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# Herbal Self-medication Practice for Coronavirus Disease 2019 in Sudan: A Public Survey, 2021

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ABSTRACT

*Background:* The coronavirus disease 2019 (COVID-19) emerged in China in late 2019 with high rate of spread and transmission. As there was no recognized therapy many people worldwide used herbs in attempt to help their body overcome the disease.
*Objective:* This study aims to evaluate the use of herbs by patients with COVID-19 in Sudan and tries to identify a possible role in cure or lowering the severity of the illness.
*Methods:* A cross-sectional population-based online survey was done targeting those who experienced COVID-19 among Sudanese through an online internet-based questionnaire distributed on social media platforms (mainly Facebook and WhatsApp). Descriptive statistics used to summarize data and present it as frequency tables and graphs. Multivariate logistic regression was used to measure the association between independent variables (comorbidities and use of herbs) and the outcome variable reflecting the severity of the disease (hospitalization).
*Results:* A total of 204 responses received from COVID-19 former and active cases. Typical symptoms of the disease were identified: fever (68.1%), cough (52.7%), shortness of breathing (59.3%), sore throat (76.5%), and loss of smelling and/or taste (67.2%). All the respondents reported using traditional herbs or plants for cure with strong statement of their usefulness. Citrus plants such as lemon, orange, and grape fruits, were the commonest, used by 94%, followed by the local herbs, acacia (65%), ginger (56%), baobab fruit (46%), hibiscus (45%), black seed (45%), and cinnamon (17%). Other used plants included onion (29%) and garlic (24%). An adjusted analysis found that obesity was associated with higher hospital admission, while using herbs had no effect on hospital admission.
*Conclusions:* All participants reported the use of herbs for cure beside other treatment. The most commonly used herbs were citrus fruits followed by acacia and ginger and other herbs. All participants stated that herbs were useful for their recovery, however our analysis revealed no significant effect on rate of hospitalization. We recommend further deeper, well-designed study to better assess the effect of herbs.


## Introduction

In December 2019, an increase in cases of patients with pneumonia of unknown etiology emerged in Wuhan, a large city of 11 million people in central China.[1] The pathogen was soon identified as a novel coronavirus which share >79% of its sequence with coronavirus of severe acute respiratory syndrome.[2] The novel virus was named; severe acute respiratory syndrome coronavirus 2

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and its infection announced by WHO as coronavirus disease 2019 (COVID-19).[3] The virus has rapid spread, the infection extended to most parts of the world with more than 81.2 million cases and 1.77 million deaths by December 29, 2020.[4] In Sudan the first reported case was on March 12, 2020 with positive cases reach up to 27,453 by February 2021. Moreover, surveillance data indicated a high case fatality rate 6.5%.[5]

Infection occurs mainly through exposure to respiratory droplets when a person is in close contact (within 6 feet) with someone who has COVID-19. It can spread sometimes by airborne transmission, and less commonly through contact with contaminated surfaces, and rarely spread between human and animals.[6]

Coronavirus disease 2019 has no recognized specific therapeutic agent, however, the efforts of developing curing antiviral agents are ongoing. The main care provided to infected people is supportive, with fluids vitamins and minerals, and more advanced oxygen and respiratory support to severe cases.

As for other illnesses, and although most of them still not well-studied, people also used foods and herbal recipes to help their body overcome the disease. Herbs are known for their antiinflammatory, antioxidant, antimicrobial, antimutagenic, and anticancer effects[7] Some countries even officially added herbal formulas to their treatment guidelines, for instance, in China there are 13 herbal formulas recommended for treatment of COVID-19.[8] In Africa, a country such as Nigeria that is known for its vulnerability and law health system capacity, had earlier announced and recommended the use of medicinal plants that are known for their immune boosting, detoxification, and antioxidation effects.[9]

In Sudan medicinal plants and herbs are widely spread and used by communities in different forms. These traditional remedies represent an important part of Sudanese life and are available for the majority of the population.[10]

Sudanese people use medicinal plant for a wide range of conditions including respiratory, gastrointestinal, skin conditions, malaria, and even diabetes.[11] This study aims to evaluate the use of herbs by patients With COVID-19 in Sudan and tries to identify a possible role in cure or lowering the severity of the illness. Furthermore, the study also aimts to identify the presentation of COVID-19 among Sudanese population, the most used herbs, risk factors associated with hospital admission, and the effect of herbs impact on hospital admission. Outcome of this study is to give insight on the use of herbs for and their role on treatment of COVID-19. Up to researchers' knowledge and their review of the literature, there is no study addressed this issue in Sudan, the findings will provide evidence-based guidance on herbal medicine use and enhance further future research regarding herbal medicine in Sudan.

## Materials and methods

A cross-sectional population-based survey was done targeting those who experienced COVID-19 among Sudanese using online internet-based questionnaire. The inclusion criteria were; (1) those who were previously infected with novel corona virus, within 3 months before the study, (2) those with active disease, and (3) all ages. The study excluded participants who were outside Sudan. Using convenient sampling technique, the sample size was calculated to be 384 using the formula: $n = z^2 \times (pq)^2/e^2$. A self-administered questionnaire was developed and transformed into an online Google form. The questionnaire was designed by the researchers based on the Sudanese experience and the commonly used herbal remedies by Sudanese communities. The questions were mostly multiple-choice questions with few open questions. Then it was distributed through social media platforms (mainly Facebook and WhatsApp) as they represent the main platforms used among Sudanese. Convenience sampling subjected the study to selection bias as some important groups who do not use the social media are excluded, however the results from the study still give insight on the herbal self-medication practice and guide more in-depth research in the future. The data then cleaned, coded, and analyzed using the Statistical Package for the Social Science software (developed by International Business Machines Corporation IBM), version 22. Description was done using frequency tables and cross tables. Statistical associations were tested and multivariate logistic regression was also conducted to measure the association between independent factors (comorbidities, use of different herbs), and the outcome (the severity of the disease represented by hospitalization).

Ethical approval was obtained from ethical committee of federal ministry of health. Each participant was required to read a written informed online consent and agree to participate before filling the online form.

**Table 1**
Demographic characteristics of the participant ($n = 204$).

| Variable | Frequency | Percent |
|---|---|---|
| Sex | | |
| Male | 69 | 33.8 |
| Female | 135 | 66.2 |
| Age | | |
| <20 y | 9 | 4.4 |
| 20–30 | 67 | 32.8 |
| 31–50 | 115 | 56.4 |
| >50 y | 13 | 6.4 |
| Residency | | |
| Urban | 196 | 96.1 |
| Rural | 8 | 3.9 |
| Job | | |
| Employee | 140 | 68.6 |
| Student | 10 | 4.9 |
| Freelance | 23 | 11.3 |
| Unemployed | 31 | 15.2 |

**Table 2**
Frequency of symptoms and signs of coronavirus disease 2019 in Sudanese patients, 2021 ($n = 204$).

| Symptoms and signs | Count (%) |
|---|---|
| Joint and muscle pain | 163 (79.9) |
| Sore throat | 156 (76.5) |
| Fever | 139 (68.1) |
| Loss of tasting and/or smelling | 137 (67.2) |
| Shortness of breath | 121 (59.3) |
| Cough | 107 (52.7) |
| Runny nose/nasal congestion | 98 (48.0) |
| Shivering | 89 (44.9) |
| Headache | 69 (34.2) |
| Painful swallowing | 67 (32.8) |

## Results

A total of 204 participants responded to the questionnaire. Females represent (66.2%) of the participants. The predominant age group was 31 to 50 years (56.4%) (Table 1). Those stated they were either active (10%) or (90%) recovered COVID-19 case within 3 months before the study. Respondents reported COVID-19 typical symptoms including fever (68.1%), cough (52.7%), shortness of breathing (59.3%), sore throat (76.5%), and loss of smelling and/or taste (67.2%). Other clinical features also reported including, joint and muscle pain (79.9%) and painful swallowing (32.8%) (Table 2).

All participants declared using herbs for treatment, as (94%) of them used citrus (lemon, orange, and grape). Significant proportions used the known traditional herbs such as acacia (65%), ginger (56%), baobab (46%), hibiscus (45%), black seed (45%), and cinnamon (17%). Other used plants included onion (29%) and garlic

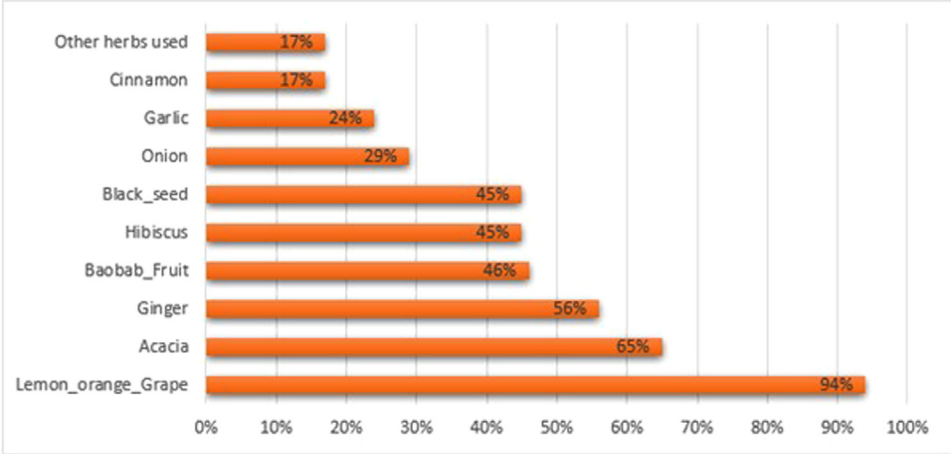


**Figure 1.** Different types of herbs used in the treatment of coronavirus disease 2019 by Sudanese patient ($n = 204$).

**Table 3**
Adjusted logistic regression analyses showing factors associated with hospital admissions of patients with coronavirus disease 2019 in Sudan ($n = 204$).

| Risk factors | aOR (95% CI) | *P* |
|---|---|---|
| Age | 0.959 (0.907–1.01) | 0.131 |
| Sex (male) | 2.327 (0.463–11.7) | 0.305 |
| Heart diseases | 8,060,287,914.419 | 0.999 |
| Hypertension | 0.478 (0.086–2.66) | 0.399 |
| Diabetes mellitus | 0.042 (0.006–0.296) | 0.001 |
| Obesity | 12.932 (1.01–16.0) | 0.049 |
| Asthma | 0.092 (0.023–0.370) | 0.001 |
| Renal diseases | 0.363 (0.002–66.6) | 0.703 |

aOR = adjusted odds ratio.

**Table 4**
Adjusted logistic regression analyses showing herbals affecting hospital admissions of patients with coronavirus disease 2019 in Sudan ($n = 204$).

| Herbs | aOR (95% CI) | *P* |
|---|---|---|
| Lemon, orange, and grape | 1.77 (0.192–16.3) | 0.616 |
| Onion | 0.503 (0.117–2.16) | 0.355 |
| Garlic | 1.99 (0.379–10.5) | 0.416 |
| Hibiscus | 1.54 (0.426–5.55) | 0.511 |
| Black seed | 0.635 (0.188–2.15) | 0.465 |
| Baobab fruit | 0.963 (0.277–3.35) | 0.953 |
| Cinnamon | 1.37 (0.253–7.40) | 0.715 |
| Acacia | 1.55 (0.425–5.62) | 0.509 |

aOR = adjusted odds ratio.

(24%) (Figure 1). All respondents (100%) stated that the herbs were useful and played a role in their recovery.

An adjusted analysis found that being obese was associated with higher hospital admission (adjusted odds ratio [aOR]: 12.932; 95% CI, 1.01–16.00; $P = 0.049$). Interestingly, having diabetes (aOR: 0.042; 95% CI, 0.006–0.296; $P = 0.001$) and asthma (aOR: 0.092; 95% CI, 0.023–0.370; $P = 0.001$) were found to be associated with less hospital admission (Table 3).

To measure the effect on herbs, use in the severity of the disease (reflected by hospitalization) an adjusted multivariate logistic regression was done. The analysis revealed that using different types of herbs has no statistically significant effect on hospital admission (Table 4).

## Discussion

Regarding the clinical presentations, the study identified cough and shortness of breath in more than half of the respondents with the fever recognized in more than two-thirds. These are the commonest symptoms of COVID-19 reported by many studies, for instance, Jiang et al[12] concluded that in their study in China. Other common features observed were joint and muscle pain. Loss of smell and taste was recognized in the majority of the respondents (68%), this is a specific symptom for COVID-19 that lately included in the WHO case definition of the probable case.[13] The reported clinical features were also reported in the COVID-19 epidemiologic country report and other studies form Sudan.[5,14,15]

The comorbidities identified were diabetes, hypertension, asthma, cardiac diseases, and renal diseases. This might be explanatory to contracting COVID-19, as these conditions increase the susceptibility of individuals.[16] Interestingly, when modeling, adjusted logistic regression, was done, it reviled that being diabetic or asthmatic was associated with a lower rate of hospitalization. This could be attributed to the nonrepresentative sample, as diabetes and asthma were known factors for the severe disease.[17] The study identifies obesity as a risk factor severity of illness as obese patients were several times more likely to be hospitalized (aOR: 12.932; 95% CI, 1.01–16.0). This is also reported by Antonio Gimeno-Miguel et al study.[16,18]

Herbs are generally used for treatment and cure for several condition as reported by many studies, such as Villena-Tejada et al[19] study. The use of local herbal remedies for treatment, especially for respiratory illnesses is known among Sudanese people.[10] Most of the respondents (94%) used citrus (lemon, orange, and grapefruit), majority of them received local remedies containing acacia and ginger. Other studies reported that ginger was the most frequently used herbs for COVID-19.[19,20] Cinnamon was also used by a proportion of participants, evidence in 2021 highlighted the antiinflammatory and antiviral effect of cinnamon and also reported its use to treat COVID-19.[21,22]

To assess the effect of herbal use on the severity of the disease, an adjusted analysis was done and no effect on hospital admissions detected. This could be because of the limited sample size and the study design, a well-designed study is recommended to dig more in this area. In contrast, Gajewski et al[23] and others declared that some herbs significantly reduce hospitalization rates and the COVID-19 symptoms.[16] Furthermore, Demeke et al[24] study shows that herbal use improves clinical symptoms, reduces mortality, and reduces the virus's recurrence rate. According to a study conducted by Aldwihi et al,[16] the use of herbal medicine significantly reduces hospitalization rates.

The study findings will guide further in-depth studies on herbal remedies use in Sudan. Directing the health authorities toward the effectiveness of herbs not only for COVID-19 but even for other diseases. We recommend further researches on the topic as Sudan is

rich with many types of herbal plants that are used for COVID-19 and other illnesses.

*Limitations*

Inability to achieve the targeted sample size because of the decreased response rate, might possibly subject the study to nonresponse bias that might affect the findings. The convenient sampling also limited the study to represent the different categories of severity (mild, moderate, and severe) and to cover a reasonable proportion of hospitalized cases, also using convenient sampling may lead to self-reporting bias, which in turn affects generalizability of the study negatively. Although the study design is reflective of the use of herbs by patients with COVID-19, other designs such as cases-control study set a better design for better assessing the herbs effects and more in-depth analysis. This was clearly recommended by the study.

## Conclusions

Patients reported clinical picture aligned with what is known for COVID-19. The study reported the practice of herbal use during pandemic in Sudan. All affected persons used herbs for cure. The most commonly used herbs were citrus fruits, acacia, ginger, baobab, hibiscus, black seed, and acacia with few used cinnamon. Being the most used herbs, citrus fruit requires more further investigations. Although participants were stated that herbs helped in their recovery, no significant association was detected between use of herbs and the severity of the disease in terms of hospitalization. More well-designed studies (e.g. case-control study) are recommended for better understanding of the medicinal effects of herbal plants used in Sudan.

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## Author Contributions

A. Izzoddeen and E. Malik conceived the study and developed the methodology. A.A. and M. Magbol developed the software. S. Ali, A. Izzoddeen, M. Musa, and A. Hamed Dafaala conducted the formal analysis. W. Yousif, M. Abouzeid, M. Hashim, and M. Musa provided the resources. A. Izzoddeen, A. Hamed Dafaala, and S. Ali prepared the original draft. A. Izzoddeen, S. Fadlelmoula, and M. Magbol reviewed and edited the manuscript. E. Malik supervised the project.

## Declaration of competing interest

The authors declare that they have no conflict of interest.

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