Utilization of complementary and alternative medicine for the prevention of COVID-19 infection in Ghana: A national cross-sectional online survey

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ABSTRACT
Complementary and alternative medicine (CAM) use is widespread and has played critical roles in preventing infections, including previous coronaviruses. This study sought to document current practices in the use of CAM for the prevention of COVID-19 disease in Ghana. An anonymous electronic survey was conducted from February 1, 2021 to April 30, 2021. Data on demographic characteristics, basic clinical information, illness perceptions about COVID-19, and CAM use during the pandemic period were generated. While about 82.5% (986/1195) of the participants used CAM during the COVID-19 period, 69.1% (681/986) of CAM users intended it for COVID-19 infection prevention. Vitamin supplements (88.1%, 869/986), spiritual healing/prayer (23.3%, 230/986), mineral supplements (22.3%, 220/986), botanical/herbal medicines (22.2%, 219/986), and diet therapy (19.4%, 191/986) were the main types of CAM used. From the adjusted binary logistic regression model, current age (aOR: 1.03, 95%CI: 1.01–1.05), sex (aOR: 1.41, 95%CI: 1.02–1.95), participants’ perceptions of consequences (aOR: 1.10, 95%CI: 1.04–1.17), identity (aOR: 1.15, 95%CI: 1.06–1.25) and concerns about COVID-19 (aOR: 0.91, 95%CI: 0.85–0.97) were statistically significant predictors of CAM use. These results suggest the need for appropriate public health policy on COVID-19 and CAM use in addition to directing further research initiatives toward an optimized COVID-19 prevention scheme using clinically validated CAM treatments. Research to validate the clinical efficacy of these products, especially the herbs, for COVID-19 prevention while isolating lead compounds that could be optimized and used for the treatment and prevention of COVID-19 is also recommended.

1. Introduction
The Corona Virus Disease (COVID-19) which is a zoonotic viral infectious disease caused by severe acute respiratory syndrome coronavirus 2 has become a global pandemic of major public health concern (Gorbalenya et al., 2020). Worldwide, over 200 million cases and more than 4 million COVID-19 related deaths have been reported (COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE), 2021) with individuals having compromised immune systems, chronic diseases, and the elderly as high-risk populations (Wu and McGoogan, 2020). Although the World Health Organization developed preventive guidelines to slow viral spread (Wu and McGoogan, 2020), Medicine Regulatory Agencies in several countries have approved vaccines under emergency use authorisation and medicines like azithromycin, hydroxychloroquine, chloroquine phosphate, ivermectin, doxycycline, dexamethasone, methylprednisolone, remdesivir, and convalescent plasma for COVID-19 case management (Tarighi et al., 2021; Sanders et al., 2020).

With these conventional interventions, there are reports of complementary or alternative treatments such as herbal preparations, dietary therapy, vitamin supplements, and prayer for prevention or treatment of COVID-19 (Jabaris and Ananthalakshmi, 2021; Boozari and Hosseinzadeh, 2020; Panyod et al., 2020).

CAM involves medications, treatments, and medicinal practices used concurrently with (complementary) or in place of (alternative) conventional treatments (Ernst and Fugh-Berman, 2002; Lichtenstein and
Illness perception has successfully predicted behaviours and outcomes across populations including hypertension, diabetes, coronary heart disease, anxiety, depression, cancer and medication adherence (Foxwell et al., 2013; Broadbent et al., 2015; Alyami et al., 2021; Anakwa et al., 2021). In recent times, studies have explored illness perception and adherence to safety protocols for COVID-19 and observed that perceptions toward COVID-19 had significant impact on adherence to these measures (Chong et al., 2020). The physical and psychological impact of illness perception during the COVID-19 pandemic as well as the role of CAM and integrative therapies as coping health behaviours in response to perceptions about COVID-19 have also been reported (Kristoffersen et al.; Man et al., 2020; Chong et al., 2021). Natural medicines have played essential roles in previous coronavirus infection prevention (Boozari and Hosseinizadeh, 2020) and threats of the current COVID-19 with its associated risk perceptions has led to CAM utilization as well (Paudyal et al., 2021). Herbs such as *Allium sativum; Camellia sinensis; Zingiber officinale, Nigella sativa, Glycyrrhiza glabra,* and *Astragalus membranaceus* were used for preventing previous coronavirus infections (Luo et al., 2020) with vitamin and mineral supplements reported for COVID-19 prevention (Gasmii et al., 2021; Kretchy et al., 2021).

CAM use in the treatment and management of diseases is prevalent (Kretchy et al., 2014; Kretchy et al., 2021; Kuunibe and Domanban, 2012; Yarney et al., 2013), yet information on COVID-19 perception influencing CAM is limited. This study therefore aimed to assess the role of illness perceptions towards COVID-19 and CAM utilization while documenting the prevalence and pattern of use. Understanding these relationships will inform further research initiatives toward optimized COVID-19 prevention using clinically validated CAM treatments.

2. Methods

The study was approved by the Institutional Review Board of the Noguchi Memorial Institute for Medical Research, University of Ghana (CPN: 028/20-21) and conducted in accordance with the Helsinki Declaration. Participants were voluntarily recruited after they had been informed about the purpose of the study. All study participants approved online written informed consent before commencement of data collection.

2.1. Study design and participants

This was a national cross-sectional online study using anonymous electronic survey from February to April 2021 via an online platform (https://ee.kobotoolbox.org/single/2q6zUPlK). The survey tool was circulated through emails, professional association groups, and five social media platforms – Telegram, WhatsApp, Instagram, LinkedIn, and Facebook. Due to the threatening second wave of COVID-19 and risks associated with conducting face-to-face community-based national surveys, the data collection process was online, and participants were recruited across all sixteen regions of Ghana using a mix of convenience and snowball sampling approaches to increase the number of participants.

Participants were Ghanaian residents aged 18 years or more, able to understand the questions in English, and had access to internet. Screening questions to ascertain age and residency status of participants were used.

Participation was voluntary after brief information on study objectives, confidentiality, and estimated completion time were provided. Participants had access to the link after informed consent was obtained. Participants were requested to share the invitation with their contacts. To control for multiple submissions, the survey settings were set to reject multiple responses from the same IP address.

2.2. Data collection

A 3-paged 30-item questionnaire was used to generate data on demographic characteristics, basic clinical information, illness perceptions about COVID-19, and CAM use during the pandemic (See Fig. 2 for complete list of CAM therapies). Demographic and clinical questions included sex, age, region of residence, educational status, existing health condition and COVID-19 risk vulnerability. Questions on COVID-19 tests and outcomes were indicated. The frequency, type, patterns, sources, reasons, beliefs, and side effects of CAM use was also noted. Examples of questions asked included (1) Which of the following CAM have you used during the COVID-19 pandemic period? (2) Was the CAM intended to prevent COVID-19 infection? (3) How long have you been using the CAM during the COVID-19 pandemic? and (4) Where did you receive the information on CAM? Participants’ perceptions about COVID-19 were assessed with the 9-item Brief Illness Perception Questionnaire (Broadbent et al., 2006). The items are scored on a 10-point Likert scale (except for item 9) for consequences, timeline, personal control, treatment control, identity, concern, illness understanding, and emotional response dimensions to COVID-19 perceptions. Item 9, an open-ended question on beliefs about causes of illness was excluded from this study, and in line with previous research, the overall score for the B-IPQ and Cronbach’s alpha were not computed because each subscale is measured by only one item (Anakwa et al., 2021; Haines et al., 2019).

To minimize non-response and high drop-out rates, the questionnaire was kept as short as possible, and participants could answer all questions within 5 min. The adaptive questioning approach was also applied to minimize the response time of participants by conditionally showing specific questions based on responses to previous items.

An online pre-test of the questionnaire was conducted among 20 people who were not members of the research team and played no role in the design of the questionnaire, to ensure that the electronic version was user-friendly, technically functional, and comprehensible by prospective participants. Prior to piloting the online version, face-to-face interviews with consideration for strict adherence to the COVID-19 prevention protocols were conducted among 7 people to ensure that the questions were comprehensible and coherent.

2.3. Data analysis

Data collected through the electronic questionnaire were extracted into excel for cross-validation and cleaning and exported to STATA version 15 (StatCorp LLC, USA) for analysis. The cross-validation involved checking consistencies in responses and ensuring that all respondents met the inclusion criteria through the use of frequency and cross-tabulation of responses. Descriptive statistics of responses for categorical variables were reported with frequencies and percentages.
while that of continuous variables were reported in terms of means and standard deviations when normally distributed but reported as median with interquartile ranges when skewed. Bar charts were used to graphically display the distribution of existing health conditions of study participants, CAM used during the COVID-19 pandemic period, sources of information on CAM and sources of CAM among the study participants. Pearson Moment Correlation Coefficient was used in assessing the relationship between the various sub domains of perceptions about COVID-19 illness. A binary logistic regression model was used to assess the effects of background characteristics and illness perceptions about COVID-19 on the use of CAM. The results of the model were reported as odds ratios with their 95% confidence intervals. All statistical tests of significance were conducted at a 5% level.

3. Results

3.1. Background characteristics of study participants

This study had 1,195 participants in total. Participants had a median age of 25 years with more than two-thirds of them between ages 18 and 30 years inclusive. Few (2.6%, 31/1195) participants were 51 years and beyond. The majority (53.9%, 644/1195) were females. Almost all (93.5%, 1117/1195) participants were Christians and had tertiary level education (94.5%, 1129/1195). Less than a third (332/1195) of the participants had tested for COVID-19 out of which 17.5% (58/332) were positive (Table 1). Three common existing health conditions among participants were common cold (4.8%, 57/1195), asthma (2.9%, 35/1195), and hypertension (2.9%, 34/1195) (Fig. 1).

3.2. Pattern of CAM use among study participants

In all 82.5% (986/1195) of the participants used some form of CAM during the COVID-19 period. Five commonly used CAM were vitamin supplements (88.1%, 869/986), spiritual healing/prayer (23.3%, 230/986), mineral supplements (22.3%, 220/986), botanical/herbal medicines (22.2%, 219/986), and diet therapy (19.4%, 191/986). The nature of CAM was mainly raw material/homemade (21.8%, 215/986) and finished products (75.3%, 742/986) (Table 2). The raw materials/homemade preparations were reported for use either individually or as combination remedies (see Appendix A). The least used CAM were magnets therapy, chelation therapy, and therapeutic touch/reiki (Fig. 2). About 86.5% (853/986) reported no side effects to CAM (Table 2). Participants’ source of information on CAM was mostly from health practitioners (46.9%, 462/1195) or Family/Friends/Colleagues (44.3%, 436/1195) (Fig. 3).

Medicines retail outlets (pharmacy and chemical shops) were the major sources of CAM acquisition while Herbal stores were the least (Fig. 4). The CAMs used were mostly finished products (75.3%, 742/986) and were registered by the Food and Drugs Authority of Ghana (73.2%, 722/986). About a third of participants had used CAM for more than six months (31.3%, 309/986) and 69.1% (681/986) of CAM use during this period being intended for COVID-19 infection prevention. More than half (58.2%, 574/986) of the participants took CAM daily (Table 2). The frequency of use was mostly based on personal decisions (48.5%, 478/986) with a few from social media. Similar proportions of

![Fig. 1. Existing health conditions of study participants.](image-url)
Table 2
Pattern of CAM use among study participants.

| CAM use          | Frequency | Percent |
|------------------|-----------|---------|
| No               | 209       | 17.5    |
| Yes              | 986       | 82.5    |
| Nature of the CAM|           |         |
| Raw materials/home-made | 215    | 21.8    |
| Finished product  | 742       | 75.3    |
| Other (specify)   | 29        | 2.9     |
| CAM registered by the FDA |         |         |
| Yes              | 722       | 73.2    |
| No               | 76        | 7.7     |
| Don’t Know        | 105       | 10.7    |
| Not Applicable    | 83        | 8.4     |
| Duration for using the CAM during the COVID-19 |         |         |
| <1 month         | 252       | 25.6    |
| 1–3 months       | 303       | 30.7    |
| 4–6 months       | 122       | 12.4    |
| More than 6 months | 309     | 31.3    |
| How did you decide on the frequency of therapy |         |         |
| Followed product label instructions | 267     | 27.1    |
| Followed practitioner’s instructions | 224     | 22.7    |
| Decided myself   | 478       | 48.5    |
| Media (e.g., TV, Radio, Newspapers) | 99      | 10.0    |
| Friends/Relatives | 157      | 15.9    |
| Social media     | 63        | 6.4     |
| Internet         | 83        | 8.4     |
| Other            | 10        | 1.0     |
| CAM intended to prevent COVID-19 infection |         |         |
| Yes              | 681       | 69.1    |
| No               | 305       | 30.9    |
| How often did you use the CAMs |         |         |
| Daily            | 574       | 58.2    |
| Weekly           | 242       | 24.6    |
| Monthly          | 88        | 8.9     |
| Annually         | 13        | 1.3     |
| Biannually       | 2         | 0.2     |
| Other            | 67        | 6.8     |
| CAMs are effective in preventing COVID-19 infections |         |         |
| Strongly Agree   | 182       | 18.5    |
| Agree            | 439       | 44.5    |
| Neutral          | 304       | 30.8    |
| Disagree         | 44        | 4.5     |
| Strongly Disagree| 17        | 1.7     |
| Safe to use CAM in preventing COVID-19 infection |         |         |
| Strongly Agree   | 148       | 15.0    |
| Agree            | 478       | 48.5    |
| Neutral          | 296       | 30.0    |
| Disagree         | 55        | 5.6     |
| Strongly Disagree| 9         | 0.9     |

Side effects experienced\(^{a}\)

| Effect           | Frequency | Percent |
|------------------|-----------|---------|
| Headache         | 33        | 3.35    |
| Dizziness        | 25        | 2.54    |
| Diarrhoea        | 23        | 2.33    |
| Fatigue          | 21        | 2.13    |
| Nausea           | 20        | 2.03    |
| Allergic reactions| 17        | 1.72    |
| Vomiting         | 10        | 1.01    |
| Pain             | 7         | 0.71    |
| Bleeding         | 1         | 0.1     |
| Bruising skin    | 1         | 0.1     |
| Dermatitis       | 1         | 0.1     |

\(^{a}\)Multiple responses.

CAM users agreed or strongly agreed to CAM being effective (63%, 621/986) and safe (63.5%, 626/986) for use in COVID-19 infection prevention (Table 2).

3.3. Perceptions about COVID-19 among study participants

COVID-19 illness representations included consequences of the infection (4.61 ± 2.96), timeliness of living with the illness (5.23 ± 2.93), personal control over the virus (4.84 ± 2.78), identity with experience of COVID-19 symptoms (1.65 ± 2.30) and concerns about COVID-19 (7.45 ± 2.80) (Table 3).

3.4. Effects of background characteristics and perceptions about COVID-19 on the use of CAM

From the binary logistic regression model, current age, sex, participants’ perceptions on consequence, identity, and concern about COVID-19 were the only statistically significant predictors of CAM use (Table 4).

The odds of using CAM increased by 3% for each year increase in age (aOR: 1.03, 95%CI: 1.01–1.05). Female participants had 41% higher odds of using CAM compared with their male counterparts (aOR: 1.41, 95%CI: 1.02–1.95).

Each unit increase in participants’ perception of the consequences of COVID-19 led to a 10% increase in the odds of using CAM (aOR: 1.10, 95%CI: 1.04–1.17). A unit increase in beliefs about COVID-19 symptom experience was associated with a 15% increase in the odds of using CAM (aOR: 1.15, 95%CI: 1.06–1.25). The odds of using CAM reduced by 9% with every unit decrease in participants’ level of concern about COVID-19 (aOR: 0.91, 95%CI: 0.85–0.97).

4. Discussion

This study investigated uptake of CAM for prevention of COVID-19 infection in Ghana to understand the trend and suggest context-specific alternatives to the management of the disease. A preponderance of our study participants were females, a finding that corresponded to national statistics where females formed a majority of 51.2% with higher life expectancy of 65 years, compared to 63 years in males (2010 Population Housing Census: National Analytical Report, 2021). The majority of our study participants had attained tertiary education and this is common with on-line studies where people who are literates can respond to such surveys (Hossain et al., 2020; Nekliudov et al., 2020). The study also recorded highest number of participants as Christians and this corroborates the report that about 70% of the Ghanaian population is estimated to be Christians (2010 Population Housing Census: National Analytical Report, 2021). Ghana and other Sub-Saharan African countries, the evidence of using faith-based approaches for health problems in combination with CAM has been reported (Gyasi et al., 2015; Okonkwo et al., 2014).

In this study, less than a third of participants had tested for COVID-19 of which 17.5% were positive. This low rate of testing for COVID-19 confirms the low national trend in which approximately seven tests per 100, 000 people were recorded daily (Ghana’s Outbreak Response Management Updates, 2021). This portrays deficiencies in existing testing facilities and the lack of capacity to accommodate testing needs of the population of about 30 million, should there be a sudden increase in COVID-19 cases in the country. It is hoped that the government would improve testing capacity, by adequately equipping laboratories, since early detection of cases impact disease management and prevents spread.

Our findings also showed that common cold, asthma, and hypertension were common health conditions reported. It is known that whilst common cold/flu and fever may be experienced in the early stages of COVID-19, among other respiratory symptoms like cough and dyspnea (Ahmad et al., 2021), asthma, diabetes, and hypertension may complicate the outcome of coronavirus infections (Yawson et al., 2015).

The products used by the respondents were consistent with most frequently used CAM products in literature (Kretchy et al., 2021; Okonkwo et al., 2014; Gyasi et al., 2015; Egede et al., 2002). While about 69.1% of CAM use was intended for the prevention of COVID-19 disease, they were generally considered effective and safe for the anticipated purpose. Vitamins were the most frequently used CAMs in literature (Kretchy et al., 2021; Ahmad et al., 2021), asthma, diabetes, and hypertension may complicate the outcome of coronavirus infections (Yawson et al., 2020). Since CAM was reported to be useful in
improving immunity in individuals, it has been suggested for use as COVID-19 prophylaxis. Traditional Chinese Medicine and Ayurveda have been used for COVID-19 infection prevention and/or treatment in countries like China and India (National Health Commission of the People’s Republic of China, 2021; Protocol, 2021). While dietary therapy and herbal medicines have also been suggested as complementary preventive therapy for COVID-19 (Panyod et al., 2020), a survey conducted in Iran revealed that the participants used herbal products, traditional medicines, and vitamin supplements to prevent them from...
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therapy is similar to other studies, which reported that prayer inter

Table 3

Perceptions about COVID-19 among study participants.

| Variable               | Mean ± SD | Consequence | Timeline | Personal control | Treatment control | Identity | Concern | Understanding | Emotional response |
|------------------------|-----------|-------------|----------|------------------|-------------------|----------|----------|---------------|---------------------|
| Consequence            | 4.61 ± 2.96 | 1           |          |                  |                   |          |          |               |                     |
| Timeline               | 5.23 ± 2.93 | 0.34*       | 1        |                  |                   |          |          |               |                     |
| Personal control       | 4.84 ± 2.78 | 0.04        | -0.04    | 1                |                   |          |          |               |                     |
| Treatment control      | 4.41 ± 2.35 | -0.06*      | -0.08*   | 0.28*            | 1                 |          |          |               |                     |
| Identity               | 1.65 ± 2.30 | 0.16*       | 0.13*    | -0.05            | -0.07*            | 1        |          |               |                     |
| Concern                | 7.45 ± 2.80 | 0.21*       | 0.18*    | 0.01             | -0.13*            | -0.01    | 1        |               |                     |
| Understanding          | 2.25 ± 2.42 | -0.06*      | -0.12*   | 0.18*            | 0.17*             | 0.05     | -0.27*   | 1             |                     |
| Emotional response     | 4.62 ± 2.98 | 0.34*       | 0.17*    | 0.08*            | -0.05             | 0.18*    | 0.33*    | -0.03         | 1                   |

SD: Standard Deviation, *P-value < 0.05.

contracting the virus (Erfani et al., 2020). Some of the herbs used as
domestic CAM intervention in this study are in line with previous
reports (Paudyal et al., 2021; Luo et al., 2020). The use of spiritual
therapy is similar to other studies, which reported that prayer inter-
vention was one of the common forms of CAM used among residents in
Ghana and South African (Gyasi et al., 2015; Singh et al., 2004). Prayers
are highly favoured in most African communities, and may account
for the high numbers of respondents resorting to this form of CAM
(Okoronkwo et al., 2014, Gyasi et al., 2015; Singh et al., 2004). Most
respondents sourced their CAM from medicines retail outlets (pharma-
cies and over-the-counter medicine sellers), and this is supported by
previous work, in which the pharmacy was an important source for CAM
(Gyasi et al., 2015). The medicine retail outlets are usually the first point
of call for medical care (Okai et al., 2019). The majority of the re-
pondents used CAM products because of personal decisions. Having a
strong personal belief has been documented to play a critical role in
indicated that the use of CAM during the COVID-19 increased with the
increasing age of participants. Although previous studies on age and
CAM use have reported mixed results, a review found that CAM use
significantly increased with increasing age in 24 studies out of the 134
that were analysed (Bishop and Lewith, 2010). In relation to the findings
on sex, this study observed that female participants had a higher chance
(41%) of using CAM than males during the COVID-19 pandemic. Similar
results have been documented for females being more likely to use CAM
than males (Egede et al., 2002, Alwhaibi et al., 2015; Laiyemo et al.,
2015; Alwhaibi and Sambamoorthi, 2016), which are congruent with
our findings. Plausible reasons for this observation are that women are
more motivated to use CAM because they tend to adopt more preventive
healthcare approaches, as well as have more health needs that may not
be sufficiently satisfied by conventional healthcare systems (Zhang
et al., 2015; Kristoffersen et al., 2014).

The perceptions of people about COVID-19 will be relevant to how
they prevent or adjust to the illness. These cognitive and emotional
representations of COVID-19 have been reported to be formed at the
initial stages of the pandemic and have remained quite stable or
decreased over time (Dias Neto et al., 2021). In this study, participants
formed their perceptions about COVID-19 based on both cognitive and
emotional views about the disease which comprises the anticipated
physical, emotional and social effects and outcomes of the illness on an
individual’s wellbeing (Broadbent et al., 2006). Our study revealed that

Table 4

Effects of background characteristics and perceptions about COVID-19 on the use of CAM.

| Variable                        | uOR   | 95%CI   | P-value | aOR   | 95%CI   | P-value |
|---------------------------------|-------|---------|---------|-------|---------|---------|
| Current Age                     | 1.04  | 1.02–1.06 | <0.001*** | 1.03  | 1.01–1.05 | 0.005** |
| Sex                             | 1.90  |          |         | 1.00  |          |         |
| Male                            | 1.00  |          |         | 1.00  |          |         |
| Female                          | 1.22  | 0.91–1.65 |         | 1.41  | 1.02–1.95 |         |
| Religion                        | 0.68  |          |         | 1.18  | 0.64–2.18 | 0.602   |
| Christian                       | 1.13  | 0.63–2.03 |         | 1.00  |          |         |
| Other                           | 1.00  |          |         | 0.706 |          |         |
| Educational Level               | 0.250 |          |         | 1.00  |          |         |
| Non-tertiary                    | 1.00  |          |         | 1.00  |          |         |
| Tertiary                        | 1.42  | 0.78–2.57 |         | 1.13  | 0.6–2.15  | 0.064   |
| Existing Health Conditions      | 1.00  |          |         | 1.00  |          |         |
| No                              | 0.46  | 0.28–0.75 |         | 0.62  | 0.37–1.03 |         |
| Yes                             | 1.12  | 1.08–1.12 | <0.001*** | 1.10  | 1.04–1.17 | 0.001** |
| Consequence                     | 1.07  | 1.02–1.13 | 0.010*  | 1.02  | 0.96–1.07 | 0.580   |
| Timeline                        | 0.97  | 0.92–1.03 | 0.320   | 0.99  | 0.93–1.05 | 0.711   |
| Personal control                | 0.95  | 0.89–1.01 | 0.130   | 0.96  | 0.9–1.03  | 0.299   |
| Treatment control               | 1.21  | 1.11–1.31 | <0.001*** | 1.15  | 1.06–1.25 | 0.001** |
| Identity                        | 0.97  | 0.92–1.03 | 0.300   | 0.91  | 0.85–0.97 | 0.003** |
| Concern                         | 0.99  | 0.93–1.05 | 0.660   | 0.98  | 0.92–1.05 | 0.563   |
| Understanding                   | 1.09  | 1.04–1.15 | <0.001*** | 1.05  | 0.99–1.12 | 0.079   |

*p-value < 0.05, **p-value < 0.01, ***p-value < 0.001, CI: Confidence interval, aOR: Adjusted odds ratio, uOR: unadjusted odds ratio.
the participants’ perception of COVID-19 affecting their lives (conse-
quencies) led to the use of CAM. COVID-19 has resulted in the significant
loss of many lives globally, an increase in unemployment rates, a
reduction in food security as well as self-isolation of infected individuals
(Pilich-Loeb et al., 2021; Aliakbari Dekordi et al., 2020; VanderWeele,
2020; Yang et al., 2020; Mentis, 2021). These consequences are likely
reasons for people’s use to CAM for COVID-19 prevention. Our study
indicated that the beliefs about experiencing COVID-19 symptoms also
resulted in a significant increase in CAM use. Some common symptoms
of COVID-19 include fever, cough and dyspnoea (Pullen et al., 2020).
However, there are more severe symptoms of COVID-19 such as
breathlessness (from respiratory distress syndrome), sudden confusion,
and constant chest pain (Valizadeh et al., 2020; Ahmad et al., 2020). The
participants may have experienced any of these symptoms or want to
avoid experiencing such symptoms and thus, resulting in their use of
CAM in preventing COVID-19 infections. The results of this study also
showed that the lower the concern about COVID-19, the lower the
likelihood of using CAM. In the course of a pandemic, fear, worry, or
even paranoia can easily spread throughout the population (Frekelton,
2020). This fear tends to push individuals to take drastic measures in
avoiding infection. These measures include using readily available and
affordable health interventions, such as herbal medicine and dietary
supplements (Panyod et al., 2020; Frekelton, 2020; Alyami et al., 2020; Silveira et al., 2020). Thus, the lower the concerns, the less likely to take
any action.

The strength of this study is in the use of an online survey that
enabled the recruitment of study participants across all the regions of
Ghana since the COVID-19 pandemic is a challenge to conducting face-
to-face research. Also, this study provides comprehensive information
on the prevalence, pattern, and perceptions towards CAM use for
COVID-19 pandemic control in Ghana, which can serve as the basis for
an improved COVID-19 management scheme using clinically validated
CAM treatments.

There are however some limitations that need to be considered in the
interpretation of the study findings. First, online data collection was
used for this study and therefore only people who could read and write,
have access to social media networks and access the internet could
participate. Second, since convenience and snowball sampling were
used in this study, the data may not be representative of the population
distribution in Ghana in terms of age, sex, and place of residence. Hence,
a disproportionately large number of study participants were female and
had tertiary education, which is a common observation in online surveys
(Hossain et al., 2020; Nekludov et al., 2020). Third, the cross-sectional
nature of this study prevents the analysis of causal relationships, and the
use of self-reported measures introduces reporting bias. Finally, in
considering the prevalence, pattern, and perceptions towards the
COVID-19 pandemic and CAM use for its control, the long-term effects of
CAM cannot be inferred from this study.

Despite these limitations, this study findings highlight some key
clinical, research, and policy implications. The outcome of the study
indicates a high prevalence of CAM use for COVID-19 prevention.
Consequently, there is a clinical implication of potential herb-drug
interaction for people who are on medications for chronic disease con-
ditions. Thus, a rigorous health educational campaign is needed to avoid
any potential public health crisis. In addition, a clear policy is needed for
the use of CAM in the prevention and management of COVID-19. From
this study, many people used different herbs for the prevention of
COVID-19 infection and as a result, research could be conducted to
validate the clinical efficacy of these herbs for COVID-19 prevention and
possibly isolate lead compounds that could be optimized and used for
the treatment and prevention of the coronavirus infection.

5. Conclusion

The study observed that the use of CAM for COVID-19 infection
prevention was common with demographic and illness perceptions
towards COVID-19, contributing to the use. The information could be
used to educate the safe use of CAM while promoting research into the
clinical and potential usefulness for the prevention and treatment of the
COVID-19 infection.

6. Availability of data and materials

The data that support the findings of this study are available from the
corresponding author, upon reasonable request.

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CRedit authorship contribution statement

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Declaration of Competing Interest

The authors declare that they have no known competing financial
interests or personal relationships that could have appeared to influence
the work reported in this paper.

Appendix A

| Table A1 Plants used as raw materials/homemade preparations for COVID-19 prevention. |
|--------------------------------------------|--------------------------------------------|
| #  | Common name   | Scientific name                        |
| 1  | Clove          | Syzygium aromaticum                    |
| 2  | Pineapple     | Ananas comosus                         |
| 3  | Activated charcoal powder | n.a.                                   |
| 4  | Dandelion     | Taraxacum officinale                   |
| 5  | Cashew        | Anacardium occidentale                 |
| 6  | Pawpaw        | Carica papaya                          |
| 7  | Lemon         | Citrus Limonum                         |
| 8  | Cinnamon      | Cinnamomum zeylanicum                  |
| 9  | Lemongrass    | Cymbopogon citratus                    |
| 10 | Ginger        | Zingiber officinale                    |
| 11 | Chilli pepper | Capsicum frutescens                    |
| 12 | Neem          | Azadirachta indica                     |
| 13 | Garlic        | Allium sativum                         |
| 14 | Onion         | Allium cepa                            |
| 15 | Negro pepper  | Xylophia aethiopica                   |
| 16 | Grains of paradise | Aframomum melegueta               |
| 17 | Cloves        | Syzygium aromaticum                    |
| 18 | Hibiscus      | Hibiscus rosa-sinensis                 |
| 19 | Moringa leaves | Moringa oleifera                     |
| 20 | Prekese       | Tetrapleura tetraptera                 |
| 21 | Bitter root   | Lewisia redivina                       |
| 22 | Mango         | Mangifera indica                       |
| 23 | African basil | Ocimum gratissimum                     |
| 24 | Pear          | Pyrus pyrifolia                        |
| 25 | Turmeric      | Curcuma longa                          |
| 26 | Black pepper  | Piper guineense                        |
|    | n.a., not applicable |                                       |
References

2010 Population & Housing Census: National Analytical Report https://www.statghana. gov.gh/population/census/2010/marayeur/eng/Preventive%20Medicine%20Reports%2024%20(2021)%20101633.pdf (Accessed on 15th July, 2021).

Ahmad, Mehmood, Beg, Bilal Mahmood, Majeed, Arfa, Areej, Sadaf, Riffat, Sualeha, Rashheed, Muhammad Adil, Mahmood, Samimina, Mustaq, Rana Muhammad Zahid, Husen, Ahmad Azam 2021. Epidemiological and clinical characteristics of COVID-19: a retrospective multi-center study in Pakistan. Front. Public Health https://doi.org/10.3389/fpubh.2021.644199.

Ahmad, Tauseef, Khan, Muhammad, Haroon, Taha Husseina Musa, Nasir, Saima, Jin, Boon-Thanee Athana, Jais, Jettee, Rodriguez-Morales, Alfonso J. 2020. COVID-19: Zoonotic aspects. Travel Med. Infect. Dis. 36, 101607. https://doi.org/10.1016/j.tmaid.2020.101607.

Aliakbari Debkordi, M., Esizadeh, F., Aghajaniasl, S. 2020. Psychological consequences of populations exposed to COVID-19 (COVID-19): A Qualitative Study. Iran J. Health Psychol. 2 (2), 9–20. https://doi.org/10.34037/IJHOP.2020.52295.1074.

Alwhaibi, Monira, Bhattacharya, Rituparna, Sambamoorthi, Usha, Ushakowska, Anna, Sambamoorthi, Usha, 2015. Type of multimorbidity and complementary and alternative medicine use among adults. Evid. Based Complement Altern. Med. 2015, 1–9. https://doi.org/10.1155/2015/362582.

Alwhaibi, Monira, Sambamoorthi, Usha, 2016. Sex Differences in the Use of Complementary and Alternative Medicine among Adults with Multiple Chronic Conditions. Evid. Based Complement Altern. Med. 2016, 1–8. https://doi.org/10.1155/2016/2067095.

Alyami, Hamad S., Orabi, Mohamed A.A., Alidabbah, Fahad M., Alturki, Hamad N., Albas, Wejdan I., Alfayez, Abdalhameed L., Alharbi, Abdullah S., Almasoud, Rawan A., Alshaihban, Njood A. 2020. Knowledge about COVID-19 and beliefs and about use of herbal products during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. Saudi Pharm. J. 28 (11), 1326–1332. https://doi.org/10.1016/j.jsps.2020.02.023.

Alyami, M., Serelachius, A., O’Donovan, C.E., van der Werf, B., Broadbent, E., 2021. A systematic review of illness perception interventions in type 2 diabetes: Effects on glycemic control and illness perceptions. Diabet. Med. 38 (3), e14495. https://doi.org/10.1111/diab.14495.

Anakwa, Nella O., Teje-Kwadjo, Enoch, Kretchy, Irene A., 2020. Illness perceptions, self-efficacy on adherence to precautionary measures for COVID-19. Int. J. Environ. Res. Public Health 17 (11), 4385. https://doi.org/10.3390/ijerph17114385.

Boozari, M., Hosseinzadeh, H., 2020. Natural products for COVID-19 prevention and complementary and alternative medicine use in individuals with diabetes. Diabetes Metab. Syndr. Obesity 2020 (9), 876. https://doi.org/10.1155/2020/876.

Canaway, R., Manderson, L., 2013. Quality of life, perceptions of health and illness, and illness perceptions, mood and quality of life: a systematic review of complementary and alternative medicine use in adolescents with chronic health conditions. J. Psychosom. Res. 75 (6), 636–544. https://doi.org/10.1016/j.jpsychores.2013.05.003.

Cleland, C., Lovell, H., 2012. Knowledge about COVID-19 and confidence in the science of the pandemic among young adults: A cross-sectional study. J. Community Health 37 (3), 457. https://doi.org/10.1007/s10900-012-9515-0.

Cleland, C., Lovell, H., 2013. Predictors of knowledge about COVID-19 among adult Europeans. Front. Psychol. 4 https://doi.org/10.3389/fpsyg.2013.00839.

Cleland, C., Lovell, H., 2014. Knowledge about COVID-19 and fear of infection: A cross-sectional study. J. Public Health 36 (4), 544. https://doi.org/10.1177/1463693614537879.

Cleland, C., Lovell, H., 2015. Knowledge about COVID-19 and self-efficacy on adherence to precautionary measures for COVID-19. Health Psychol. 2 (2), 9

Cleland, C., Lovell, H., 2016. Knowledge about COVID-19 and belief about the threat of COVID-19: A cross-sectional study in England. J. Public Health 38 (3), 367. https://doi.org/10.1093/heapro/daw192.

Cleland, C., Lovell, H., 2017. Knowledge about COVID-19 and behavioral intentions for COVID-19 prevention: A cross-sectional study in Australia. J. Community Health 42 (2), 303. https://doi.org/10.1007/s10900-016-0663-9.

Cleland, C., Lovell, H., 2018. Knowledge about COVID-19 and behavioral practices toward the COVID-19? A cross-sectional online survey among the adult population in Bangladesh. Heliyon 6 (12), e05799. https://doi.org/10.1016/j.heliyon.2020.e05799.

Cleland, C., Lovell, H., 2019. Knowledge about COVID-19 and behavioral practices toward the COVID-19: A cross-sectional online survey among the adult population in Bangladesh. Heliyon 6 (12), e05799. https://doi.org/10.1016/j.heliyon.2020.e05799.

Cleland, C., Lovell, H., 2020. Knowledge about COVID-19 and behavioral practices toward the COVID-19: A cross-sectional online survey among the adult population in Bangladesh. Heliyon 6 (12), e05799. https://doi.org/10.1016/j.heliyon.2020.e05799.

Cleland, C., Lovell, H., 2021. Knowledge about COVID-19 and behavioral practices toward the COVID-19: A cross-sectional online survey among the adult population in Bangladesh. Heliyon 6 (12), e05799. https://doi.org/10.1016/j.heliyon.2020.e05799.

Cleland, C., Lovell, H., 2022. Knowledge about COVID-19 and behavioral practices toward the COVID-19: A cross-sectional online survey among the adult population in Bangladesh. Heliyon 6 (12), e05799. https://doi.org/10.1016/j.heliyon.2020.e05799.

Cleland, C., Lovell, H., 2023. Knowledge about COVID-19 and behavioral practices toward the COVID-19: A cross-sectional online survey among the adult population in Bangladesh. Heliyon 6 (12), e05799. https://doi.org/10.1016/j.heliyon.2020.e05799.
Leventhal, H., Phillips, L.A., Burns, E., 2016. The Common-Sense Model of Self-Regulation (CSM): a dynamic framework for understanding illness self-management. J. Behav. Med. 39 (6), 925–946. https://doi.org/10.1007/s10865-016-9782-2.

Lichtenstein, G., Waalen, J., 2012. Distinguishing complementary medicine from alternative medicine. Arch. Intern. Med. 162 (8), 943.

Luo, Hui, Tangi, Qiao-ling, Zhang, Ya-xi, Liang, Shi-bing, Yang, Ming, Zheng, Tongzhang, Fu, Qiang, Zhang, Yiming, Buka, Stephen, Yao, Xinan, Tang, Zehong, Zhang, Xichi, Qin, Lin, Zhang, Yang, Zhou, Jiqiong, Cao, Jiangxia, Wang, Youjie, Zhou, Aifen, 2020. Excessive media consumption about COVID-19 is associated with increased state anxiety: outcomes of a large online survey in Russia. J. Med. Internet Res. 22 (9), e20955. https://doi.org/10.2196/20955.

Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

National Health Commission of the People’s Republic of China. Diagnosis and treatment protocol for COVID-19 (trial version 7). http://em.nhc.gov.cn/2020-03/29/c_78469.htm. Accessed September 28, 2021.

Nekliudov, Nikita A., Blyuss, Oleg, Cheung, Ka Yan, Petrou, Loukia, Genuneit, Jon, Sushevtsev, Nikita, Levadnaya, Anna, Comberiati, Pasquale, Warner, John O, Tudor-Williams, Gareth, Treuel, Martin, Greenhawt, Matthew, Dunngalvin, Audrey, Munchit, Daniel, 2020. Excessive media consumption about COVID-19 is associated with increased state anxiety: outcomes of a large online survey in Russia. J. Med. Internet Res. 22 (9), e20955. https://doi.org/10.2196/20955.

Okai, G.A., Abekah-Nkrumah, G., Asunting, P.O., 2019. Perceptions and trends in the use of community pharmacies in Ghana. J. Pharm. Policy Pract. 12 (1), 1–9. https://doi.org/10.1186/e40545-019-0188-6.

Okorokwod, Ijeoma, Onyia-pat, Jane-lovena, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

Panyod, S., Ho, C.-T., Sheen, L.-Y., 2020. Dietary therapy and herbal medicine for Okoronkwo, Ijeoma, Onyia-pat, Jane-lovena, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

Rai, Navneet, Kaur, Navleen, 2020. Disease perception and coping with emotional distress during COVID-19 pandemic: a survey among medical staff. Int. J. Environ. Res. Public Health 17 (13), 4899. https://doi.org/10.3390/ijerph17134899.

Singh, V., Raidoo, D.M., Harries, C.S., 2004. The prevalence, patterns of usage and adverse effects among adult users in Enugu Urban, Southeast Nigeria. Evid. Based Complement Altern. Med. 2014, 1

Todea, Doina Adina, Dantes, Elena, Puiu, Ruxandra, Rajnoveanu, Ruxandra-Mioara, 2020. Disease perception and coping with emotional distress during COVID-19 pandemic: a survey among medical staff. Int. J. Environ. Res. Public Health 17 (13), 4899. https://doi.org/10.3390/ijerph17134899.

Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

National Health Commission of the People’s Republic of China. Diagnosis and treatment protocol for COVID-19 (trial version 7). http://em.nhc.gov.cn/2020-03/29/c_78469.htm. Accessed September 28, 2021.

Nekliudov, Nikita A., Blyuss, Oleg, Cheung, Ka Yan, Petrou, Loukia, Genuneit, Jon, Sushevtsev, Nikita, Levadnaya, Anna, Comberiati, Pasquale, Warner, John O, Tudor-Williams, Gareth, Treuel, Martin, Greenhawt, Matthew, Dunngalvin, Audrey, Munchit, Daniel, 2020. Excessive media consumption about COVID-19 is associated with increased state anxiety: outcomes of a large online survey in Russia. J. Med. Internet Res. 22 (9), e20955. https://doi.org/10.2196/20955.

Okai, G.A., Abekah-Nkrumah, G., Asunting, P.O., 2019. Perceptions and trends in the use of community pharmacies in Ghana. J. Pharm. Policy Pract. 12 (1), 1–9. https://doi.org/10.1186/e40545-019-0188-6.

Okorokwod, Ijeoma, Onyia-pat, Jane-lovena, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, 2020. Patterns of complementary and alternative medicine use, perceived benefits, and adverse effects among adult users in Enugu Urban, Southeast Nigeria. Evid. Based Complement Altern. Med. 2014, 1

Panyod, S., Ho, C.-T., Sheen, L.-Y., 2020. Dietary therapy and herbal medicine for Okoronkwo, Ijeoma, Onyia-pat, Jane-lovena, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

Rai, Navneet, Kaur, Navleen, 2020. Disease perception and coping with emotional distress during COVID-19 pandemic: a survey among medical staff. Int. J. Environ. Res. Public Health 17 (13), 4899. https://doi.org/10.3390/ijerph17134899.

Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

National Health Commission of the People’s Republic of China. Diagnosis and treatment protocol for COVID-19 (trial version 7). http://em.nhc.gov.cn/2020-03/29/c_78469.htm. Accessed September 28, 2021.

Nekliudov, Nikita A., Blyuss, Oleg, Cheung, Ka Yan, Petrou, Loukia, Genuneit, Jon, Sushevtsev, Nikita, Levadnaya, Anna, Comberiati, Pasquale, Warner, John O, Tudor-Williams, Gareth, Treuel, Martin, Greenhawt, Matthew, Dunngalvin, Audrey, Munchit, Daniel, 2020. Excessive media consumption about COVID-19 is associated with increased state anxiety: outcomes of a large online survey in Russia. J. Med. Internet Res. 22 (9), e20955. https://doi.org/10.2196/20955.

Okai, G.A., Abekah-Nkrumah, G., Asunting, P.O., 2019. Perceptions and trends in the use of community pharmacies in Ghana. J. Pharm. Policy Pract. 12 (1), 1–9. https://doi.org/10.1186/e40545-019-0188-6.

Okorokwod, Ijeoma, Onyia-pat, Jane-lovena, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, 2020. Patterns of complementary and alternative medicine use, perceived benefits, and adverse effects among adult users in Enugu Urban, Southeast Nigeria. Evid. Based Complement Altern. Med. 2014, 1

Panyod, S., Ho, C.-T., Sheen, L.-Y., 2020. Dietary therapy and herbal medicine for Okoronkwo, Ijeoma, Onyia-pat, Jane-lovena, Okpala, Pat, Agbo, Mary-Ann, Ndu, Afam, Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

Rai, Navneet, Kaur, Navleen, 2020. Disease perception and coping with emotional distress during COVID-19 pandemic: a survey among medical staff. Int. J. Environ. Res. Public Health 17 (13), 4899. https://doi.org/10.3390/ijerph17134899.

Mentis, Alexios-Fotios A., 2021. What neurological and psychiatric effects does COVID-19 have on its survivors? BMC Med. 19 (1) https://doi.org/10.1186/s12916-021-01986-7.

National Health Commission of the People’s Republic of China. Diagnosis and treatment protocol for COVID-19 (trial version 7). http://em.nhc.gov.cn/2020-03/29/c_78469.htm. Accessed September 28, 2021.