

The Use of Complementary Alternative Medicine in HIV-infected Patients during COVID-19 Pandemic: Its Related Factors and Drug Interactions with Antiretroviral Therapy

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ABSTRACT

Background: The use of complementary and alternative medicine (CAM) is widespread among patients with chronic disease despite lack of supporting evidence for most CAM types. Concerned regarding higher risk of COVID-19 for HIV-infected patients, probably increase the use of CAM during COVID-19 pandemic in this population. This study aimed to assess the prevalence and factors related to CAM use among HIV-infected patients during COVID-19 pandemic, then identify drug- to-drug interaction (DDI) of antiretroviral (ARV) drugs with CAM that they used. **Methods:** The study was conducted in HIV Clinic Cipto Mangunkusumo Hospital in September-October 2021, specifically targeting adults HIV-infected patients routinely using ARV. Demographic and clinical data, including COVID-19 and vaccine history, were taken from clinic survey and hospital medical records data. **Results:** 554 of 1275 patients (43.5%) reported using any type of ingested CAM during COVID-19 pandemic, mostly vitamins and/or minerals. Factors related to CAM use were history of COVID-19 infection (aOR 2.28; 95% CI 1.65-3.14) and 2-5 years ARV duration compared to more than 10 years (aOR 1.4; 95% CI 1.02–1.91). Five known potential interactions involving 20 patients and two potential weak interactions involving 8 patients were found, but many of other interactions categorized as unknown. Only limited number of patients (3.8%) were aware about the drug interaction between ARV and CAM that they used. **Conclusion:** CAM was commonly used by HIV-infected patients on ARV during the COVID-19 pandemics, but patient awareness related to CAM-ARV drug interactions was extremely low.

Keywords: Complementary therapies, HIV, COVID-19, herbal, drug interactions.

INTRODUCTION

Complementary and alternative medicine (CAM) is a term for medical products and practices that are not part of standard medical care. CAM consists of various types, such as reflexology, herbal medicine, nutritional supplements, yoga, and acupuncture.¹ CAM is often used by patients with chronic diseases, including HIV. Previous studies have shown that many HIV-infected patients did not disclose their use of CAM to the doctors. The use of CAM is often based on the belief that it is more natural, and it can improve general health and ensure long term survival.²

Indonesia is a country with rich biodiversity, especially medicinal plants. More than 2500 species in Indonesia are recognized as medicinal plants.³ Based on data released by WHO on Traditional and Complementary Medicine (T&CM) in 2019, 40-59% of the Indonesian population used traditional and herbal medicine. However, percentage data on the type used was not available.⁴ Many studies reported that CAM was routinely used for HIV-infected patients since they were first diagnosed with HIV.^{2,5-13} Research on the use of CAM among HIV-infected patients in Indonesia is still minimal. A small study involving 88 HIV-infected patients in Jambi City, showed that all of them had used CAM. The types of CAM used were prayer, aromatherapy, cupping, herbal medicine, vitamin, and massage.¹⁴

Since the presence of COVID-19, research is still being carried out to find a definitive therapy or prevention. Patient immunity plays an essential role in COVID-19 infection. Herbal medicine and supplement were proposed to have immunomodulatory effects that can be preventive and even therapeutic agents for patients with COVID-19 disease.¹⁵ Public interest in CAM has increased drastically after the first confirmed case of COVID-19 was reported in Indonesia.¹⁶ Concern over the increased risk of developing severe COVID-19 for HIV-infected patients is based on the fact that they are more likely to be immunosuppressed.¹⁷ In a recent meta-analysis, HIV-positive individuals have a significantly higher risk of SARS-CoV-2 infection and risk of death, compared to people who are not infected with HIV.¹⁸ On this basis, HIV-infected patients

might use CAM to increase their immunity during the COVID-19 pandemic, in addition to the vaccine and their antiretroviral (ARV) therapy. However, clinicians have to be aware that almost all ARV classes have a potential drug interaction with other drugs, as substrate, inhibitor, and/or inducer of various enzymes and drug transporters in metabolic processes. Interaction of ARV drug with CAM can cause various clinical problems, particularly reducing the concentration of ARV drug, leading to treatment failure.^{6,19}

Therefore, the aim of this study was to describe CAM use among HIV-infected patients with ARV during the pandemic and its related factors. In addition, we would like to evaluate the drug- to-drug interaction (DDI) of ARV with CAM and whether the patients were aware of their drug interactions.

METHODS

This was a cross-sectional study of HIV-infected patients in HIV Integrated Clinic Cipto Mangunkusumo Hospital, Jakarta. Some of the data were taken from a routine survey among patients visiting the clinic in September and October 2021. The survey was planned to complete the medical history of the patients, such as partner testing, alcohol use, cigarette use, other drug use, and recent medical event, including COVID-19. The use of CAM was assessed by asking the patients non-judgementally whether they use ingested CAM at least once, including vitamins, herbal medicines, and supplements. Inclusion criteria were HIV-infected patients, aged above 18 years, using ARV, and have completely filled the clinic survey for COVID-19. Other clinical and demographic characteristics of the participants were extracted from hospital medical records. A standardized form was used when abstracting data from the survey and hospital electronic medical records, consisting of demographic and clinical information.

Ethics approvals were obtained from the Ethics Committee of the Faculty of Medicine Universitas Indonesia for the use of survey and routinely collected anonymous data with a waiver for informed consent.

Factors Associated with CAM Use

Demographic and HIV clinical data, as well as COVID-19 history, were evaluated as potential factors associated with CAM use. These include gender, age, HIV risk transmission, duration of antiretroviral therapy, using once-daily fixed-dose combination (FDC) ARV, history of COVID-19, and COVID-19 vaccine status.

Drug to Drug Interaction

For those who took CAM, drug interaction between each CAM use with ARV drug was assessed. References for classification of drug interaction were taken from the Indonesian National Guidelines of Clinical Management of HIV and Antiretroviral Therapy and Liverpool HIV interaction (Liverpool iChart).^{20,21} Moreover, we asked the patients' awareness of drug interaction between their antiretroviral drugs with the CAM that they used.

Statistical Analysis

Frequencies and percentages were used to describe categorical variables, and continuous variables were expressed as mean with standard deviation (SD) or median with interquartile range (IQR). Bivariate analysis was performed to compare variables related to the use of CAM during the COVID-19 pandemic. A logistic regression model was fitted using the backward stepwise selection process. Factors with $p < 0.25$ in the bivariate analysis were chosen for inclusion in the multivariate analysis. Factors with $p < 0.05$ were considered statistically significant in the final multivariate analysis. Data management and statistical analyses were performed using Statistical Package for Social Science program version 20.0 (SPSS Inc, Chicago IL, USA).

RESULTS

A total of 1278 HIV-infected patients joined the survey. However, three patients did not give the correct medical record numbers that can be linked to hospital medical record data, leaving 1275 data for the analysis. Most of them were male (68.1%), with a median age of 41 years (IQR 9). All participants have used various ARV drugs, with a median duration of nine years (IQR 7). Tenofovir (TDF)-based was the most common backbone NRTI used and EFV was the most

common anchor ARV used.

There were 183 participants reported to have COVID-19 infection from March 2020 to October 2021 (14.4%). Less than half of them (41.5%) have completed the first and second COVID-19 vaccination, but 33.6% have not been vaccinated at all. A total of 554 (43.5%) participants used any type of ingested CAM during the COVID-19 pandemic: 504 (39.5%) used vitamin and/or mineral, 88 (6.9%) used nutritional supplements, and 72 (5.6%) used herbal medicine, as shown in **Table 1**.

Factors Related to CAM Use

Gender, risk of HIV transmission, using once-daily FDC ARV did not relate to the use of CAM during the first and second wave COVID-19 pandemic in our participants, nor their

Table 1. Demographic and clinical description of participants

Characteristics		N = 1275	
Male gender, n (%)	Male	868 (68.1)	
	Female	407 (31.9)	
Age, years, median (IQR)		41 (9)	
HIV risk factor, n (%)	Heterosexual	641 (50.3)	
	Homo/bisexual	168 (13.2)	
	IVDU	355 (27.8)	
	Others	47 (3.7)	
	Unknown	64 (5.0)	
Backbone ARV, n (%)	AZT	594 (46.6)	
	TDF	681 (53.4)	
Anchor ARV, n (%)	NVP	433 (34.0)	
	EFV	628 (49.3)	
	LPV/r	144 (11.3)	
	DTG	69 (5.4)	
		9 (7)	
ARV duration, year, median (IQR)		9 (7)	
	History of COVID-19 infection, n (%)	Ever infected	183 (14.4)
		Never/unknown	580 (45.5)
Unknown		512 (40.2)	
COVID-19 vaccine, n (%)	Never	428 (33.6)	
	1 st dose	273 (21.4)	
	2 nd dose	529 (41.5)	
	3 rd dose	8 (0.6)	
	Unknown	37 (2.9)	
Use ingested CAM, n (%)	Yes*	554 (43.5)	
	No	(56.5)	

*Vitamin or mineral: 504 participants, nutritional supplement: 88 participants, and herbal medicine: 72 participants.
IVDU = intravenous drug user; ARV = antiretrovirus; AZT = azidiotidine/zidovudine; TDF = tenofovir disoproxil fumarate; NVP = nevirapine; EFV = efavirenz; LPV/r = lopinavir/ritonavir; DTG = dolutegravir

COVID-19 vaccine history, as shown in **Table 2**. HIV-infected patients who had experienced COVID-19 infection used CAM 2.28 times more often than those who never got infected

with COVID-19 (95% CI 1.65-3.14). CAM use was also more common in patients who had been treated with ARV drugs for 2-5 years compared to more than 10 years (aOR 1.41; 95% CI 1.02-1.91).

Table 2. Factors related to CAM use among HIV-infected patients on ARV during COVID-19 pandemic (n=1275).

Variable	CAM User n (%)	Non-CAM User n (%)	Bivariate		Multivariate	
			OR (95%CI)	p	aOR (95% CI)	p
Gender						
Female	183 (45)	224 (55)	1.11 (0.87-1.40)	0.445		
Male	369 (42.5)	499 (57.5)				
Age						
50 years and more	58 (36.3)	102 (63.8)	1.48 (0.89-2.44)	0.130	1.73 (0.99-3.03)	0.056
40-49 years	251 (44.2)	317 (55.8)	1.06 (0.70-1.62)	0.787	1.24 (0.77-2.02)	0.376
30-39 years	196 (44.1)	248 (55.9)	1.06 (0.69-1.63)	0.784	1.13 (0.71-1.81)	0.609
Less than 30 years	47 (45.6)	56 (54.4)	1		1	
Risk of HIV transmission						
Heterosexual	287 (44.8)	354 (55.2)	1.00 (0.77-1.30)	1.00	0.95 (0.71-1.25)	0.697
Homosexual	66 (39.3)	102 (60.7)	1.25 (0.86-1.82)	0.236	1.24 (0.81-1.91)	0.321
Others/Unknown	40 (36)	71 (64)	1.44 (0.93-2.24)	0.105	1.42 (0.87-2.31)	0.156
IVDU	159 (44.8)	196 (55.2)	1		1	
Using once-daily FDC ARV						
Yes	178 (44.2)	254 (58.8)	0.88 (0.70-111)	0.308		
No	374 (44.4)	469 (55.6)				
ARV duration						
0-1 years	52 (47.7)	57 (52.3)	0.94 (0.62-1.43)	0.788	0.94 (0.62-1.44)	0.777
2-5 years	107 (38.1)	174 (61.9)	1.40 (1.04-1.89)	0.028	1.41 (1.02-1.91)	0.027
6-10 years	169 (42.1)	232 (57.9)	1.18 (0.91-1.54)	0.218	1.17 (0.89-1.52)	0.265
More than 10 years	224 (46.3)	260 (53.7)	1		1	
COVID-19 infection history						
Ever	111 (60.7)	72 (39.3)	2.28 (1.65-3.14)	< 0.001	2.28 (1.65-3.14)	< 0.001
Never/Unknown	441 (40.4)	651 (59.6)				
Primary COVID-19 vaccine history						
Never/Unknown	195 (41.9)	270 (58.1)	1.17 (0.91-1.50)	0.218	1.24 (0.96-1.60)	0.098
First dose only	111 (40.7)	162 (59.3)	1.23 (0.92-1.66)	0.163	1.30 (0.96-1.75)	0.089
Complete (1 st and 2 nd dose)	246 (45.8)	291 (54.2)	1		1	

ARV = antiretrovirus; FDC = fixed-drug combination.

Description of CAM Use

Of 554 participants who reported using ingested CAM, the most common vitamin and mineral used was vitamin C (48.6%), followed by multivitamin (31.8%) and vitamin D (20.9%). Honey, omega 3, and propolis were the most common nutritional supplements used

by the participants (7.4%, 5.2%, and 1.8%, respectively). Echinacea, curcumin, and black cumin extract were the three most commonly used herbal medicines during the COVID-19 pandemic (2.9%, 2.5%, and 2.5%, respectively), as seen in **Table 3**.

Table 3. Description of CAM use and possible drug interaction with ARV drugs (n = 554)

	Frequency (%)	Drug interaction with ARV drugs	no of patients
Vitamin and Mineral			
Vitamin C	269 (48.6)	No interaction	
Multivitamin	176 (31.8)	potential interaction with DTG	10
Vitamin D	116 (20.9)	No interaction	
Vitamin B	69 (12.5)	No interaction	
Vitamin E	35 (6.3)	No interaction	
Iron	23 (4.2)	potential interaction with DTG	5
Zinc	20 (3.6)	No interaction	
Folic acid	12 (2.2)	potential interaction with DTG	3
Vitamin A	6 (1.1)	No interaction	
Nutritional supplement			
honey	41 (7.4)	Unkown interaction with ARV	41
Omega 3	29 (5.2)	Unkown interaction with ARV	29
Propolis	10 (1.8)	Unkown interaction with ARV	10
Virgin olive oil	8 (1.4)	Unkown interaction with ARV	8
Protein drink	3 (0.5)	Unkown interaction with ARV	3
Palm date	2 (0.4)	Unkown interaction with ARV	2
Albumin	1 (0.2)	Unkown interaction with ARV	1
Garlic	1 (0.2)	Potential interaction with NVP	1
Virgin coconut oil	1 (0.2)	Unkown interaction with ARV	1
Herbal			
Echinacea	16 (2.9)	No interaction	
Curcumin	14 (2.5)	Potential weak interaction with TDF	7
Black cumin extract (<i>habbatussauda</i>)	14 (2.5)	Unkown interaction with ARV	14
Traditional indonesian medicine (TIM)	10 (1.8)	Unkown interaction with ARV	10
Cordyceps spp (fungi) extract	8 (1.4)	Unkown interaction with ARV	8
Garcinia mangostana (<i>kulit manggis</i>) extract	8 (1.4)	Unkown interaction with ARV	8
Phylantus niruri (<i>meniran</i>) extract	6 (1.1)	Unkown interaction with ARV	6
Green tea extract	2 (0.4)	Potential weak interaction with TDF	1
Elderberry extract	2 (0.4)	Unkown interaction with ARV	2
Morindae spp (<i>mengkudu</i>) extract	2 (0.4)	Unkown interaction with ARV	2
Schisandra spp	2 (0.4)	Unkown interaction with ARV	2
Zingiber officinale (<i>jahe merah</i>) extract	2 (0.4)	No interaction	
Annona muricata (<i>daun sirsak</i>) extract	1 (0.2)	Unkown interaction with ARV	1
Cantella asiatica (<i>daun pegagan</i>) extract	1 (0.2)	Unkown interaction with ARV	1
Ginkgo biloba	1 (0.2)	Potential interaction with EFV	1
Moringa spp (<i>daun kelor</i>) extract	1 (0.2)	Unkown interaction with ARV	1
Panax ginseng	1 (0.2)	No interaction	-
Pandanus conoideus (<i>buah merah</i>) extract	1 (0.2)	Unkown interaction with ARV	1
Sausera costus extract (<i>Qustul Al Hindi</i>)	1 (0.2)	Unkown interaction with ARV	1

ARV = antiretrovirus; TDF = tenofovir disoproxil fumarate; NVP = nevirapine; EFV = efavirenz; DTG = dolutegravir.

Drug interaction of CAM with ARV drugs

As shown in **Table 3**, we found 5 potential (moderate) interactions of CAM with ARV drugs: 1). multivitamin with DTG, involving 10 patients; 2). iron with DTG (5 patients); 3). folic acid with DTG (3 patients); 4). garlic with NVP (1 patient); 5). ginkgo biloba with EFV (1 patient). Potential weak interactions were found between curcumin and TDF (7 patients) and green tea extract with TDF (1 patient). No known major drug interaction was found. However, we could not define the interaction between 8 of 9 types of nutritional supplements and 13 of 19 types of herbal medicines with ARV drugs.

Of 554 patients who used CAM with ARV drugs, only 21 patients (3.8%) were aware of drug interactions, some of them had discussed with the physicians before. Many others just thought that CAM would improve their health and well-being during the pandemic.

DISCUSSION

The prevalence of CAM users found in this study was 43.5%. This result was comparable to other studies among HIV study population before the COVID-19 pandemic, ranging from 1.8% to 96.8%. This wide range of variability was likely to occur due to the differences in CAM definition used between studies. The CAM reported in this study was ingested CAM, consisting of vitamins and/or minerals, nutritional supplements, and herbal medicines, while other studies included spiritual therapy, energy therapy, and mind-body therapy as part of CAM modalities.^{2,5-13} The other possible cause in this varied result was the different methods to assess the CAM use among the study populations, sample size, and period of study data collection. In this study, the data was reported from a routine survey among patients visiting the HIV Integrated Clinic Cipto Mangunkusumo Hospital by directly asking the patient whether they used ingested CAM during the COVID-19 pandemic. Face-to-face interview to 343 patients using a questionnaire in Trinidad reported 32.8% patients using CAM.⁷ Anonymous survey conducted to 1211 adult patients in clinics across Australia reported 53% patients using CAM.⁹ This difference of method might partly be a factor that affected patients'

disclosure of CAM use, but the rate of disclosure was not further evaluated in this study.

Among CAM modalities used in our patients, vitamins and/or minerals were the most common (39.5%), followed by nutritional supplements (6.9%), and herbal medicines (5.6%). Studies conducted in high-income countries like Australia and USA reported vitamins and minerals supplementation as the most common CAM,^{9,11} while in low-middle income countries, such as Trinidad, Ethiopia, and Lebanon, herbal medicines emerged as the most common type of CAM used.^{2,7,10,13} Nevertheless, we could not directly compare our findings with these studies since our study described only the situation during the COVID-19 pandemic. Unfortunately, we did not have the data on the use of CAM before 2020.

This study was conducted after the second wave of the COVID-19 pandemic in Indonesia when a total of 14.4% participants had ever been infected with COVID-19. The prevalence might be higher because we only included HIV-infected patients who had recovered from COVID-19 infection and joined the survey in the clinic. Referring to two recent meta-analysis, HIV-positive individuals had a higher risk of getting SARS-CoV-2 infection and risk of death.^{18,22}

When the survey was conducted, the free COVID-19 vaccine had become an Indonesian government program for the general public for about 4 months. A total of 63.5% of participants had been vaccinated: 21.4% had first dose vaccination only, 41.5% had second dose vaccination, and 0.6% had the third dose. The Indonesian Food and Drug Administration has granted emergency use permits for ten types of COVID-19 vaccines: Sinovac, AstraZeneca, Sinopharm, Moderna, Pfizer, Novavax, Sputnik-V, Janssen, Convidencia, and Zifivax.²² However, 33.6% of subjects have not been vaccinated against COVID-19 for several possible reasons. One of the reasons was fear of being rejected when registering for vaccinations because of their HIV status. In addition, some vaccination sites require a certificate of eligibility for vaccination from a doctor. A study that predicts COVID-19 vaccine acceptance and practices among HIV-infected patients in

Indonesia is warranted.

This study investigated the use of complementary alternative medicine in HIV-infected patients during the COVID-19 pandemic along with the related factors. We found that history of COVID-19 infection was a significant factor of CAM use among people with HIV (aOR 2.8, 95%CI 1.65–3.14). In Iran, a study in the general population also showed that participants with COVID-19 infection history used CAM to treat and improve the symptoms of the disease during the COVID-19 outbreak.²³ During the COVID-19 pandemic, there has been an increase in demand for alternative medicines to increase immunity, prevent the body from being exposed to the virus, and provide additional treatment for COVID-19. Clinical pharmacists have been increasingly requested an information about dietary supplementation, vitamins, and any options on the shelves that could offer symptom relief and boost the immune system since the start of the COVID-19 pandemic.²⁴ A study in the general population also showed there was a significant increase in the use of CAM in those who have experienced symptoms of COVID-19 such as fever, cough and dyspnoea.²⁵

We also found that in people with HIV, ARV treatment duration of 2-5 years was a significant factor of CAM use with ARV duration of more than 10 years as reference (aOR 1.4; 95% CI 1.02–1.91). This result was different from a review that showed longer disease duration/time on ARV being one of the most common predictors of CAM use before the COVID-19 pandemic. Furthermore, CAM is often used to address the limitations of or problems with ARV during the period of ARV use.²⁶

Starting in 2020, the new class of ARV drug integrase inhibitors (INI) was introduced in Indonesia. Dolutegravir (DTG) as the only INI available was recommended in the first line and second-line ARV regimen due to its simplicity and high barrier of resistance. Polyvalent minerals such as calcium, magnesium, and iron can reduce the absorption rate of INI by chelation. Plasma DTG AUC, C_{max}, C₂₄ were reduced up to 39%, 37%, 39%, respectively when co-administered with 480 mg elemental calcium under fasting condition, and up to 54%,

57%, 56%, respectively when co-administered with 107 mg elemental iron under fasting condition.^{27,28} One study reported that virological failure was observed in 15% patients with DTG-based regimens with concomitantly used multivitamin/supplements containing polyvalent cations. Thus, calcium, magnesium, iron, zinc, or multivitamin supplement should be co-administered with DTG during meals or at least 6 hours before/2 hours after taking DTG if they are not co-administered with a meal.^{29,30} As vitamins and/or minerals were the most common CAM used in our setting, drug interaction with DTG was also common. With the increasing number of patients using a DTG-based regimen, clinicians should consider discussing CAM with HIV-infected patients as part of routine care, to ensure the success of ARV treatment.

In the community, supplements containing garlic were claimed to have several benefits for the health such as anti-cholesterol, antioxidant, antimicrobial, and immune-modulating effects. Despite these positive health effects, garlic has been shown to have drug interactions with some antiretrovirals. Garlic can inhibit or induce CYP450 and P-gp enzymes which can reduce the concentration of protease inhibitor antiretroviral drugs, especially saquinavir and ritonavir-boosted atazanavir. Garlic can reduce saquinavir AUC by up to 50%.¹⁹ In addition, treatment failure has also been reported in a one case report in a patient who took ritonavir-boosted atazanavir with 6 cloves of garlic 3 times a week, decreasing the drug concentration by up to 70%.³¹ The same effect is expected in HIV-infected patients who used nevirapine (NVP)-based regimen because they can induce CYP3A4 and/or P-gp, leading to reduce NVP concentration. Patients should be advised against the use of garlic supplements.²¹

Ginkgo biloba extract is an herbal supplement that contains flavonoids and terpenoids which have been implicated in the inhibition and induction of CYP3A4, UGT, and P-gp. This supplement has several positive effects on cognitive function, including improvement in concentration, memory, dementia, and depression.^{19,27} HIV-infected patients need to be cautioned on the use of this product because

of drug interaction with ARV, especially EFV. Ginkgo biloba extract would accelerate the hepatic clearance of EFV that affected the EFV serum concentrations to become lower by 38-62% following the initiation of supplements that contain GBE that can lead to a viral breakthrough. Naccarato, et al.³² reported one case that experienced virological breakthrough after 10 years of being on the same antiretroviral regimen due to drug interaction caused by a negative interaction of Ginkgo biloba on EFV. Until now, the interaction of TDF-based regimen with herbal supplements containing curcumin and green tea extract is still unknown. However, *in vivo* study showed that both curcumin and green tea extract inhibit P-gp enzyme that potentially makes unfavorable outcomes to patients taking TDF.²¹ Moreover, for most herbal medicines and nutritional supplements, no drug interaction information had been available of studied before, including for black cumin (*habbatussauda*) and traditional Indonesian medicine. Pharmacokinetic studies that evaluate the effect of various herbal medicines and nutritional supplements co-administered with current ARV are needed.

In this study, of 554 patients taking CAM, only 3.8% had knowledge of the interaction between ARV and CAM. This number was much lower than a study conducted in Lebanon that revealed nearly half of the CAM users were unaware of the potential interaction between the drug and the CAM they used.² The lack of knowledge about the potential interactions between ARV and CAM is due to the lack of education related to the potential interactions of drugs and CAM by the physicians and nurses who treat them and the lack of awareness of the patient to notify the doctor about the use of CAM. Based on our findings, special education for ARV drug interactions need to be designed for health care workers and patients.

This is the first report for the use of CAM in HIV-infected patients on ARV therapy during the COVID-19 pandemic. Although, the study involved a large number of participants, the selection of the patients was from a single HIV clinic in Jakarta. The attendees of the clinic tended to be lower to middle socioeconomic

status, which is not fully representative of HIV-infected patients in Indonesia. Secondly, we used a cross-sectional study design that has limited ability to define the causal association between the use of CAM and other related factors. Moreover, we were unable to follow the consequences of drug-to-drug interaction on the HIV treatment outcome. Finally, we utilized self-reported question which might not describe the actual condition and may cause recall bias.

CONCLUSION

This study revealed a prevalent CAM use among HIV-infected patients during the COVID-19 pandemic, with vitamins and/or minerals being the most reported modality. CAM usage was more common among COVID-19 survivors and patients who used ARV for 2-5 years. The lack of awareness related to CAM-ARV drug interactions shows the need to enhance the education for clinicians and patients on the proper use of CAM as complementary to ARV medication.

CONFLICT OF INTERESTS

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