Original Research Article

Oral Dietary Supplements Use Among Healthcare Workers During the COVID-19 Pandemic in Malaysia

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Article History
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Abstract: Healthcare workers (HCWs) must be aware of the latest data supporting or refuting the use of oral dietary supplements (ODS) in order to disseminate evidence-based health information and help patients make informed decisions. Nevertheless, there is relatively scant data on the prevalence of dietary supplement use among HCWs, the types of dietary supplements recommended to patients by HCWs, and their reasons for recommending these products, particularly during the COVID-19 outbreak. This study examined the prevalence of ODS use among surveyed HCWs, considered the types of ODS used and recommended by those HCWs, identified the reasons given by those HCWs for using or not using ODS, and determined whether those HCWs were recommending or not recommending ODS to their patients during the COVID-19 pandemic. This cross-sectional study targeted all HCWs working at a district hospital in Malaysia and was conducted via a self-administered online survey. The survey revealed that 67.3% of HCWs did not recommend ODS for patient use during the pandemic, despite 55.3% of HCWs reported personal use of ODS during the pandemic. Type of HCWs (P=0.001), monthly household income (P=0.019), prior ODS use (P<0.001) and recommendation of ODS to patients (P<0.001) were significantly associated with personal ODS use during the pandemic. Vitamin C was the most commonly used (81.3%) and recommended (95.0%) ODS. “To maintain overall health and wellness” was the most common reason for personal ODS use and recommendation to patients (83.3% & 79.2%). Given the increasing rate of ODS use during the pandemic, further research should be done so that evidence-based recommendations can be formulated to ensure patient safety.

Keywords: oral dietary supplements; healthcare workers; personal use; recommendation; COVID-19; pandemic

1. Introduction

Individuals exposed to risks and uncertainties tend to seek affordable self-protective measures such as complementary and alternative medicine (CAM), including taking oral
dietary supplements (ODS), to maintain good health, mitigate risk, and make an unpredictable condition more manageable[1,2]. ODS are products that can be taken by mouth (such as a tablet, capsule, powder, or liquid), and include vitamins, minerals, herbs or other botanicals, amino acids, enzymes, tissues from organs or glands, or extracts of these. ODS are a common type of CAM[3,4]. Malaysia has undergone rapid urbanization in recent years resulting in the transformation of dietary intake patterns, including the consumption of dietary supplements. The most common ODS consumed by Malaysian adults was Vitamin C[3,5].

Since the onset of the COVID-19 outbreak, some online media platforms have been promoting dietary supplements such as vitamins C and D for the treatment and prevention of coronavirus infection, although there is still a lack of evidence and guidance for the use of micronutrient supplements[6–8]. Recent scientific literature on the use of vitamins and minerals as prevention and treatment for critically ill patients with COVID-19 appear to support the idea of high-dose of vitamin C and other micronutrient intervention due to their excellent safety profile, low-cost and immediate availability[9–11]. The personal use of ODS by healthcare workers (HCWs) and the recommendation by HCWs for others to use ODS is of interest for several reasons. HCWs are important sources of dietary information for patients and are expected to provide sound advice about the use of various dietary supplements. Some HCWs provide information and dietary advice based on their personal experiences and eating habits. Therefore, we explored personal ODS use among HCWs themselves since their personal health habits could affect their decision to recommend a dietary supplement[12–14]. HCWs must be aware of the latest data supporting or refuting ODS use in order to disseminate evidence-based health information and help patients make informed decisions. Previous studies have shown that dietary supplements are used by a large proportion of the general public to treat and prevent diseases. Nevertheless, there is relatively scant data on the prevalence of dietary supplement use among HCWs. There is even less available up-to-date information regarding the types of dietary supplements recommended to patients by HCWs and their reasons for recommending these products, particularly during the COVID-19 pandemic[15–17].

Therefore, this study was done to (a) examine the prevalence of ODS use among surveyed HCWs, (b) consider the types of ODS used and recommended by those HCWs, (c) identify the reasons given by those HCWs for using or not using ODS, and (d) determine whether those HCWs were recommending or not recommending ODS to their patients during the COVID-19 pandemic.

2. Materials and Methods

2.1. Ethics Statement

This study was registered with the Malaysian National Medical Research Register (NMRR-20-2275-56853) and received ethical approval from the Medical Research and Ethics Committee, Ministry of Health Malaysia.
2.2. Study Design and Participants

This descriptive cross-sectional study was conducted via an anonymous, self-administered online survey using a convenient sampling method. The targeted study population comprised all of the HCWs (including doctors, nurses, pharmacists, allied health professionals, and assistant medical officers) working at Hospital Seberang Jaya (HSJ), Malaysia. The time period for data collection was between 4th November 2020 and 4th December 2020. The survey was conducted using a self-administered online survey method in order to comply with the standard operating procedures imposed by the government during the COVID-19 pandemic. HCWs aged 18 years old and above were eligible to participate in the survey and were required to complete the electronic informed consent form. The study excluded non-Malaysian people and those who were unable to read or understand the questionnaire.

2.3. Sample Size

Cochran’s formula was used to calculate the minimum recommended sampling size and an estimated proportion of dietary supplements users of 0.760 was calculated from a previous study\textsuperscript{[15]}. The sample size required for this study with a confidence level of 95% and ± 5% precision was 280 study participants. A further 30% (\(N=84\)) was added to compensate for nonresponse, resulting in a final sample size of 365\textsuperscript{[18]}.

2.4. Survey Instrument

Because previous research tools on ODS use among HCWs during the COVID-19 outbreak were unavailable, a semi-structured survey questionnaire instrument was developed for this study after doing a thorough literature review\textsuperscript{[3,16,17,19–25]} and seeking opinions from experts. To assess the content and face validation of the survey instrument, the questionnaire was reviewed by five researchers to evaluate appropriateness, relevancy, clarity, adequacy, and organization of the questions\textsuperscript{[26]}. The questionnaire was pilot-tested to examine length, clarity, and difficulty of the questions, and items were revised based on the results. Responses obtained from the pilot study were not included in the final data analysis of this study. The study questionnaire was made available in the English language.

The finalised survey included 24 items with both multiple-choice and open-ended questions and consisted of four major sections. The participants were asked to complete their socio-demographic information, such as age, gender, marital status, ethnicity, religion, education level, type of HCWs, and monthly income, in the first section. The second section consisted of four questions on health-related characteristics. The third part had six questions about participants’ personal ODS use before and during the COVID-19 pandemic (11\textsuperscript{th} March 2020 onwards); types of ODS consumed; reasons for taking or not taking ODS; and average expenditure per month for ODS. Available choices for types of ODS included vitamins A, B complex, B12, C, D, and E, as well as zinc, selenium, magnesium, multivitamin/multimineral (MVMM), omega-3 and probiotics, due to their potential utility...
in COVID-19 as had been highlighted in different studies\textsuperscript{[24,27–31]}. Herbal products were excluded because they are not taught in traditional health care professional education programs. The fourth section contained five questions regarding the recommendation by HCWs that patients should or should not use ODS during the COVID-19 pandemic. The last section asked questions relating to participants’ educational background regarding ODS and their interest in receiving continuing education regarding the subject of ODS.

2.5. Statistical Analysis Methods

The collected data of 367 participants was analysed statistically using the Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics were used to analyse the prevalence of ODS use and the socio-demographic and health-related characteristics of all HCWs involved in the study. Data on types of ODS used and recommended by HCWs to patients; reasons for using or not using ODS; and reasons for recommending or not recommending ODS to patients during the COVID-19 pandemic were summarized using frequency counts (n) and percentages (%). Mean and standard deviation were calculated for the normally distributed continuous data whereas continuous data that were not normally distributed were reported using median and interquartile range (IQR). The ODS users and non-ODS users were compared by using the Mann-Whitney Test. Pearson Chi-square or Fisher's exact tests were performed to determine the categorical variables related to ODS use and any associations between ODS use and recommendation of ODS to patients. Tests were 2-tailed and P-value of less than 0.05 was considered statistically significant for all analyses.

3. Results

A total of 367 HCWs participated in this study. Table 1 summarised the socio-demographic and health-related characteristics of all participants. The median age of participants was 32.00 years (IQR = 9.00). Most of the participants were female (87.2%), married (69.8%), Malays (64.9%) and Muslims (66.2%). More than 90% of the participants received tertiary education, did not smoke, and did not consume alcohol. Among the participants surveyed, 52.6% were nurses, 21% were pharmacists, 15.3% were doctors, and 11.2% were allied health professionals. Half of the participants (51.0%) had monthly household income ranging from RM 4 850 to RM 10 959. About 80% of the participants had no underlying co-morbidities. A majority (99.5%) of them were not infected with COVID-19. However, there were 2 unconfirmed cases at the time the survey was conducted. The percentage of participants who had used ODS before the COVID-19 pandemic was 47.7% but during the pandemic 55.3% of participants used ODS. Despite that, the survey revealed that 67.3% of HCWs did not recommend ODS for patient use during the pandemic. Only 120 of the HCWs (32.7%) recommended ODS to patients during the COVID-19 pandemic.
Table 1. Sociodemographic and health characteristics of all participants (n=367).

| Characteristics                  | n (%)   |
|----------------------------------|---------|
| **Age (years)**                  | 32 (9.0) |
| **Gender**                       |         |
| Female                           | 320 (87.2) |
| Male                             | 47 (12.8)  |
| **Marital status**               |         |
| Married                          | 256 (69.8) |
| Single                           | 104 (28.3) |
| Widowed                          | 4 (1.1)  |
| Divorced                         | 3 (0.8)  |
| **Ethnicity**                    |         |
| Malay                            | 238 (64.9) |
| Chinese                          | 78 (21.3)  |
| Indian                           | 48 (13.1)  |
| Others                           | 3 (0.8)  |
| **Religion**                     |         |
| Islam                            | 243 (66.2) |
| Buddhism                         | 68 (18.5)  |
| Hinduism                         | 40 (10.9)  |
| Christianity                     | 16 (4.4)  |
| **Educational level**            |         |
| Secondary school                 | 14 (3.8)  |
| Pre-University                   | 165 (45.0) |
| Undergraduate                    | 132 (36.0) |
| Postgraduate                     | 56 (15.3)  |
| **Type**                         |         |
| Allied health professions        | 41 (11.2)  |
| Doctors                          | 56 (15.3)  |
| Pharmacist                       | 77 (21.0)  |
| Nurse                            | 193 (52.6) |
| **Monthly household income**     |         |
| < RM 4850 per month              | 133 (36.2) |
| ≥ RM 4850 – RM 10 959 per month  | 187 (51.0) |
| > RM 10 959 per month            | 47 (12.8)  |
| **Smoking status**               |         |
| No                               | 359 (97.8) |
| Yes                              | 8 (2.2)  |
| **Alcohol consumption**          |         |
| No                               | 341 (92.9) |
| Yes                              | 26 (7.1)  |
| **Co-morbid(s) present**         |         |
| No                               | 295 (80.4) |
| Yes                              | 72 (19.6)  |
| **COVID-19 status**              |         |
| No                               | 365 (99.5) |
| Possibly infected                | 2 (0.5)  |
| Infected                         | 0 (0.0)  |
Table 2 summarizes all types of ODS used and recommended by HCWs to their patients. Among 367 participants, 203 (55.3%) used ODS and 120 (32.7%) recommended ODS to patients during the COVID-19 pandemic. It was found that the use of vitamin C was the highest (81.3%), followed by Multivitamin/ multimineral (MVMM) supplement (17.7%), vitamin B complex (17.7%), omega-3 (10.3%), and probiotics (9.9%). Both vitamin C (95.0%) and MVMM (32.5%) were also the most common ODS recommended to patients during the pandemic, followed by omega-3 (12.5%), vitamin B complex (10.0%), and probiotics (10.0%). HCWs were also asked how much on average they spent on ODS per month during the COVID-19 pandemic. The majority of the respondents (96.6%) reported their monthly expenses on ODS in median (IQR) was RM100.00 (110.00).

| Types of ODS                | Used personally (n = 203) | Recommended to patients (n = 120) |
|-----------------------------|---------------------------|----------------------------------|
|                             | n  | %  | n   | %  |
| Vitamin A                   | 6  | 3.0| 3   | 2.5|
| B complex vitamin           | 36 | 17.7| 12  | 10.0|
| Vitamin B12                 | 12 | 5.9| 3   | 2.5|
| Vitamin C                   | 165| 81.3| 114 | 95.0|
| Vitamin D                   | 7  | 3.4| 3   | 2.5|
| Vitamin E                   | 18 | 8.9| 6   | 5.0|
| Zinc                        | 14 | 6.9| 4   | 3.3|
| Selenium                    | 1  | 0.5| 0   | 0  |
| Magnesium                   | 6  | 3.0| 1   | 0.8|
| Multivitamin/Multimineral   | 36 | 17.7| 39  | 32.5|
| Omega-3                     | 21 | 10.3| 15  | 12.5|
| Probiotics                  | 20 | 9.9| 12  | 10.0|

ODS = Oral dietary supplements, HCW = Healthcare workers, COVID-19 = Coronavirus disease 2019

Our survey questions on the reasons for using and recommending ODS during the COVID-19 pandemic are summarized in Table 3. The most frequently reported reason for taking ODS was “to maintain overall health and wellness” (83.3%). The second highest reason was “to prevent getting infection” (58.6%) followed by “to strengthen the immune system” (24.6%). Similarly, the most commonly used reasons for recommending ODS to
patients were “to maintain overall health and wellness” (79.2%), “to prevent getting infection” (74.2%), and “to strengthen the immune system” (37.5%).

**Table 3.** Reasons for using and recommending ODS during the COVID-19 pandemic.

| Reasons                                           | Using ODS | Recommending ODS |
|---------------------------------------------------|-----------|------------------|
|                                                   | n = 203   | n = 120          |
| To maintain overall health and wellness           | 169 83.3  | 95 79.2          |
| Inadequate dietary intake and nutritional deficiency | 20   9.9   | 17 14.2          |
| To prevent getting an infection                   | 50 24.6   | 45 37.5          |
| To strengthen the immune system                   | 119 58.6  | 89 74.2          |
| To help cope with the adverse effects of conventional treatment | 3   1.5   | 4 3.3            |
| To help in the treatment of a specific disease    | 12 5.9    | 8 6.7            |
| Conventional treatment/modern medicine is not effective | 1 0.5    | 0 0.0            |

ODS = Oral dietary supplements, COVID-19 = Coronavirus disease 2019.

Meanwhile, Table 4 presented the feedback of the HCWs on the reasons for not using and not recommending ODS during the COVID-19 pandemic. Nearly 44% of them reported “dietary intake is adequate” as the main reason for not using ODS. Other reasons for not using ODS included “worried about its safety and adverse effects” (31.1%) which was second, followed by “do not know much about dietary supplements” (17.1%) and “worried about its potential drug-dietary supplement interactions” (11.6%). In contrast, the most common reasons for not recommending ODS to patients were “worried about its safety and adverse effects” (34.8%) and “worried about its potential drug-dietary supplement interactions” (31.6%), followed by “lack of scientific evidence on its effectiveness in disease treatment” (23.5%), “dietary intake is adequate” (22.3%), and “do not know much about dietary supplements” (18.6%).

**Table 4.** Reasons for not using and not recommending ODS during the COVID-19 pandemic.

| Reasons                                           | Not using ODS | Not recommending ODS |
|---------------------------------------------------|---------------|----------------------|
|                                                   | n = 164       | n = 247              |
| Lack of scientific evidence on its effectiveness in disease treatment | 13 7.9 | 58 23.5 |
| Worried about its potential drug-dietary supplement interactions | 19 11.6 | 78 31.6 |
| Worried about its safety and adverse effects | 51 31.1 | 86 34.8 |
| Dietary supplements are expensive | 11 6.7 | 28 11.3 |
| Do not know much about dietary supplements | 28 17.1 | 46 18.6 |
| Satisfied with conventional treatment/modern medicine | 17 10.4 | 18 7.3 |
| Dietary intake is adequate | 72 43.9 | 55 22.3 |

ODS = Oral dietary supplements, COVID-19 = Coronavirus disease 2019.

The association among socio-demographic, health-related characteristics, and ODS use during the COVID-19 pandemic is depicted in Table 5. We observed that personal ODS use during the COVID-19 pandemic was not associated with age, gender, marital status, ethnicity, religion, educational level, smoking status, alcohol consumption, or underlying non-communicable diseases. However, type of HCWs (P=0.001), monthly household
income ($P=0.019$), prior ODS use ($P<0.001$), and recommendation of ODS to patients ($P<0.001$) were significantly associated with personal ODS use during the COVID-19 pandemic, tested using Pearson Chi-square test.

**Table 5.** Association between socio-demographic, health-related characteristics, and ODS use during the COVID-19 pandemic.

| Characteristics                  | ODS users         | Non-users       | $P$-value |
|----------------------------------|-------------------|-----------------|-----------|
|                                  | $n = 203$         | $n = 164$       |           |
| **Age in years, median (IQR)**   | 32.0 (8.0)        | 31.5 (11.0)     | 0.811$^d$ |
| Gender                           |                   |                 |           |
| Female                           | 183 (90.1)        | 137 (83.5)      | 0.060$^b$ |
| Male                             | 20 (9.9)          | 27 (16.5)       |           |
| Marital status                   |                   |                 |           |
| Single                           | 55 (27.1)         | 49 (29.9)       | 0.471$^c$ |
| Married                          | 146 (71.9)        | 110 (67.1)      |           |
| Widowed                          | 1 (0.5)           | 3 (1.8)         |           |
| Divorced                         | 1 (0.5)           | 2 (1.2)         |           |
| Ethnicity                        |                   |                 |           |
| Malay                            | 128 (63.1)        | 110 (67.1)      | 0.662$^c$ |
| Chinese                          | 47 (23.2)         | 31 (18.3)       |           |
| Indian                           | 27 (13.3)         | 21 (12.8)       |           |
| Others$^d$                       | 1 (0.5)           | 2 (1.2)         |           |
| Religion                         |                   |                 |           |
| Islam                            | 129 (63.5)        | 114 (69.5)      | 0.164$^b$ |
| Buddhism                         | 43 (21.2)         | 25 (15.2)       |           |
| Christianity                     | 6 (3.0)           | 10 (6.1)        |           |
| Hinduism                         | 15 (7.4)          | 25 (15.2)       |           |
| Educational level                |                   |                 | 0.232$^b$ |
| Secondary school                 | 5 (2.5)           | 9 (5.5)         |           |
| Pre-University                   | 88 (43.3)         | 77 (47.0)       |           |
| Undergraduate                    | 74 (36.5)         | 58 (35.4)       |           |
| Postgraduate                     | 36 (17.7)         | 20 (12.2)       |           |
| Type                             |                   |                 | 0.001$^b$ |
| Allied health professions        | 12 (6.0)          | 29 (17.7)       |           |
| Doctors                          | 28 (13.8)         | 28 (17.1)       |           |
| Pharmacist                       | 51 (25.1)         | 26 (15.9)       |           |
| Nurse                            | 112 (55.2)        | 81 (49.4)       |           |
| Monthly household income         |                   |                 | 0.019$^b$ |
| < RM 4850 per month              | 63 (31.0)         | 70 (42.7)       |           |
| ≥ RM 4850 – RM 10 959 per month  | 107 (52.7)        | 80 (48.8)       |           |
| > RM 10 959 per month            | 33 (16.3)         | 14 (8.5)        |           |
| Smoking status                   |                   |                 | 0.736$^c$ |
| No                               | 198 (97.5)        | 161 (98.2)      |           |
| Yes                              | 5 (2.5)           | 3 (1.8)         |           |
| Alcohol consumption              |                   |                 | 0.284$^b$ |
| No                               | 186 (91.6)        | 155 (94.5)      |           |
| Yes                              | 17 (8.4)          | 9 (5.5)         |           |
| Co-morbid(s) present             |                   |                 | 0.827$^b$ |
| No                               | 164 (80.8)        | 131 (79.9)      |           |
| Yes                              | 39 (19.2)         | 33 (20.1)       |           |
Table 6 shows that most of the HCWs involved in this study did not receive any formal education or training about ODS (77.9%) but were interested in receiving continuing education about ODS (86.9%).

Table 6. HCWs’ education background and interest in receiving continuing education about ODS (n = 367).

| Variables                                      | Received formal education or training about ODS | Interested in receiving continuing education about ODS |
|------------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| Prior ODS use                                  |                                               |                                                     |
| No                                             | 192 (77.9)                                    | 48 (13.1)                                           |
| Yes                                            | 81 (2.1)                                      | 319 (86.9)                                          |
| Recommendation of ODS to patients              |                                               |                                                     |
| No                                             | 247 (104.51)                                  | 104 (51.2)                                          |
| Yes                                            | 120 (99.48)                                   | 99 (48.8)                                           |

COVID-19 = Coronavirus disease 2019, ODS = Oral dietary supplements, RM = Ringgit Malaysia. * Mann-Whitney Test, b Pearson Chi-square test, c Fisher’s exact test, d Including Kadazan, Dusun, and Siamese.

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| Variables                                      | Received formal education or training about ODS | Interested in receiving continuing education about ODS |
|------------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| Prior ODS use                                  |                                               |                                                     |
| No                                             | 192 (77.9)                                    | 48 (13.1)                                           |
| Yes                                            | 81 (2.1)                                      | 319 (86.9)                                          |
| Recommendation of ODS to patients              |                                               |                                                     |
| No                                             | 247 (104.51)                                  | 104 (51.2)                                          |
| Yes                                            | 120 (99.48)                                   | 99 (48.8)                                           |

HCW = Healthcare workers, ODS = Oral dietary supplements, TV = Television. * Including Google Search and Nurse.

4. Discussion

To our knowledge, this study is the first in the country to examine the use of ODS among HCWs during the COVID-19 pandemic. Socio-demographic and health-related characteristics were explored to understand the association of these factors with ODS use among HCWs. As such, the findings of this study will hopefully help support the development of nutritional guidelines and policies, education programs, and future studies related to dietary supplements in order to guide HCWs in providing the best advice to patients.

According to our survey, almost half of HCWs had used ODS before the COVID-19 pandemic. The Malaysian Adults Nutrition Survey 2014 (MANS 2014) conducted during a non-pandemic period among Malaysian adults showed that the prevalence of ODS use among adults in the general population was 59.1%[3]. Notably, the data showed that the use of ODS was less common among HCWs as compared to the general population during the non-pandemic period. Nevertheless, the consumption of ODS among HCWs increased during the COVID-19 pandemic as indicated by our study. The recent PLifeCOVID-19 Online Study conducted in Poland revealed that ODS was consumed more often during the first wave of the pandemic than in the second[32]. This trend might be due to the belief that ODS can give benefits and potentially prevent and help manage a variety of health conditions, including COVID-19 and other infections, although evidence to prove their efficacy with COVID-19
is still lacking\cite{8,24,27,31,33–35}. Similarly, a study in Korea also demonstrated an overall rise in CAM use by 21.4\% during the Middle East Respiratory Syndrome outbreak among outpatients\cite{16}. Another study also found that dietary supplements were one of the most commonly used CAM by patients with dengue fever\cite{21}. Therefore, like other members of the public, HCWs could be expected to consume dietary supplements for their health benefits during the outbreak of disease.

Our results suggest that the type of HCW (e.g., doctor, nurse, etc.) influenced the personal use of ODS during the COVID-19 pandemic. Concerning each type of HCW, ODS use was higher among nurses (55.2\%), followed by pharmacists (25.1\%), doctors (13.8\%) and allied health professionals (6.0\%). For comparison, the Healthcare Professionals Impact Study found that 72\% of physicians and 89\% of nurses used dietary supplements regularly, occasionally, or seasonally, whereas 51\% of physicians and 59\% of nurses used dietary supplements regularly\cite{15}. It is challenging to obtain reliable estimates of the prevalence of ODS use due to differences in definitions, frequency of use, diversity of dietary supplement formulations, and availability of dietary supplements\cite{5,36}. Overall, previous studies showed the prevalence of ODS use varying among HCWs, ranging from 21\% to 88\%\cite{12,37–39}. This study also found that monthly household income was significantly associated with the use of ODS. Those with a monthly income of more than RM 4 850 showed higher ODS use than those with a monthly income of less than RM 4 850. Interestingly, those with a monthly income of more than RM 10 959 showed the least use of ODS despite having a higher income. Nevertheless, our findings were consistent with previous studies suggesting that the relationship between ODS use among HCWs and monthly income remains unclear\cite{3,40}.

Apart from that, our study revealed a positive association between prior ODS use, recommendation of ODS to patients, and the use of ODS during the COVID-19 pandemic. Among ODS users during the pandemic, most of them had used ODS before the pandemic. Our study found that the majority of HCWs did not recommend ODS to patients. However, among those who did recommend ODS to patients, a large proportion of them used ODS during the COVID-19 pandemic themselves, which result was similar to other studies\cite{17,41,42}. One previous study revealed that personal use of dietary supplements was associated with a twofold increase in the likelihood that a pharmacist would recommend a dietary supplement to others\cite{43}.

Our results showed that the most commonly used and recommended ODS during the pandemic was vitamin C, followed by MVMM, and these results concurred with previous studies conducted in Malaysia and other countries before the COVID-19 outbreak\cite{3,15,16,38,44}. Another recent study conducted in Saudi Arabia during the COVID-19 pandemic discovered that almost all of the ODS users reported taking vitamin C\cite{45}. The high use of vitamin C could be related to recent studies that promoted vitamin C’s potential benefits as a prophylactic intervention to combat viral infection and as an immune modulator to mitigate the risk of contracting severe COVID-19\cite{10,46–49}. Selenium appeared to be the least consumed and recommended among HCWs which could be due to limited knowledge about this
supplement among HCWs. Nevertheless, previous studies suggest that it could contribute to the prevention and management of COVID-19 and other viral infections.

Our survey also revealed that HCWs commonly used ODS to maintain their overall health and wellness, strengthen their immune system, and prevent getting an infection during the COVID-19 pandemic. These findings were similar to the reasons reported in previous surveys of other HCWs and the general population during the non-pandemic period. Most of them used ODS as a complementary therapy and a primary prevention intervention rather than a substitute for conventional treatment. ODS should not replace a healthy and balanced diet. Promoting the health effects of ODS in a generally healthy population and, in particular, their effectiveness during a pandemic warrant further investigation. Since ODS, especially vitamin C and MVMM, are thought to boost immunity against infection during the pandemic, more studies or clinical trials should be conducted to explore their possible beneficial effects in prevention or management of disease. It is crucial to explore the exact intracellular mechanisms and anti-inflammatory and anti-oxidative activities of ODS.

While the majority of participants in this study used ODS during the pandemic, there were still almost half of them (44.7%) who did not. Most of those who did not use ODS believed that their dietary intake is adequate. Therefore, dietary guidelines provided by governing bodies play a crucial role in ensuring proper nutritional practices, such as eating a balanced diet and maintaining optimal health. Most of the HCWs who did not recommend the use of ODS to patients had concerns about their safety and possible adverse effects as well as potential drug-dietary supplement interactions. Indeed, many marketed ODS or nutraceutical products are not strictly regulated, thus their safety and efficacy can be questioned. It is important to evaluate the evidence regarding the use of such products especially relating to their safety, adverse effects, and drug interactions. Data from ongoing large randomized trials will be necessary to establish the role of ODS during a disease outbreak or pandemic.

In addition, our survey also revealed that most of the HCWs had not received any formal education or training regarding ODS but were interested to learn about it. In agreement with prior studies, most of the HCWs who were likely to recommend that their patients consume ODS would be interested in continuing medical education courses and training on various ODS therapies. The majority of HCWs expressed a marked preference and interest in integrative medicine modalities in the management of certain types of infectious diseases and their complications. Accordingly, it is hoped that our findings will help government, policymakers, and international organizations in efforts to provide effective guidelines and evidence-based recommendations for patient safety.

5. Limitation

Several limitations were encountered throughout this study. This was a questionnaire-based cross-sectional study in which we relied completely on information provided by the participants, and their responses could have been biased or based on a misunderstanding of
the questions. The results obtained are based on self-reported data rather than on direct observation or by interview which could over or underestimate the true use of ODS. Our study was conducted at only one district hospital and it is possible that the results may not be generalized to the majority of HCW in our country. In addition, the survey sample was not selected with true randomization methods but rather relied on a convenience sample. These limitations may affect the generalizability of the results. Nevertheless, it provides useful information and may serve as a benchmark for further study.

6. Conclusion

In summary, further research is required before evidence-based recommendations can be formulated. HCWs still share responsibility for providing correct information about ODS use. Given the weak evidence relating to the use of many ODS, there is a need to strengthen the health science curriculum to produce better informed future professionals. Lastly, the use of ODS should be evidence-based to ensure patient safety.

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