-	-	0.23 (0.1)	-	-
Nationality Egyptian- Saudi	-	-	0.26 (0.11)	-	-	-	0.29 (0.09)	-	-
Residence country Egypt- Saudi Arabia	-	-	-	-	-	-	0.27 (0.1)	-	-
Residence city: Jeddah- Riyadh	0.41 (0.13)	-	-	-	-	-	-	-	-
Cairo- Riyadh	-	-	0.49 (0.15)	0.39 (0.12)	-	-	0.34 (0.13)	-	0.36 (0.14)
Cairo- Jeddah	-	-	-	-	-	-	0.31 (0.1)	-	-
Age 51- 70 years- 18- 30 years	0.64 (0.12)	-	-	-	-	-	0.53 (0.11)	-	-
51- 70 years- 31- 50 years	0.38 (0.12)	-	-	-	-	-	-	-	-
31- 50 years- 18- 30 years	-	-	-	-	-	-	0.27 (0.09)	-	-
Marital status Married- Single	0.43 (0.09)	-	0.54 (0.1)	0.37 (0.08)	-0.45 (0.09)	0.44 (0.09)	0.44 (0.08)	0.43 (0.11)	0.46 (0.09)
Employment Employee- Student	0.56 (0.11)	-	0.64 (0.12)	0.57 (0.09)	-0.58 (0.12)	0.63 (0.11)	0.49 (0.1)	0.58 (0.13)	0.67 (0.11)
Retired- Student	0.81 (0.16)	-0.58 (0.19)	0.86 (0.17)	0.76 (0.13)	-0.96 (0.16)	0.93 (0.15)	0.64 (0.14)	0.9 (0.18)	0.87 (0.15)
Employee- Retired	-	0.45 (0.17)	-	-	-	-	-	-	-
Chronic disease history Yes- No	-	-	0.47 (0.11)	0.19 (0.09)	-0.26 (0.11)	0.33 (0.1)	0.29 (0.09)	0.51 (0.12)	0.38 (0.1)
Under anxiety or stress Sometimes- Always	0.3 (0.09)	-0.4 (0.1)	-	-	-0.38 (0.09)	-	-	-	-
Rarely- Always	0.59 (0.18)	-0.64 (0.21)	-	-	-0.53 (0.18)	-	-	-	-



Have a temper or irritable person Rarely- Always	0.43 (0.14)	-	0.37 (0.15)	0.33 (0.12)	-	-	-	-	-
Sometimes- Always	-	-	0.34 (0.12)	0.28 (0.1)	-	-	-	-	-
Were infected/currently infected (Yes- No)	-	-	0.29 (0.14)	0.23 (0.11)	-	0.31 (0.12)	-	-	-
In contact with a patient (No- Yes)	-	-	-	-	-	-	-	-	0.21 (0.09)

(A-B): Groups that cause the significant difference -: No significant difference

MD: Mean difference

SE: Standard error

*: Significance at the level of 0.05