Journal of Research in Pharmacy

Research Article

www.jrespharm.com

Self-medication Practices for COVID-19 Prevention: A Study among Medical Students in Yogyakarta, Indonesia

Putri Salisa MAULIDA [1], **Riana RAHMAWATI** [2*]

[1] Faculty of Medicine, Universitas Islam Indonesia, Yogyakarta, Indonesia.
[2] Department of Pharmacology, Faculty of Medicine, Universitas Islam Indonesia, Yogyakarta, Indonesia.
* Corresponding Author. E-mail: riana.rahmawati@uii.ac.id (R.R.); Tel. +62-274-898 444.

Received: 23 September 2022 / Revised: 29 January 2023 / Accepted: 30 January 2023

ABSTRACT: The corona virus disease 2019 (COVID-19) pandemic has increased the interest in self-care strategies, including self-medication. Medical students, as future health practitioners, learn more about medications than other students. This study aimed to describe self-medication practices for preventing COVID-19 among medical students at Universitas Islam Indonesia. This observational study used a cross-sectional design and was undertaken in November–December 2020. The study sample included 336 undergraduate medical students determined using a consecutive sampling technique based on inclusion and exclusion criteria. Data were collected using an online questionnaire about self-medication practices in the preceding 3 months. Among a total of 336 students, 137 (41%) reported using self-medication intending to prevent COVID-19, and 126 (92%) of these 137 took preventive supplements, mainly vitamins C, D, and E, and omega-3. Seven students reported the use of zinc, mainly in combination with other vitamins. Students who practiced self-medication lived closer to people confirmed with COVID-19, washed their hands more often, and desinfected their belongings more frequently than their counterparts ($p<0.05$). The mean duration for consuming vitamins was 11–16 days. Forty students (29%) used herbal medicine to prevent COVID-19; ginger, turmeric, honey, black seed, cutcherry, and Curcuma were the most often consumed herbal remedies. Fourteen students (10%) reported taking over-the-counter medications to relieve symptoms related to COVID-19, including antipyretic, analgesic, antiseptic, antihistamine, decongestant, antitussive, and expectorant medications. Most respondents (82%) purchased their medications at pharmacies, and 11 (9%) obtained them from online shops. These findings show the high rate of self-medication using vitamins and herbal remedies for COVID-19 prevention among university medical students. Further studies are needed to explore students' knowledge about the risks of self-medication including the use of herbal medicines.

KEYWORDS: COVID-19; self-medication; medical students; vitamin; herbal medicine

1. INTRODUCTION

Since the first case reported in Wuhan, China, corona virus disease 2019 (COVID-19) has spread worldwide. A high prevalence of self-medication use among people intending to prevent or treat COVID-19 symptoms has been reported [1, 2]. A study in Togo surveyed 955 people from several sectors (not limited to the health-care sector) and found that 34% practised self-medication to prevent COVID-19. Self-medication is defined as part of a patient's self-care by purchasing treatments without consulting a health professional [3]. This practice includes purchasing over-the-counter medications, supplements, or herbal medicine without prior consultation with a health practitioner. Despite the awareness of antibiotic resistance related to the inappropriate use of medication, self-medication with prescribed medication occurs at a higher rate, especially in low or middle income countries [4–6].

As future health practitioners, medical students learn more about medicine than students in other majors. Previous studies have reported self-medication practices among medical students [7, 8], pharmacy students [9, 10], nursing and midwifery students [11], and health-care workers [12]. A survey reported a high prevalence (51%) of self-medication among health science students in Peru [13]. However, to our knowledge, only one article published in English has reported on a self-medication practices among Indonesian medical students; this study involved a survey of 96 medical students in Yogyakarta province and found that 42% of respondents purchased antibiotics without a prescription [14]. Articles published in Bahasa have also reported self-medication practices among health science students [15, 16]. A survey of 41 Indonesia medical students reported that 46% consumed herbal medicine during the COVID-19 pandemic [17].

How to cite this article: Maulida PS, Rahmawati R. Self-medication Practices for COVID-19 Prevention: A Study among Medical Students in Yogyakarta, Indonesia. J Res Pharm. 2022; 26(7_special issue): 1960-1968.

ISSN: 2630-6344

http://dx.doi.org/10.29228/jrp.340

It appears that information about self-medication practices related to COVID-19 by Indonesian medical students is scarce. As for other health science students (e.g., pharmacy, nursing), medical students, should be prepared to assist patients in self-medicating appropriately [18]. During the COVID-19 pandemic, students have studied at home, which has limited their direct communication with lecturers. They may have had to choose COVID-related medications for themselves or their families on occasion. The objective of this study was to describe self-medication practices for COVID-19 prevention among medical students at Universitas Islam Indonesia (UII), Indonesia's oldest private university. Students at UII come across provinces in Indonesia and represent diverse communities. The findings of this study will provide information that may be useful to the medical curriculum on self-medication risks awareness and responsible self-medication.

2. MATERIALS AND METHODS

This study was performed in November–December 2020 and involved a descriptive observational study with a cross-sectional approach. The respondents were UII medical students who began their university studies in 2020 (first-year students) to 2017 (fourth-year students) who agreed to participate as respondents by completing the informed consent form and surveys through Google Forms. The total population was 646 students. A consecutive sampling method was applied in the sampling. The proportion estimation formula was used to determine the minimal sample size of 226 students (d=5%, p=34.2% [19], CI=95%). The sample size calculation used in this study is as follows.

$$n = \frac{Z^2_{\alpha/2}\, p(1-p)N}{d^2\,(N-1) + Z^2_{\alpha/2}\, p(1-p)}$$

The data for this study were collected via an online questionnaire (Google Forms). The questionnaire included questions about general characteristics (class year, sex, and residence); COVID-19-related variables (zone, case exposure, related symptoms, and prevention efforts); and self-medication practices (product content, duration of use, sources of information, and place of purchase). The data were then transformed into frequency distribution tables using SPSS 23.0 (IBM Corp, Chicago). Descriptive statistical analyses were performed to present the distribution and percentages for every item related to categorical variables. The participants were divided into two groups based on their self-medication practices to prevent COVID-19. The differences of sociodemographic and some COVID 19-related variables between the two groups were calculated. The Pearson's chi-square test, also known as the chi-square test for independence, was applied to determine whether the two or more categorical variables in a single sample are independent or related [20, 21]. Significance was defined as a p-value <0.05. The Medical and Health Research Ethics Committee, Faculty of Medicine, Universitas Islam Indonesia, granted ethical approval.

3. RESULTS

The questionnaire was piloted using seven medical students (class year 2016) and nine medical students from other universities. The questionnaire was then reviewed and improved based on the pilot feedback. Data were collected from the UII medical students from the classes of 2017 to 2020; the total number was 646 students. All students were invited through broadcasts sent to their class groups.

3.1. Characteristics of the respondents

The total number of respondents was 336 students. Most of the respondents (78%) were female. The highest response rate was in the oldest class year (fourth-year students). For the class years 2017, 2018, 2019, and 2020, the percentages of respondents were 39%, 18%, 25%, and 18%, respectively.

The respondents came from 23 of Indonesia's 33 provinces, representing more than two-thirds of the country's provinces. The highest percentage of participants was from Central Java (30%), followed by the Special Region of Yogyakarta (29%), West Java (14%), East Java (8%), and Banten (3%). All of these provinces are located on Java Island.

Based on the COVID-19 zoning in Indonesia, most of respondents lived in the orange zone (48%) and red zone (42%). Based on case exposure, 137 respondents (41%) said they lived near (within a maximum radius of 5 km) a person who had been confirmed positive for COVID-19. Two hundred students (59.5%) said they have travelled outside the city in the previous 3 months. A high percentage of respondents (95.5%) had no history of contact with COVID-19 patients and most (91%) had not experienced any of the disease's symptoms.

3.2. COVID-19 prevention

Respondents were asked about their COVID-19 prevention efforts during the preceding 3 months. As presented in Table 1, 38.7% of respondents said they always practised physical distancing, 58.3% that they always washed their hands, and 84.8% that they always wore a mask when going outside (84.8%). Only 27.7% of respondents said they always disinfected their belongings.

Table 1. COVID-19 prevention efforts among the respondents

COVID-19 prevention	Frequency	
	Total (n=336)	Percentage (%)
Physical distancing		
Seldom	2	0.6
Sometimes	41	12.2
Often	163	48.5
Always	130	38.7
Washing hands		
Seldom	1	0.3
Sometimes	20	6.0
Often	119	35.4
Always	196	58.3
Wearing a mask		
Seldom	1	0.3
Sometimes	0	0.0
Often	50	14.9
Always	285	84.8
Disinfecting belongings		
Never	7	2.1
Seldom	37	11.0
Sometimes	94	28.0
Often	105	31.3
Always	94	27.7
Self-medication practice		
Never	196	58.3
Consulation with a doctor	3	0.9
Self-medication and consultation with a doctor	1	0.9
Self-medication only	136	40.5

3.3. Self-medication practices

Self-medication was reported as a frequent method for preventing COVID-19. As shown in Table 1, 137 of the 336 respondents (41%) reported using self-medication practices. The frequency of respondents using self-medication ranged from 37% in class 2017 to 45% in class 2019. The types of self-medication included the use of supplements, herbal medicines, and modern medicines.

Table 2. Types of self-medication practices

Description	Frequency	
	Total	Percentage (N=137)
Supplements	**136***	**99.3%**
Vitamin C	120	87.6%
Vitamin D	29	21.2%
Vitamin E	31	22.6%
Omega-3	31	22.6%
Imboost ® (Echinacea purpurea, zinc pilocorpate)	13	9.5%
Vitamin B complex	7	5.1%
Multivitamin (unknown brand)	10	7.3%
Other supplements (imunostimulants, probiotic, zinc)	11	8.0%
Herbal	**40***	**29.2%**
Ginger	17	12.4%

Turmeric	14	10.2%
Honey	11	8.0%
Black seed	9	6.6%
Galangal	8	5.8%
Curcuma	5	3.6%
Tamarind	3	2.2%
Lemongrass	3	2.2%
Olive oil	2	1.5%
Other herbal products: spirulina, lemon, lime, Eucalyptus, cinnamon, sappan wood, jelly gamat	9	6.6%
Over-the counter medicines	**14**	**10.2%**
Paracetamol	6	4.4%
Ibuprofen	2	1.5%
Degirol® (Dequalinium Klorida)	1	0.7%
Other OTC-medicines: Panadol extra®, Bodrex extra®, Intunal®, Tuzalos®, Decolgen®	5	3.6%

Note: The total number of participants who practiced self-medication in each category indicated the use of two or more supplements/herbals/OTC-medicine in the preceding 3 months

The distribution of self-medication practices among the respondents based on sex, province, and COVID-related variables is shown in Table 3. According to the findings, respondents who self-medicated living closer to COVID-19 patients than their counterparts. In addition, these respondents washed and disinfected their belongings more frequently ($p<0.05$). Self-medication practices did not differ significantly ($p > 0.05$) according to the class year, gender, province, COVID-19 zone, travel history, wearing mask, or having contact with COVID-19 patients (Table 3).

Table 3. The distribution of self-medication practices based on sociodemographic and COVID-related variables.

Variables	Self-medication practices		p value
	Yes (n, %) N=137	No (n, %) N=199	
Year of study			
- 1 (2020 class)	27 (43.5%)	35 (56.5%)	0.671
- 2 (2019 class)	38 (45%)	46 (55%)	
- 3 (2018 class)	23 (38%)	37 (62%)	
- 4 (2017 class)	49 (38%)	81 (62%)	
Sex			
- Female	111 (42%)	151 (58%)	0.286
- Male	26 (35%)	48 (65%)	
Provinces			
- Within Java Island	122 (41%)	174 (59%)	0.733
- Outside Java Island	15 (37.5%)	25 (62.5%)	
Zone			
- Green	6 (43%)	8 (57%)	0.989
- Yellow	8 (38%)	13 (62%)	
- Orange	65 (41%)	96 (60%)	
- Red	58 (41%)	82 (59%)	
Symptoms related to COVID-19 (fever, cough, shortness of breath, fatigue, headache, or diarrhea)			
- Yes	14 (47%)	16 (53%)	0.561
- No	123 (40%)	183 (60%)	
Travel outside the city in the past 3 months			
- Yes	79 (39.5%)	121 (60.5%)	0.574
- No	58 (43%)	78 (57%)	

History of contact with COVID-19 in the past 3 months			
- Yes	6 (40%)	9 (60%)	1.000
- No	131 (41%)	190 (59%)	
Live near (with a 5-km radius) of a confirmed positive case			
- Yes	66 (48%)	71 (52%)	**0.024***
- No or don't know	71 (36%)	128 (64%)	
Physical distancing			
- Always	55 (42%)	75 (58%)	0.651
- Not always	82 (40%)	124 (60%)	
Wear a mask			
- Always	121 (42.5%)	164 (57.5%)	0.164
- Not always	16 (31%)	35 (69%)	
Wash hands			
- Always	90 (46%)	106 (54%)	**0.025***
- Not always	47 (34%)	93 (66%)	
Disinfect belongings			
- Always	48 (52%)	45 (48%)	**0.013***
- Not always	89 (37%)	154 (63%)	

*p value <0.05

3.4. Use of supplements

In the preceding 3 months, 126 of 137 respondents (92%) reported self-medicating with supplements intended for the prevention of COVID-19 (Table 2). The most frequently consumed supplements were vitamin C (95%), followed by vitamin E (25%), omega-3 (25%), vitamin D (23%), and other supplements (26%). Among the "other supplements" category, the most popular supplements were Imboost® (10.3%) and vitamin B complex (5.6%). Calcium, zinc, iron, immunomodulators, astaxanthin, probiotics, 4Life® Trans Factor, Starmuno®, Youvit®, Powteen®, Renovit®, Tonikum Bayer®, Immunos®, Roove®, Blackmores®, and other unbranded multivitamins were also categorized as others. The duration of supplement use was 1–30 days. The average duration for taking vitamin C was 14 ± 10 days. Vitamin D, vitamin E, and omega-3 supplements were consumed on average for 16, 13, and 11 days, respectively.

Respondents took supplements as self-medication mainly because of their previous experience (43%) and information from family members (30%). Other sources of information reported by respondents included lectures (17%), advertisements on social media (4%), pharmacists (4%), and friends (2%). Most of the respondents (82%) bought supplements at a pharmacy. Supplements were also purchased at a pharmacy, stall, minimarket, or supermarket. Eleven respondents reported purchasing these online through Shopee, Tokopedia, and Instagram. Four respondents said they received the supplements as a gift from relatives or friends.

3.5. Use of herbal medicines

Forty respondents (29%) reported self-medication with herbal medicine, comprising self-mixed components or ready-made products (Table 2). The average duration of taking herbal medicine was 10 days. Traditional herbs were consumed most often; these included ginger (42.5%), turmeric (35%), honey (27.5%), black cumin (22.5%), *Kaempferia galanga* (20%), and curcuma (12.5%). In Bahasa, these herbs are categorized as *empon-empon;* they can be served as a single herb or in a herbal combination. Several respondents also consumed tamarind, *wedang uwuh*, a traditional herbal drink made from steeping dried leaves and spices), lemongrass, propolis, olive oil, pandan, cinnamon, lemon, *Biancaea sappan*, lime, spirulina, eucalyptus, Soman®, Barefit® (*Zingiber officinale rhizoma, Cinnamomum burmannii cortex, Malus sylvestris fructus, Aqua cocos,* honey), Dunhard® *Dunaliella bardawil,* rapeseed oil, and soybean oil extract), Tolak Angin®, Jelly Gamat luxor® (sea cucumber), and Sancoidan® (*Laminaria japonica*). One of the herbal mixtures, Soman®, contained several herbal substances such as *Morinda citrifolia fructus, Garcinia mangostana fructus, Averrhoa carambola fructus, Averrhoa bilimbi fructus, Daucus carota tuber, Carica papaya fructus, Solanum melongena fructus, Musa acuminafe fructus, Momordica charantia fructus, Apium graveolens herba, Solanum tuberosum tuber, Pandanus conoideus fructus, Citrus maxima fructus, Solanum lycoprsicum fructus, Eagle marmelos fructus,* and *Pyrus marus fructus.*

In answer to the question about the source of information, respondents said that information about herbal medicines was received mainly from their family (40%) and previous experience (37.5%). Information was also obtained from friends (12.5%), advertisements on social media (5%), lectures (2.5%), and hadith (2.5%). In addition to pharmacies (22.5%) and drug stores (17.5%), respondents also bought herbal medicines at online stores (15%), markets (12.5%), supermarkets (2.5%), minimarkets (2.5%), and peddlers (2.5%). Five respondents (12.5%) mixed herbs by themselves. Five reported receiving herbs as a gift.

3.6. Use of over-the-counter (OTC) medicines

Among the 137 respondents who used self-medication, only 14 (10%) took any allopathic medicines, and fewer than 10% of respondents had COVID-19-related symptoms. No antimicrobial agents were taken by the respondents. The medications used were paracetamol, ibuprofen, and Degirol® (dequalinium chloride). Brand-name combination medications used in this study were Panadol® (paracetamol, dextromethorphan, phenylephrine, and pseudoephedrine), Bodrex extra® (paracetamol, ibuprofen, and caffeine), Intunal® (paracetamol, phenylpropanolamine HCl, dexchlorpheniramine maleate, dextromethorphan, and glyceryl guaiacolate), Tuzalos® (paracetamol, dextromethorphan, phenylpropanolamine HCl, and chlorpheniramine maleate), and Decolgen® (paracetamol, phenylpropanolamine, and chlorpheniramine maleate).

These OTC medications were taken to relieve symptoms such as fever, cough, fatigue, headache, nausea, or diarrhoea. The mean duration was 3.3 days. Respondents purchased medications from pharmacies (n=13) and drug stores. The type of medication was chosen mainly based on previous experience. Other sources of information were lectures, family members, and pharmacists.

4. DISCUSSION

A meta-analysis study reported that the self-medication rate is much higher among medical students than non-medical students [22]. During the preceding 3 months, 41% of the medical students in this study practised self-medication with the aim of preventing COVID infection. This prevalence is lower than that previously reported in a study from Pakistan, in which an online survey of 489 medical or pharmacy students showed that 83% of them practised self-medication during the COVID-19 pandemic [23]. A high prevalence of self-medication with the aim of maintaining health among medical students has been reported in studies in Indonesia (49%)[14] and other developing countries such as Nepal (80%) [8], Zambia (61%) [24], Serbia (80%) [7]and Iran (90%) [5].

In this study, the proportion of students who self-medicated for COVID-19 prevention was higher among those who lived near COVID-19 patients. Fear of COVID-19 infection and contact with suspects have been identified as factors that contribute to self-medication [25]. It was also found that the proportion of self-medication practice was higher among those who washed their hands and disinfected their belongings more frequently. However, the proportion did not differ according to other COVID-19 prevention efforts, namely physical distancing and wearing a mask. These findings should be cautiously interpreted as in this study the statistical test couldn't provide the causal relationship and strength of associations [20, 21].

As reported in previous studies, vitamins are taken most often for preventing COVID-19 [1, 19, 25]. The most commonly used supplement is vitamin C, a water-soluble vitamin with antioxidant, anti-inflammatory, antithrombotic, and immunomodulatory properties. Vitamin C neutralizes reactive oxygen species, restores vitamin E, and increasing iron uptake in the gut, and acts as a cofactor for enzymes, including alpha-ketoglutarate-dependent dioxygenases. These mechanisms are linked to the virucidal effect of vitamin C [26]. People who consume adequate vitamin C in their diet have milder and shorter viral infections. A randomized controlled trial [27] found that giving a daily dose of 30 mg of zinc and 1 g of vitamin C reduced common cold symptoms. According to a meta-analysis [28], adults who consume more than 0.2 g of vitamin C per day have shorter and milder colds.

The other vitamins that are often consumed for COVID-19 prevention are vitamin D and vitamin E. Vitamin D, also known as calcitriol, regulates the antimicrobial proteins cathelicidin and β-defensins, which protect the lungs against respiratory tract infections. By reducing the cytokine storm brought on by the innate immune system, vitamin D supports cellular immunity [29]. The innate immune system creates pro-inflammatory and anti-inflammatory cytokines in response to SARS-CoV-2 infection. By controlling the production of proteins for tight junctions, adherens junctions, and gap junctions—all of which can be damaged by viruses—vitamin D enhances the body's physical barrier [30]. The role of vitamin E in preventing COVID-19 is closely associated with its antioxidant activity. Alpha-tocopherol, a form of vitamin E, significantly reduces plasma levels of IL-6 and C-reactive protein [31].

The percentage of medical students who took herbal medicines in this study (29%) was lower than the 46% of 41 Indonesian medical students who reported that they consumed herbal medicine during the COVID-

19 pandemic [17]. In our study, the most commonly used herbal medicine was *empon-empon*. This term refers to rhizomes, such as ginger, turmeric, and galangal, used as traditional herbs. In this study, 42.5% of medical students consumed ginger, the rhizome of *Zingiber officinale*. The therapeutic activities of ginger in preventing COVID-19 relate mainly to its potential effects as an antiviral, immunomodulator, antioxidant, and anti-inflammatory agent [32].

Only 10% of respondents used allopathic medicines to relieve COVID-19-related symptoms such as fever, cough, shortness of breath, fatigue, headache, nausea, or diarrhoea. The medications used were antipyretic/analgesics (paracetamol, ibuprofen), decongestants (phenylpropanolamine HCl), antihistamines (chlorpheniramine maleate), antitussives (dextromethorphan), expectorants (glyceryl guaiacolate), or antiseptics (dequalinium chloride). These medications were previously identified as the most common medications used to prevent COVID-19 [2, 23]. In this study, no students used antimalarials or antibiotics, and all medicines used in this study are categorized as OTC drugs. By contrast, Pakistani medical students reported self-medication with azithromycin, hydroxychloroquine, ivermectin, doxycycline, and antivirals [23]. Antimicrobial resistance in developing countries is of concern, particularly in countries where antibiotics can be purchased without a prescription [33]. Antibiotics and antimalarials are still being debated as COVID-19 prevention measures [34, 35]. Despite the antimalarial, immunomodulatory, and antiviral effects of hydroxychloroquine, this medication should not be taken as a prophylactic medication for COVID-19.

Medical students have more opportunity to learn about diseases and medications than non-health science students. As future health professionals, they will need to decide on the best medications for self-medication for themselves, friends, relatives, and patients. Accordingly, they should be aware of the benefits and risks of self-medication such as OTC medicines, supplements, and herbal products. Awareness about the potential risks and drawbacks related to inappropriate self-medication is an important topic that should be taught in medical schools.

The findings of this study add to the understanding of COVID-19-related self-medication among medical students derived from Indonesian data. However, this study has limitations. The sample distribution was not proportional across the class years. A stratified random sampling technique would be preferable for future studies. To enrich the analysis of the safety issues, future studies should add questions about the dosing and frequency of medications and supplements used.

5. CONCLUSION

Over-the-counter supplements such as vitamins and herbal medicines were chosen by these medical students for the prevention of COVID-19. Given the high prevalence of self-medication among medical students, more studies are needed to understand better their knowledge of and attitudes toward the risks of self-medication and how to practise responsible self-medication.

Acknowledgements: We thank Faculty of Medicine Universitas Islam Indonesia, Yogyakarta, Indonesia for providing financial support to publish this manuscript.

Author contributions: Concept – R.R.; Design –P.S.M., R.R.; Supervision – R.R.; Data Collection and/or Processing – P.S.M.; Analysis and/or Interpretation – R.R., P.S.M.; Literature Search – P.S.M., R.R.; Writing – R.R., P.S.M.; Critical Reviews – R.R., P.S.M.

Conflict of interest statement: The authors declared no conflict of interest

REFERENCES

[1] Quincho-Lopez A, Benites-Ibarra CA, Hilario-Gomez MM, Quijano-Escate R, Taype-Rondan A. Self-medication practices to prevent or manage COVID-19: A systematic review. PLoS One. 2021;16(11):e0259317. [CrossRef]

[2] Ayosanmi OS, Alli BY, Akingbule OA, Alaga AH, Perepelkin J, Marjorie D, Sansgiry SS, Taylor J. Prevalence and Correlates of Self-Medication Practices for Prevention and Treatment of COVID-19: A Systematic Review. Antibiotics. 2022;11(6):808. [CrossRef]

[3] Bennadi D. Self-medication: A current challenge. J basic Clin Pharm. 2013;5(1):19. [CrossRef]

[4] Rodrigues CF. Self-medication with antibiotics in Maputo, Mozambique: practices, rationales and relationships. Palgrave Commun. 2020;6(1):1–12. [CrossRef]

[5] Abdi A, Faraji A, Dehghan F, Khatony A. Prevalence of self-medication practice among health sciences students in Kermanshah, Iran. BMC Pharmacol Toxicol. 2018;19(1):1–7. [CrossRef]

[6] Porter G, Kotwani A, Bhullar L, Joshi J. Over-the-counter sales of antibiotics for human use in India: The challenges and opportunities for regulation. Med Law Int. 2021;21(2):147–73. [CrossRef]

[7] Lukovic JA, Miletic V, Pekmezovic T, Trajkovic G, Ratkovic N, Aleksic D, Grgurevic A. Self-medication practices and risk factors for self-medication among medical students in Belgrade, Serbia. PLoS One. 2014;9(12):e114644. [CrossRef]

[8] Banerjee I, Sathian B, Gupta RK, Amarendra A, Roy B, Bakthavatchalam P, Saha A, Banerjee I. Self-medication practice among preclinical university students in a medical school from the city of Pokhara, Nepal. Nepal J Epidemiol. 2016;6(2):574. [CrossRef]

[9] Alsous M, Elayeh E, Jalil MA, Alhawmdeh E. Evaluation of Self-Medication Practice among Pharmacy Students in Jordan. Jordan J Pharm Sci. 2018;11(1).

[10] Sharif SI, Ibrahim OHM, Mouslli L, Waisi R. Evaluation of self-medication among pharmacy students. Am J Pharmacol Toxicol. 2012;7(4):135–40. [CrossRef]

[11] Williams A, Crawford K. Self-medication practices among undergraduate nursing and midwifery students in Australia: a cross-sectional study. Contemp Nurse. 2016;52(4):410–20. [CrossRef]

[12] Onchonga D, Omwoyo J, Nyamamba D. Assessing the prevalence of self-medication among healthcare workers before and during the 2019 SARS-CoV-2 (COVID-19) pandemic in Kenya. Saudi Pharm J. 2020;28(10):1149–54. [CrossRef]

[13] Miñan-Tapia A, Conde-Escobar A, Calderon-Arce D, Cáceres-Olazo D, Peña-Rios AJ, Donoso-Romero RC. Associated factors to self-medication with drugs related to COVID-19 in health science students from a peruvian city. In SciELO Preprints. 2020. [CrossRef]

[14] Sandhu S, Suryani Y, Dwiprahasto I, Atthobari J. A survey of antibiotic self-medication and over the counter drug use among undergraduate medical students in Yogyakarta, Indonesia. Southeast Asian J Trop Med Public Health. 2017;48(6):1290–8.

[15] Harun H, Herliani YK, Fitri SUR, Platini H. Swamedikasi pemakaian antibiotik pada mahasiswa Fakultas Keperawatan Universitas Padjadjaran. J Perawat Indones. 2021;5(2):755–8.

[16] Wulandari A, Permata M. Hubungan tingkat pengetahuan mahasiswa farmasi ISTN terhadap tindakan swamedikasi demam. Sainstech Farma. 2016;9(2).

[17] Septianawati P, Pratama TS, Pratiwi H, Sumoprawiro M. Pengetahuan Dan Sikap Terhadap Swamedikasi Obat Herbal Pada Mahasiswa Kedokteran Selama Pan-Demi Covid19. Herb-Medicine J: Terbit Berk Ilm Herbal, Kedokt dan Kesehat. 2020;3(2):39–45. [CrossRef]

[18] Chouhan K, Prasad SB. Self medication and their consequences: a challenge to health professional. Asian J Pharm Clin Res. 2016;314–7. [CrossRef]

[19] Sadio AJ, Gbeasor-Komlanvi FA, Konu RY, Bakoubayi AW, Tchankoni MK, Bitty-Anderson AM, Gomez IM, Denadou CP, Anani J, Kouanfack HR. Assessment of self-medication practices in the context of the COVID-19 outbreak in Togo. BMC Public Health. 2021;21(1):1–9. [CrossRef]

[20] Turhan NS. Karl Pearson's chi-square tests. Educ Res Rev. 2020;15(9):575–80. [CrossRef]

[21] Rana R, Singhal R. Chi-square test and its application in hypothesis testing. J Pract Cardiovasc Sci. 2015;1(1):69. [CrossRef]

[22] Behzadifar M, Behzadifar M, Aryankhesal A, Ravaghi H, Baradaran HR, Sajadi HS, Khaksarian M, Bragazzi NL. Prevalence of self-medication in university students: systematic review and meta-analysis. East Mediterr Heal J. 2020;26(7):846–57. [CrossRef]

[23] Yasmin F, Asghar MS, Naeem U, Najeeb H, Nauman H, Ahsan MN, Khattak AK. Self-medication practices in medical students during the COVID-19 pandemic: A cross-sectional analysis. Front Public Heal. 2022;10. [CrossRef]

[24] Banda O, Vlahakis PA, Daka V, Matafwali SK. Self-medication among medical students at the Copperbelt University, Zambia: A cross-sectional study. Saudi Pharm J. 2021;29(11):1233–7. [CrossRef]

[25] Wegbom AI, Edet CK, Raimi O, Fagbamigbe AF, Kiri VA. Self-medication practices and associated factors in the prevention and/or treatment of COVID-19 virus: a population-based survey in Nigeria. Front public Heal. 2021;635. [CrossRef]

[26] Shahbaz U, Fatima N, Basharat S, Bibi A, Yu X, Hussain MI, Nasrullah M. Role of vitamin C in preventing of COVID-19 infection, progression and severity. Aims Microbiol. 2022;8(1):108. [CrossRef]

[27] Vorilhon P, Arpajou B, Vaillant Roussel H, Merlin É, Pereira B, Cabaillot A. Efficacy of vitamin C for the prevention and treatment of upper respiratory tract infection. A meta-analysis in children. Eur J Clin Pharmacol. 2019;75(3):303–11. [CrossRef]

[28] Hemilä H, Chalker E. Vitamin C for preventing and treating the common cold. Cochrane database Syst Rev. 2013;(1). [CrossRef]

[29] Musavi H, Abazari O, Barartabar Z, Kalaki-Jouybari F, Hemmati-Dinarvand M, Esmaeili P, Mahjoub S. The benefits of Vitamin D in the COVID-19 pandemic: biochemical and immunological mechanisms. Arch Physiol Biochem. 2020;1–9. [CrossRef]

[30] Bae M, Kim H. The role of vitamin C, vitamin D, and selenium in immune system against COVID-19. Molecules. 2020;25(22):5346. [CrossRef]

[31] Asbaghi O, Sadeghian M, Nazarian B, Sarreshtedari M, Mozaffari-Khosravi H, Maleki V, Alizadeh M, Shokri A, Sadeghi O. The effect of vitamin E supplementation on selected inflammatory biomarkers in adults: a systematic review and meta-analysis of randomized clinical trials. Sci Rep. 2020;10(1):1–17. [CrossRef]

[32] Jafarzadeh A, Jafarzadeh S, Nemati M. Therapeutic potential of ginger against COVID-19: Is there enough evidence? J Tradit Chinese Med Sci. 2021;8(4):267–79. [CrossRef]

[33] Aslam A, Gajdács M, Zin CS, Ab Rahman NS, Ahmed SI, Zafar MZ, Jamshed S. Evidence of the practice of self-medication with antibiotics among the lay public in low-and middle-income countries: a scoping review. Antibiotics. 2020;9(9):597. [CrossRef]

[34] Das S, Ramachandran AK, Birangal SR, Akbar S, Ahmed B, Joseph A. The controversial therapeutic journey of chloroquine and hydroxychloroquine in the battle against SARS-CoV-2: A comprehensive review. Med Drug Discov. 2021;10:100085. [CrossRef]

[35] Bansal P, Goyal A, Cusick IV A, Lahan S, Dhaliwal HS, Bhyan P, Bhattad PB, Aslam F, Ranka S, Dalia T. Hydroxychloroquine: a comprehensive review and its controversial role in coronavirus disease 2019. Ann Med. 2021;53(1):117–34. [CrossRef]