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The Effectiveness of Garlic Consumption on Improving Anosmia and Dysgeusia in Patients with COVID-19

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ABSTRACT

Background: Anosmia and dysgeusia are symptoms associated with COVID-19 infection following the announcement of the disease as a pandemic. Moreover, there is no effective treatment for the disease. Garlic is a well-known herb with antimicrobial and antiviral properties. This study evaluates the potential therapeutic effect of garlic consumption on reducing the recovery time from anosmia and dysgeusia symptoms among participants with COVID-19. **Methods**: 388 Jordanian participants with COVID-19 infection were enrolled in an online computer-assisted web survey during the period from 20th September 2021 to 20th January 2022. The survey consisted of three constructs**;** socio-demographic profile, symptoms associated with COVID-19, and frequency of garlic and onion consumption used during the infection. **Results**: The results of this study showed that almost half of the participants were between 20-40 (193, 49.7%); most of them complained about fever, fatigue, anosmia, and dysgeusia and used onion (20, 93%) and garlic (29, 23%) to alleviate symptoms of the disease. In total, 40.7% of garlic-using participants recovered from anosmia within the first 11-15 days, whereas 35.3% recovered between 6-10 days. Results also revealed that there was no correlation between garlic consumption and recovery from dysgeusia. Hence, there was a weak inverse association between garlic consumption and recovery time from anosmia**. Conclusion**: The authors concluded that consumption of garlic will enhance immune system during the fight against COVID-19. There is need for further study to identify the proper amount of garlic consumption to relieve anosmia symptoms during COVID-19.

Key word: *Garlic intake; Anosmia; Dysgeusia; COVID-19*

Introduction

COVID-19 is a disease caused by a new mutation of coronavirus which was declared a pandemic in 2020 (Alam *et al.*, 2021). An interaction between COVID-19 and the immune system results in a clinical manifestation (Li *et al.*, 2020, Paces *et al.*, 2020) which range from mild influenza symptoms, fever, headache, dry cough, myalgia, fatigue, loss of appetite, anosmia

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(loss of smell), and dysgeusia (loss of taste) to severe acute respiratory tract infection (Calder, 2020, Li *et al.*, 2020, Moscatelli *et al.*, 2020). Unfortunately, until now, there has been no treatment for COVID-19. However, many strategies were adopted to limit the spread of COVID-19 such as, vaccination, social distancing, and proper nutrition (Hiedra *et al.*, 2020, Murthy *et al.*, 2020).

Proper nutrition should be at the forefront of the strategies to control the spread of COVID-19 (Alam *et al.*, 2021) due to its cost-effectiveness, safety, and efficiency to enhance the body's immune system (Alam *et al.*, 2021, Hiedra *et al.*, 2020, Murthy *et al.*, 2020). Several recent studies have reported the positive influence of nutritional status and food intake on COVID-19 patients (Moscatelli *et al.*, 2020). In this regard, garlic (*Allium sativum*) has been used for therapeutic purposes in many countries (Bayan *et al.*, 2014). Moreover, garlic has anti-viral properties that can be added to COVID-19 prevention and treatment strategies programs (de Wit and Cook, 2014). Garlic contains a variety of minerals such as Ca, Fe, K, Cu, and Mg, as well as different vitamins. Moreover, garlic is full of water-soluble organosulfur compounds (Suleria *et al.*, 2015), and is rich in various phytochemicals, especially allicin. Allicin has anti-microbial, anti-viral, and anti-fungal potential which interacts with the viral phospholipids and amino acids involved in infection, preventing them from attachment to the host cell by denaturing these viruses (Razavi *et al.*, 2006). Even though many studies have suggested that garlic use could be beneficial in helping the immune system to cope better with the viral infection by enhancing the response to viruses, balancing the inflammatory response can prevent immune overreaction to viral infection (Cunningham-Rundles *et al.*, 2005). Therefore, no study has been conducted to evaluate the effectiveness of garlic consumption on COVID-19 symptoms. This study evaluates the potential therapeutic effect of garlic consumption on reducing the recovery time from anosmia and dysgeusia symptoms among participants with COVID-19 infection.

Materials and Methods

Study design and participants: 388 Jordanian participants with laboratory confirmed COVID-19 infection were enrolled in this online computer-assisted web survey during the period from 20th September 2021 to 20th January 2022. The sample size was determined using Mendenhall's equation (Barbara, 2003). The online self-administered structured questionnaire was constructed in Arabic language using Google Forms. The link of the questionnaire was distributed using different social media platforms. The inclusion criteria were as follows: participants were ≥ 18 years old, were confirmed cases of COVID-19, were clinically able to fulfill the questionnaire, and had no medical history of any respiratory disease. The patients with a history of anosmia and dysgeusia before the epidemic as well as those who were in the intensive-care unit at the time of the study were excluded.

Development of the questionnaire: The online questionnaire items were collected from previous research articles about strengthening immune defenses against COVID-19 through nutrition. The questionnaire was divided into four parts: the first part of Google questionnaire asked participants to provide written informed consent prior to the administration of the questionnaire. The second part included the demographic profile which consisted of multiple-choice questions related to age, sex, and educational level; this was while self-reported weight and height were provided by open-ended questions. Moreover, in the third part, the participants were asked to choose from a list of symptoms that they had suffered from during their COVID-19 infection (dyspnea, fever, headache, fatigue, anosmia, and dysgeusia). Finally, in the fourth part, the participants were asked to choose from a list of the types of herbs or plants they had used to relieve anosmia and dysgeusia symptoms which included garlic, onion, lemon, black pepper, curcuma, ginger, and nutritional supplementation. The questionnaire was expected to take 5-10

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minutes to fill. The online survey was performed according to the ethical principles of the World Medical Association Declaration of Helsinki.

Data analysis: Data were extracted as a Microsoft Excel spreadsheet, and then, coded and prepared for analysis. Statistical analysis was performed using SPSS version 22 (IBM Corp, Armonk, NY, USA). The descriptive analysis was expressed as frequencies, percentages, and numbers. The potential associations between binary or categorical variables were assessed through cross-tab generation and chi-square test. Linear regression analyses were conducted to investigate the association between variables, garlic intake as a dependent variable, and anosmia and dysgeusia as independent variables. On the other hand, certain demographic variables, nutritional supplementation, plants, and herbs were used as adjusting variables. A P-value <0.05 was considered to be statistically significant in all the analyses.

Results

Socio-demographic characteristics of the study participants in **Table 1** showed that the participants were distributed almost equally among females (51.5%) and males (48.5%). Almost half of the participants (49.7%) were between the ages of 20-40, and nearly more than half of them (52%) were within the educational level of bachelor's degree.

Figure 1 shows the participants' consumption of some common herbs and plants. The results showed that about 75% of the participants used garlic (29.23%), black pepper (24.43%), and onion (20.93%). Furthermore, **Figure 2** shows the distribution of participants according to the common symptoms of COVID-19. Results demonstrated that fatigue, fever, anosmia, and dysgeusia were the most common symptoms among the participants (21.3%, 19.3%, 19.9%, and 15.5%, respectively).

Table 1. Socio-demographics of the participants.

Variables	n(%)
Age (y)	
18-20	36 (9.3)
20- 40	193 (49.7)
40-60	140 (36.1)
60<	19 (4.9)
Gender	
Male	188 (48.5)
Female	200 (51.5)
Educational level	
Under High school degree	62 (61.0)
High school diploma degree	35 (9.0)
Bachelor's degree	204 (52.6)
Higher education degree	87 (22.4)
Body mass index (kg/m^2)	
≤ 18.5	29 (7.5)
18.5-24.9	146 (37.9)
25–29.9	144 (37.4)
30–34.9	53 (13.8)
35-39.9	8 (2.1)
40≤	5 (1.3)
Total	388 (100)

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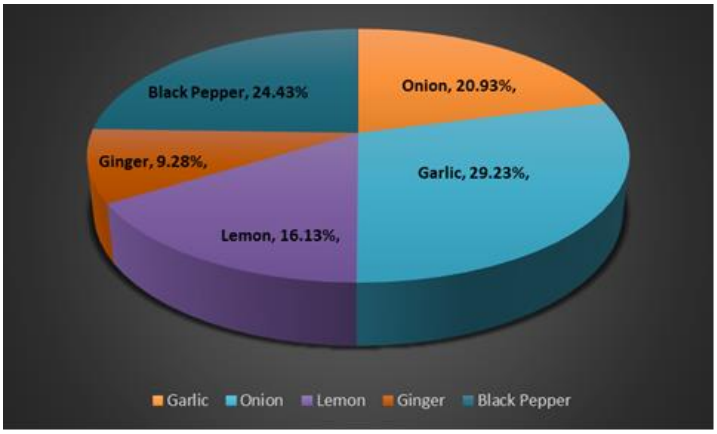

Figure 1. Participants' distribution according to the common herbs and plants' consumption.

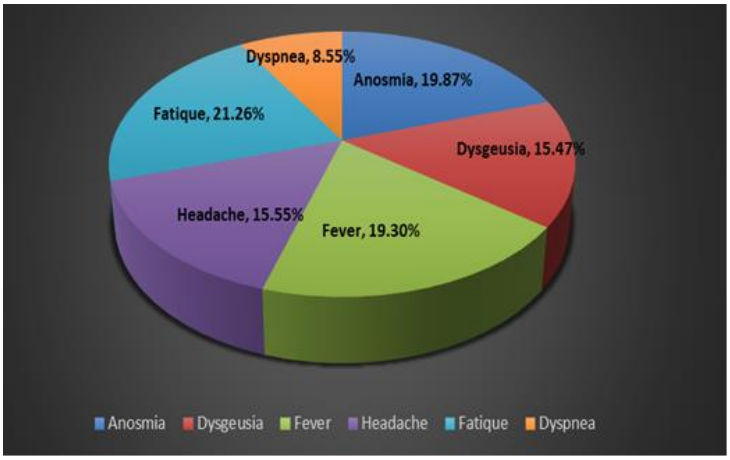

Figure 2. Distribution of participants according to common symptoms of COVID-19.

Table 2 shows the association between garlic intake, anosmia, and dysgeusia. The results showed a significant but negative and weak correlation between garlic consumption and anosmia (-0.313±0.069, P<0.05) as well as a significant and very weak correlation between garlic consumption and dysgeusia.

Thus, **Figure 3** shows the different recovery times from anosmia among participants who reported using garlic during COVID-19. 40.7% of the participants recovered from anosmia within the first 11-15 days followed by 35.3% of participants who recovered within 6-10 days.

Table 2. Association between garlic consumption and recovery from anosmia and dysgeusia.

Symptoms	Garlic intake B ± SEM	P-value
Anosmia	- 0.313 ± 0.069	0.001
Dysgeusia	- 0.022 ± 0.006	0.01

The model adjusted for age, sex, vitamin D, vitamin C, lemon, ginger, curcuma, and onion intake.

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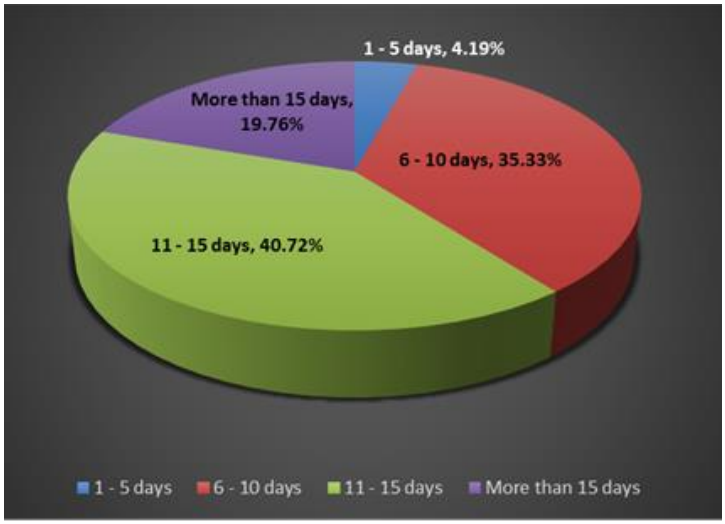

Figure 3. Distribution of participants with anosmia according to garlic consumption and recovery time.

Discussion

The results of this study indicated that the prevalence of confirmed cases of COVID-19 infection among 388 participants in this study was substantially higher among younger participants. In addition, there was a significantly higher prevalence of anosmia and dysgeusia symptoms among participants, and more than half of them used garlic during COVID-19 infection. Interestingly, the study showed that the recovery time from anosmia symptoms was also significantly reduced among garlic consumers during COVID-19 infection. Moreover, after adjusting confounding variables, it was found that the association between garlic consumption and recovery time from anosmia among participants were inversely related. Furthermore, the pathological mechanisms leading to anosmia during COVID-19 infection are still unknown. The results of available clinical evaluations indicated that anosmia was the main form of neurological injury in patients with COVID-19 (La Rosa *et al.*, 2020). DNA and RNA of COVID-19 viruses could be directly or indirectly responsible for mild to severe infection of mucosal epithelium in oral cavity which may lead to ulceration or lesions of the oral tissue (La Rosa *et al.*, 2020). Similarly, only one study reported hyposmia as a symptom of COVID-19 infection (Mao *et al.*, 2014). The pathological mechanism that supported the fact that some patients had hyposmia during COVID-19 infection suggested that COVID-19 virus may invade CNS through a retrograde neuronal route (Lechien *et al.*, 2020).

Garlic is a functional food containing a bioactive compound which may address pre-exposure and post-exposure prophylaxis, playing a role in antimicrobial, antiviral, immunomodulator, and antioxidant activities (Aly *et al.*, 2008, Sivaram *et al.*, 2004). Previous studies suggested that beneficial health properties of garlic were mainly attributed to bioactive compounds, including sulphur containing compounds, particularly thiosulfinates, such as, allicin, allin, and diallyl sulfides (Amagase and Milner, 1993, Block, 1992). Hence, garlic compound may enhance the activity of cytokine suppressors, promotion of lymphocyte synthesis, natural killer cells, and macrophages. Furthermore, garlic improves the outcomes of COVID-19 by decreasing inflammation and respiratory symptoms (Kyo *et al.*, 1998, Mohajer Shojai *et al.*, 2016).

In a randomized clinical study, garlic extracts were evaluated for their inhibitory effect on infectious bronchitis virus during replication. Participants were randomly provided with either garlic or placebo during viral infectious bronchitis. It was shown that virus titters in treatment groups were significantly decreased as compared to the control group (Chen *et al.*, 2014). A similar finding

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was observed on the inhibitory effect of garlic against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) multiplications, which suggested a beneficial preventive measure before being infected with the SARS-CoV-2 virus. Garlic decreased the expression of proinflammatory cytokines and reversed the immunological abnormalities to more acceptable levels probably due to the formation blocking of structural proteins and genetic materials (Chen *et al.*, 2006). Several randomized double-blind trials were conducted to assess the effect of garlic supplementation on common cold infections. A randomized control trial was conducted on 146 participants who were allocated to either garlic (180 mg allicin) powder once per day or to a placebo group. Self-reported common cold infection was significantly less common in the garlic group as compared to the placebo group. As a result, the severity and duration of common cold symptoms were significantly reduced in the garlic group compared to the placebo (Josling, 2001, Lissiman *et al.*, 2014).

On the other hand, vaccines are expensive and may not be available in large quantities and to everybody. Therefore, there is a need for alternative nutritional intervention as one of the efficient strategies to fight against COVID-19. Overall, the findings of this study indicated that the prevalence of nutritional supplement intake was significantly higher among participants with COVID-19. Several researchers focused on nutrition to control COVID-19 around the world for its role in the developing and maintaining the immune system to decrease susceptibility to infection (Alam *et al.*, 2021, Sasi *et al.*, 2021).

This study had several limitations. First, only 388 patients were studied which could cause biases in clinical observation. Therefore, it would be better to include more participants in the study. Second, all the data were extracted from electronic web survey based on the participants' self-reported data on COVID–19 symptoms and intake of supplements and herbs during the disease.

Conclusions

Because of the emergency state of COVID-19, there are numerous effective and safe treatments and preventive measures against COVID-19. Within the scope of preventive measures, garlic may be an acceptable therapeutic measure against COVID-19 infection and seems to counteract the symptoms caused by the disease. The authors believe that the administration of this functional food enhance immune system in the fight against COVID-19.

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Conflict of interests

The authors declared no conflict of interests.

Authors' contribution

Baha'a Abu Salma wrote the paper, conducted research, analyzed the data and drafted the paper; Hanen Tarawneh and Nizar Al-Rabadi were involved with conception of the research idea and revision the final content of the paper; Mohammed Omar Ibrahim had primary responsibility to revise the final content of the paper; Ali Ibrahim Elmoumani was in volved with conducting the research and wrote the paper. All authors read and approved the final manuscript.

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