Research Article
Sciences of Pharmacy

Self-Medication Practices among University Students during the COVID-19 Pandemic

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Abstract: Self-medication is a treatment effort often undertaken by students, especially when the burden on healthcare services increases due to the coronavirus disease 2019 (COVID-19) pandemic. Nevertheless, up to five years after the onset of the global pandemic caused by the SARS-CoV-2 virus, no empirical evidence has been found to elucidate the self-medication practice among students in Indonesia. This observational study with a cross-sectional design aimed to identify students' self-medication practices at a university during the second wave of the COVID-19 pandemic. The research data was collected online using a questionnaire (Google Form). The questionnaire used consisted of two parts: student characteristics and student self-medication practices. A total of 1,019 students were involved in this study. The most used drugs for self-medication by students were vitamins/multivitamins (91.66%) and analgesics (64.57%). Most medicines used by students were obtained from pharmacies (88.71%), while information related to drugs was obtained from recommendations from friends and family members (72.72%). The primary consideration that prompted students to self-medicate during the COVID-19 era was the easy access to medicines (83.81%). Students' self-medication practices during a health service delivery crisis can be irrational. As this study was conducted within a single institution using a specific sampling approach, the findings should be regarded as context-specific rather than broadly generalizable.

Introduction

Coronavirus disease 2019 (COVID-19) is an acute respiratory tract infection caused by the novel coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The World Health Organization (WHO) declared COVID-19 a global pandemic in March 2020, coinciding with the first reported case in Indonesia. Since then, the number of cases in Indonesia has continued to rise, reaching its first peak on 30 January 2021 with approximately 14,500 new daily cases and 476 reported deaths. Over time, viral mutations led to higher transmissibility, resulting in a second peak in July 2021 with 56,757 new daily cases and a fivefold increase in mortality compared to the first peak (1). East Java was among the five provinces with the highest incidence of cases and deaths (2). This exponential increase placed a significant burden on healthcare systems, as the number of confirmed cases exceeded the facilities' capacity to provide adequate care. Contributing factors included shortages of healthcare professionals, limited isolation and intensive care units, inadequate medication supplies, and insufficient medical devices such as ventilators. Moreover, the limited number of hospitals providing COVID-19 inpatient services led to hospital bed occupancy rates exceeding 100% (3).

The reduced capacity of healthcare facilities during the COVID-19 pandemic has contributed to an increase in self-medication (4-6). This practice is widespread among students, with a systematic review by Kazemioula *et al*. (2022) reporting a higher prevalence compared to the general population (54.5% vs. 49.0%) (7). Students' tendency to self-medicate may be linked to the typically milder symptoms in this group, such as cough, headache, and fever, which lessen the perceived need for hospital care (8, 9). This behavior is consistent with the Health Belief Model, which suggests that lower perceived severity and manageable symptoms increase the likelihood of self-treatment, especially when combined with the convenience of medicine accessibility (10). In addition, the availability of online purchasing platforms and numerous pharmacies across Indonesia further facilitates this practice (6, 11, 12).

The self-medication practice, which is common among students during the COVID-19 pandemic, may contribute to an increased risk of irrational drug use. A study conducted by Nasir, Chowdhury, and Zahan (2020) demonstrated that 78.91% of participants had not been confirmed as having contracted the SARS-CoV-2 virus. This included individuals who had undergone a PCR test and tested negative (78

participants) and those who had not undergone a PCR test (416 participants). However, these individuals had used drugs for the treatment of the virus, the majority of such medications being classified as prescription-only medications. Among the participants who were not confirmed to have contracted the novel coronavirus, the most prescribed drugs were azithromycin (46.15%), doxycycline (32.19%), hydroxychloroquine (8.91%), and ivermectin (75.71%) (13). This finding indicates the existence of a potential risk for the irrational use of drugs in the COVID-19 pandemic, which could result in an increased prevalence of adverse drug reactions (ADRs) (13-15).

To ensure responsible self-medication practices during healthcare facility crises related to the COVID-19 pandemic, research is needed to provide an initial overview of self-medication practices among university students. At the time of this study, research on student behavior during the COVID-19 pandemic, particularly regarding self-medication practices, was still limited (16, 17). This study aims to provide an initial overview of self-medication practices among students at a private university in Surabaya.

Methodology

Research Design, Setting, and Participants

This study employs an observational, cross-sectional design, which was reviewed by the Institutional Ethical Committee of the University of Surabayaand obtained a research ethics permit (letter number 221a/KE/XII/2021). The study was conducted on undergraduate students at a private university in Surabaya, which has eight faculties: pharmacy, medicine, biotechnology, business and economics, law, creative industry, psychology, and engineering.

Population and Sample

The population of this study consisted of all active undergraduate students (n = 8,928) enrolled in programs across eight faculties at the time of the second wave of COVID-19 in Indonesia, from May to October 2021. The sampling technique used was non-probability sampling, with a minimum sample size of 988 students. This sample size was calculated using the Slovin formula (**Equation 1**), with a 3% margin of error.

Students involved in this study were those who met the inclusion criteria: individuals who used medications purchased without a doctor's prescription during the second wave of COVID-19 and those who volunteered to complete the questionnaire.

Research Instruments

The data collection process was conducted using a data collection sheet, designed in Google Form, which comprised two sections: student characteristics and student self-medication practices during the COVID-19 pandemic. The student characteristics section consists of five variables, including: gender, age, faculty of origin, working status of the students, and the profile of health workers who live with students. The section on students' self-medication practices in the COVID-19 pandemic consists of six questions, which were developed based on a comprehensive review of published articles (6, 18-27). Six questions about self-medication practices in this study include: 1) types of drugs used for self-medication, 2) source of drugs for self-medication, 3) sources of information on self-medicate drugs, 4) reason for self-medication during COVID-19 pandemic, 5) symptom improvement after self-medication, and 6) Action taken when symptom does not improve after using medication. Students can choose more than one answer to questions related to self-medication practices, numbers 1 to 4. Subsequently, the data collection sheet was validated for content and face validity by three experts with experience in questionnaire development and interest in clinical and community pharmacy research. Moreover, the face validation process was conducted on 30 students.

$$n = \frac{N}{1 + Ne^2}$$

Equation 1 | Description: n = sample size, N = total population, e = margin of error.

Data Collection

The data collection was administered online via Google Form, as the research was conducted during the ongoing pandemic, which did not allow for face-to-face data collection. The research team will contact the academic staff in each faculty to request permission to attend online lectures and collect data for this research. Once the lecturer has granted permission, the research team will give a brief explanation about the study and share a Google Form link with the students. The student's willingness to participate in this research is indicated by their selection of the option "Yes, I am willing to take part" on the informed consent form, which was provided at the initial stage of the online survey. Moreover, the research team contacted final-year students working on thesis research via WhatsApp, as they had not been reached via the online lectures. The data on final-year students was obtained from the administrative officers of each faculty, following permission from the faculty dean to access the information.

Data Analysis

The data will be analysed descriptively using the IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, New York, USA). Categorical data will be presented as frequencies (N) and percentages (%), while continuous data will be shown as mean values with standard deviations.

Results and Discussion

A total of 1,019 students were included in this study. The majority of participants were female (66.34%) and not currently employed (79.98%). Additionally, among the participants, only 13.05% lived with family members who worked in healthcare facilities. Further details regarding the characteristics of the students involved in the study are presented in **Table 1**.

The most commonly used drugs among students who practiced self-medication were vitamins and multivitamins (91.66%) (**Figure 1**). During the COVID-19 pandemic, students often preferred multivitamins because they were widely perceived to strengthen the immune system, were easily accessible over-the-counter, and were considered relatively safe compared to other medications (28, 29). These results are consistent with those reported by Yasmin *et al*. (2021), who found that multivitamins were the most commonly used drugs (56.0%) among health students in Pakistan during the COVID-19 pandemic (30). In addition to students, several published studies have demonstrated that health workers and the general public frequently use

Table 1. Sociodemographic characteristics of university students participating in the study on self-medication practices during the COVID-19 pandemic.

Characteristics	Number of students (%)
Gender	
Men	343 (33.66)
Women	676 (66.34)
Age (mean ± SD in years)	20.06 ± 1.56
Faculty of Origin	
Pharmacy	288 (28.26)
Medicine	53 (5.20)
Biotechnology	33 (3.24)
Business and economics	182 (17.86)
Law	123 (12.07)
Creative industry	66 (6.48)
Psychology	128 (12.56)
Engineering	146 (14.33)
Working status	
Full-time student	815 (79.98)
Working students	138 (13.54)
Students living with health workers	
No	886 (86.95)
Yes*[a]	133 (13.05)
Pharmacist	33 (3.24)
Pharmacy technicians	5 (0.49)
Midwife	20 (1.96)
Doctor[b]	45 (4.42)
Nurse	28 (2.75)
Others[c]	4 (0.39)

Note: *Participants could choose more than one answer. ([a]) Missing data (n = 66; 6.48%); ([b]) includes general practitioners, dentists, and veterinarians; ([c]) not specified (n = 2; 0.19%), nutritionists (n = 1; 0.10%), and acupuncture practitioners (n = 1; 0.10%). SD = standard deviation; TTK = pharmacy technician; AA = pharmacist assistant.

multivitamins to prevent and treat COVID-19 (4, 6, 31, 32). Multivitamins contain several types of vitamins and minerals, including zinc and selenium, which have antioxidant effects and roles in the immune system. This is confirmed by the findings of cohort studies conducted in three countries, which indicate that the utilisation of multivitamins is linked to a reduction in the likelihood of a positive test result for SARS-CoV-2 in the UK, USA, and Sweden, with a respective decrease of 13%, 12%, and 22% (33). A randomised controlled study conducted by Beigmohammadi *et al* (2021) with a total of 60 patients in the ICU compared laboratory parameters related to inflammation and duration of hospitalisation in the group of patients who received multivitamin supplementation (vitamins A, B complex, C, D, and E) compared to those who did not. The results showed that the multivitamin group had significantly ($p < 0.005$) lower blood sedimentation rates, C-reactive protein (CRP), interleukin 6 (IL-6), and tumor necrosis factor alpha (TNF-alpha) on day seven compared to patients who did not receive multivitamins. Additionally, patients in the multivitamin group experienced a shorter hospitalization time compared to the control group ($p < 0.001$). In contrast to the observed differences in laboratory parameters and length of hospitalisation, no significant differences were identified in mortality rates between the two groups (34).

The second most commonly used class of drugs among students during the COVID-19 pandemic was analgesics, including paracetamol, ibuprofen, and mefenamic acid. In addition to their analgesic effects, paracetamol, ibuprofen, and mefenamic acid also possess antipyretic properties (35-38). Before the onset of the COVID-19 pandemic, analgesic and antipyretic medications were the most commonly used drugs by the general public, including students, for self-medication to treat pain and fever (21, 39-44). In the context of the COVID-19 pandemic, the drug plays a role in disease management at different levels of severity, alleviating the most prevalent symptoms, such as fever and headache, as well as other symptoms like fatigue (8, 45-47). The tendency of students to purchase analgesics may be influenced by their ease of accessibility, as paracetamol and ibuprofen are widely available not only in pharmacies but also in supermarkets and small local shops. Furthermore, the relatively low cost of these commonly used analgesics, particularly paracetamol and ibuprofen,

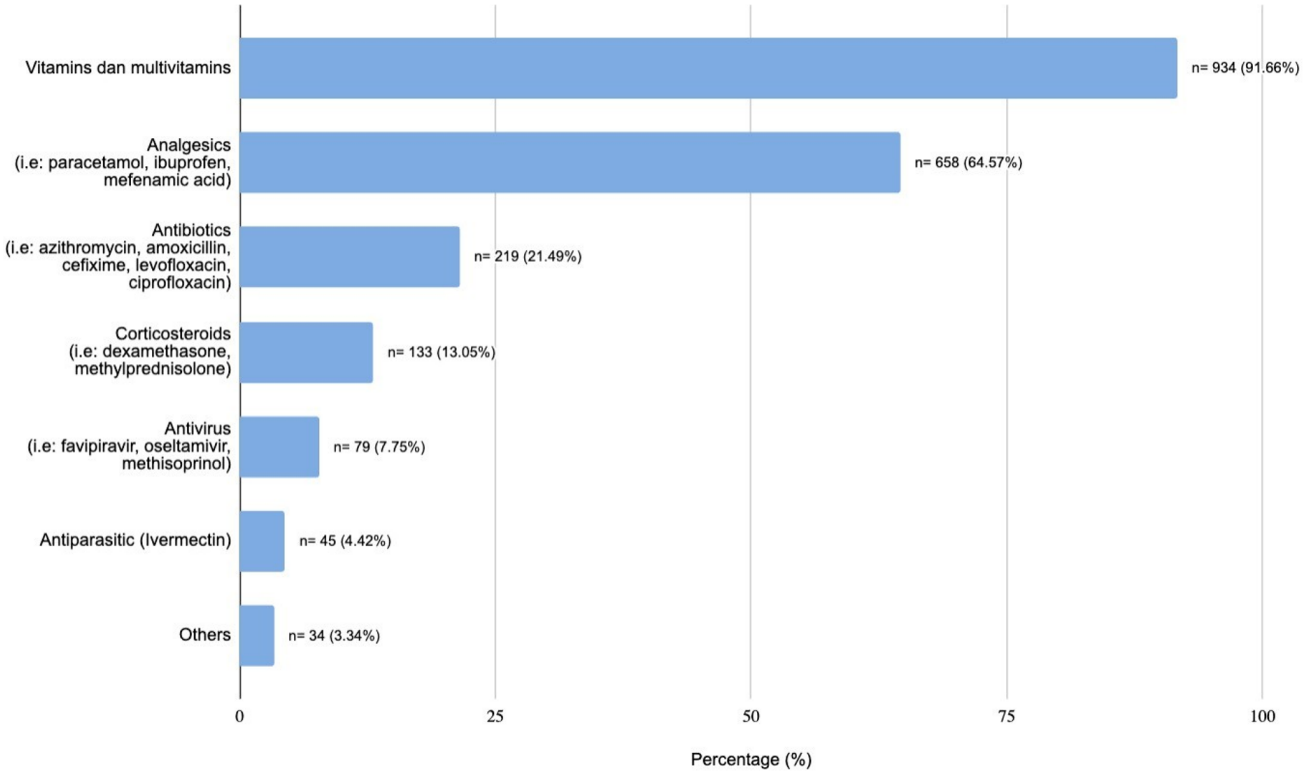

Figure 1. Types of medications used for self-medication among university students during the COVID-19 pandemic.

enhances their financial affordability, thereby reinforcing students' preference for self-medication with such drugs (48, 49).

It is also important to note that some corticosteroids, such as dexamethasone and methylprednisolone, are used by students. Corticosteroid medications constitute a class of drugs that are not included in the list of essential medicines (OWA) and should only be obtained with a physician's prescription (50). The inappropriate use of ethical drugs can result in adverse events, including the exacerbation of the underlying disease and, in some cases, even death. The use of corticosteroids in an inappropriate way can result in adverse drug reactions (ADRs), including hyperglycaemia, hypertension, an increased risk of infection, and gastrointestinal disorders (51). Based on the COVID-19 guideline, corticosteroids are administered solely to patients with severe or critical COVID-19 (8). It is inadvisable to self-medicate with corticosteroids in cases of COVID-19 until a qualified healthcare professional has conducted further investigations to assess the severity of the infection.

In addition to anti-inflammatory drugs, students are also using antibiotics and antiviral drugs. It is important to note that both classes of drugs should only be obtained by prescription. The self-medication with antibiotics during the COVID-19 pandemic has also been documented in several published studies from various countries, with a prevalence ranging from 20.8% to 45.8% (11, 19, 30, 31, 52-54). This is consistent with the findings of Nandi *et al*. (2023), which demonstrated that the sales of three classes of antibiotics, namely cephalosporins, penicillins, and macrolides, increased by 0.2% to 0.3%, 0.2% to 0.3%, and 0.4% to 0.6%, respectively, in 71 countries from 2020 to 2022 (55). In accordance with the 2022 guidelines for the treatment of patients with COVID-19 published by five professional organizations in Indonesia, antibiotics may only be administered to patients presenting with confirmed evidence of bacterial co-infection (8). Consequently, the self-administration of antibiotics is contraindicated, as their utilisation requires further examination by a medical practitioner to diagnose the presence of a co-infection or secondary bacterial infection in patients diagnosed with COVID-19. Furthermore, the overuse or misuse of antibiotics has the potential to increase the incidence of bacterial resistance (56, 57).

Ivermectin, which has been identified as an antiparasitic agent, is also a drug that is frequently utilised by the general public, including students, during COVID-19. At the time of this study, the use of ivermectin for treating patients with confirmed or suspected SARS-CoV-2 infections was not yet supported by evidence from well-designed clinical trials. Ivermectin is an antiparasitic agent that acts by increasing the influx of chloride ions into invertebrate cell membranes, resulting in membrane hyperpolarisation and subsequent paralysis (58). Several studies have sought to identify the mechanism of action of ivermectin in the context of SARS-CoV-2 infection. The potential mechanisms of action of ivermectin in SARS-CoV-2 infection include: (1) Inactivation of the virus when it is extracellular, (2) prevention of virus attachment, (3) prevention of virus replication, (4) prevention of the synthesis of specific viral proteins, and (5) prevention of assembly or release of new virions (58). Over time, research has been conducted to investigate the efficacy and safety of ivermectin in the context of the COVID-19 pandemic (59-63).

A review of the drugs used by students for self-medication reveals several irrational uses of drugs during crises at health facilities. This phenomenon can be attributed to several factors, including the fear of contracting the novel coronavirus (SARS-CoV-2) among the student population. During the second wave of the pandemic, the number of

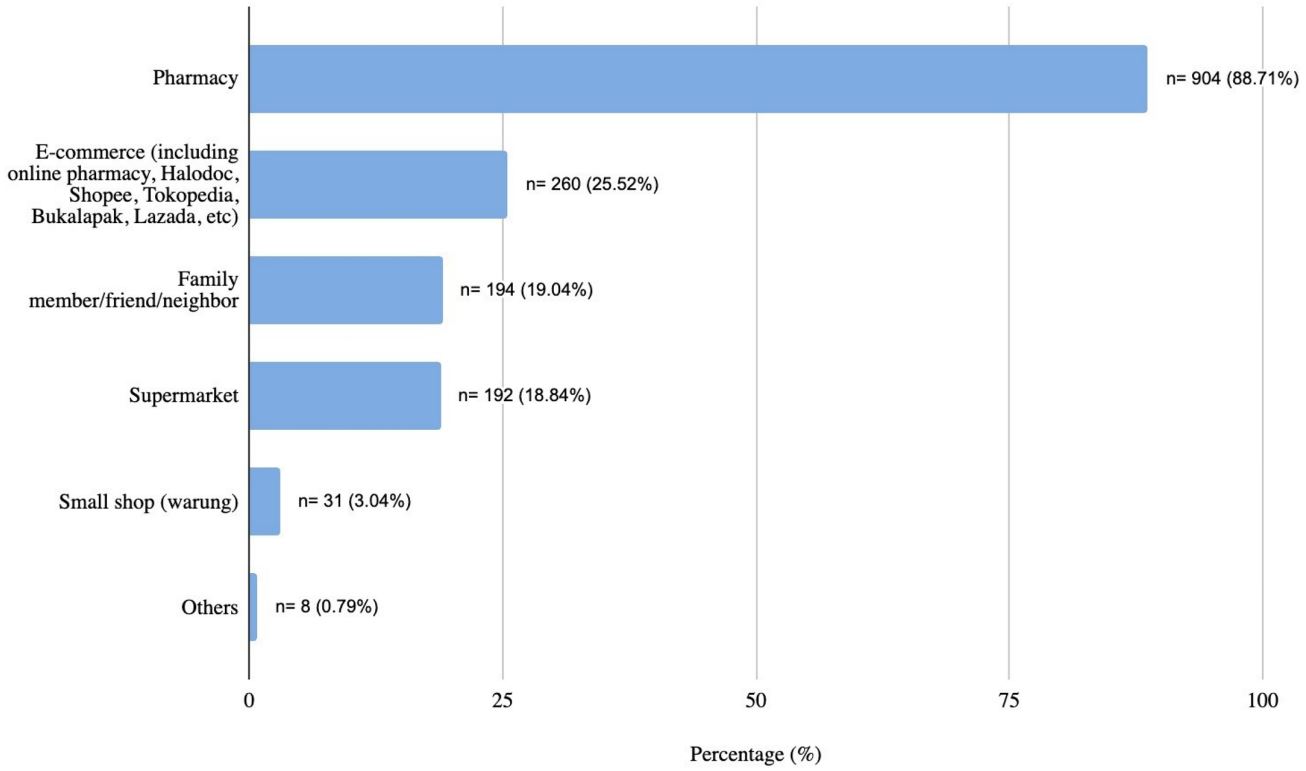

Figure 2. Sources of medications used for self-medication among university students during the COVID-19 pandemic.

confirmed SARS-CoV-2 cases increased significantly, resulting in a substantial increase in the burden on healthcare facilities (1). The constrained capacity of healthcare facilities to treat patients with COVID-19 resulted in many individuals who required intensive care being unable to receive it. Consequently, mortality rates associated with COVID-19 increased fivefold in comparison to the initial wave of infections (3). This phenomenon can lead to students buying a variety of drugs in anticipation of being infected, without considering the efficacy and safety of these drugs in treating the disease (64, 65).

The majority of the medicines used by students in this study (88.71%) were obtained from pharmacies (**Figure 2**). This finding is consistent with the results of several published studies, which indicate that pharmacies are frequently the source of self-medication drugs during the COVID-19 pandemic (6, 19, 66). One of the pharmaceutical care services provided by pharmacists in Indonesia is the selection of appropriate medications for self-medication. Pharmacists play a pivotal role in providing information and guidance to patients regarding self-medication for minor ailments, with a particular focus on selecting appropriate medicines in consideration of the patient's specific condition (67). In practice, students are still able to purchase several drug classes that are not intended for self-medication at pharmacies. One of the factors that may lead pharmacists to "serve" these drug requests is competitive business competition and the inconsistent implementation of drug sales policies (68-71). In some cases, pharmacists may choose to implement policies that restrict the sale of certain drugs, which are not intended for self-medication. However, this may lead to individuals seeking alternative sources for obtaining these drugs. For instance, in Indonesia, antibiotics can be readily obtained from informal marketplaces, such as stalls or kiosks (72, 73).

Information regarding the drugs used by students was primarily obtained from individuals who are close to them, such as friends and family members (**Figure 3**). Various reasons were identified for students' engagement in self-medication during the COVID-19 pandemic. The majority of students (83.81%) reported that the ease of access to medicines, either because the drugs were already available at home or could be readily obtained from nearby sources, contributed to the increased prevalence of self-medication practices. This finding suggests that keeping medicines at home serves as a strategic measure to anticipate future needs. Similar practices have also been documented in previous studies (74-80). The increased likelihood of storing medicines at home may be due to government regulations regarding social distancing, which limited students' mobility during the pandemic. In addition to these regulations, the accessibility of medications in healthcare facilities has been significantly limited throughout the ongoing pandemic, predominantly due to the exponential increase in COVID-19 cases. The limited access to drugs may contribute to a sense of insecurity among students, leading them to opt for the purchase and storage of medication at home for future use (81, 82).

The influence of medicine accessibility on self-medication has also been supported by other research. Heshmatifar *et al.* and Wegbom *et al.* (2021) reported that 15.5% and 21% of students, respectively, practiced self-medication during the COVID-19 pandemic due to the ease of access to medicines and the proximity of pharmacies (6, 11). Supporting this finding, data from the Indonesian Health Profile in 2022 showed that the number of pharmacies (32,282) was three to four times higher than the number of drugstores (8,691) during the second wave of the pandemic (83). Moreover, 25.5% of students in the present study obtained medicines through e-commerce platforms. Similar

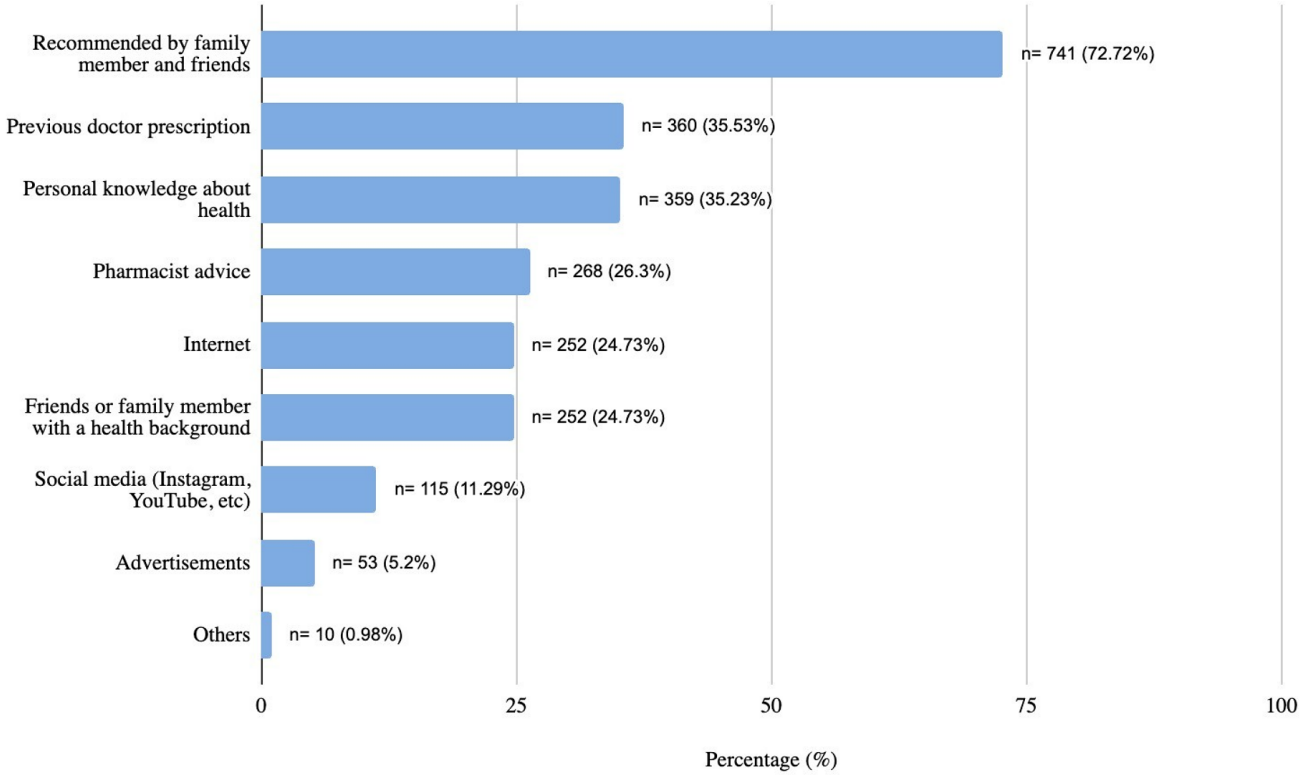

Figure 3. Sources of information influencing self-medication among university students during the COVID-19 pandemic.

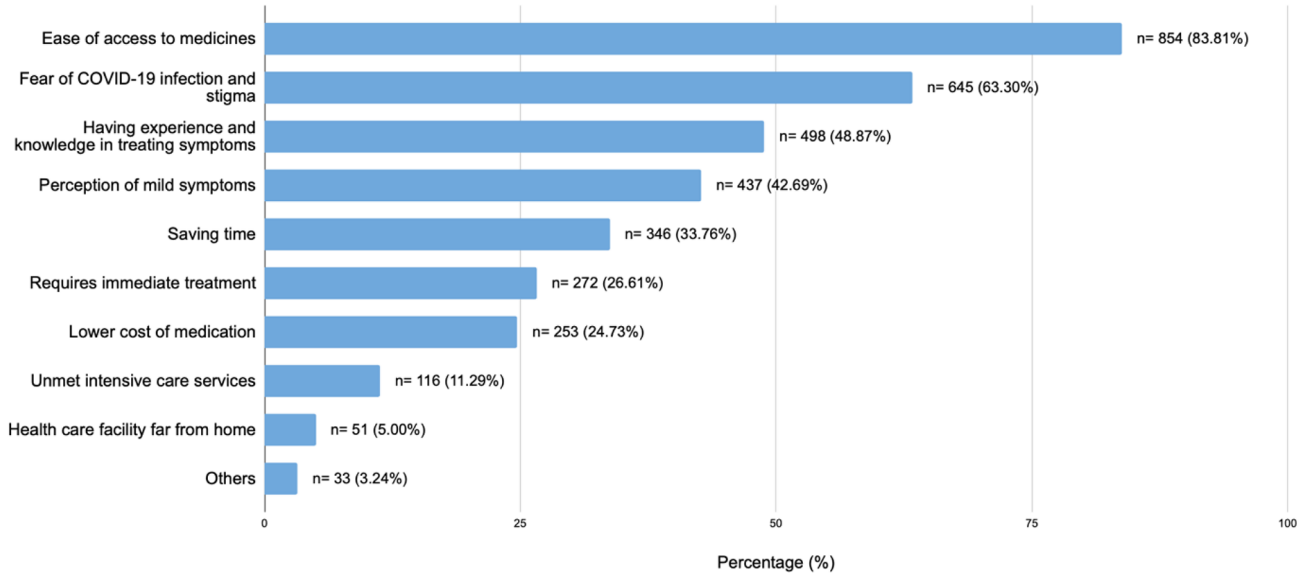

Figure 4. Factors influencing self-medication among university students during the COVID-19 pandemic.

findings were reported by Jairoun *et al*. in the United Arab Emirates, where 31.2% of participants purchased medicines online during the pandemic (12). Likewise, Ozawa *et al*. identified 117 websites in the United States selling dexamethasone, hydroxychloroquine, and lopinavir/ritonavir, of which 63.25% were unlicensed or potentially harmful (84). While online purchasing provides convenience, it also poses several risks. These include uncertainty about the authenticity of medicines, the possibility of purchasing falsified products, inappropriate drug selection due to misdiagnosis, and insufficient information that may lead to improper use and adverse drug reactions (12, 85, 86).

A total of 63.30% of the students in the study indicated that the reason for self-medication was the fear of COVID-19 infection and stigma (**Figure 4**). Similar findings were also found in several studies, which stated that the fear of being infected with the virus was a factor that encouraged students to self-medicate (5, 6, 11, 19, 87). Based on behavioural theory, specifically the Health Belief Model (HBM), an individual's behaviour may be influenced by their perception of susceptibility to illness. In the context of self-medication, as observed in this study, the fear of students contracting the SARS-CoV-2 virus is identified as the primary reason for self-medication (10).

More than 75% of students reported that their symptoms had improved after using medicines obtained through self-

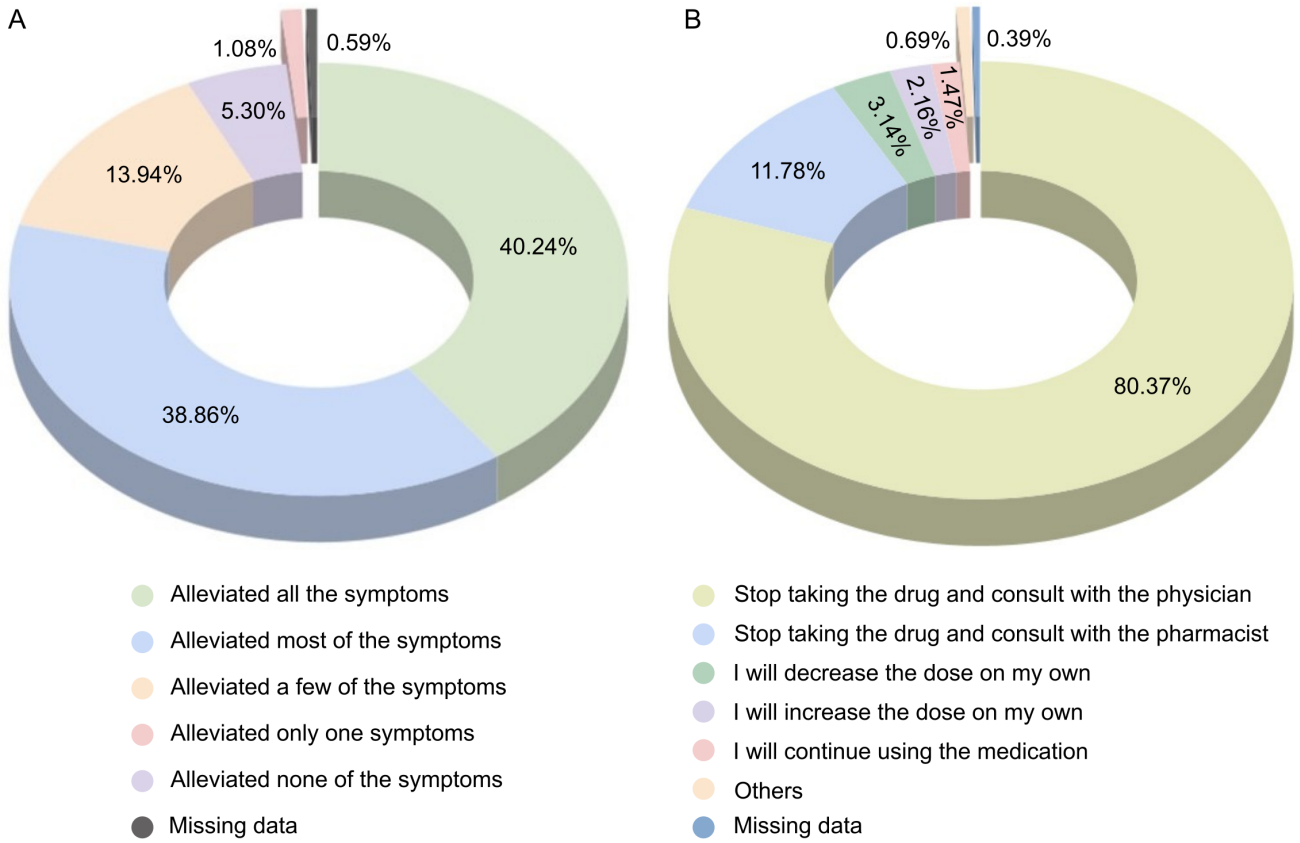

Figure 5. Perceived effectiveness and subsequent actions following self-medication among university students during the COVID-19 pandemic. (A) Reported effectiveness of self-medication in alleviating symptoms and (B) Actions taken when symptoms did not improve after using the medication.

medication (**Figure 5**). This finding is consistent with research conducted in communities in Peru, which showed that more than 70% of people reported an improvement in their condition after self-medicating during the COVID-19 era (23). The improvement in symptoms in this study may be attributed to the milder severity of COVID-19 in students compared to older individuals (8, 9). Based on the drugs used by students, vitamins and symptomatic drugs are the two most common drugs used by students. Both drugs are included in the standard COVID-19 treatment regimen at different levels of severity and have been shown to help relieve symptoms. In addition, COVID-19 is a disease caused by a virus; therefore, in younger age groups, such as students, COVID-19 can improve and recover (self-limiting) with symptomatic medications (8).

This study had some limitations. First, there is a potential recall bias among students when providing information related to self-medication practices, particularly regarding symptom improvement after self-medication, within the last six months. Second, this study used a non-probability sampling technique and was conducted at a single private university in Surabaya; therefore, the findings may not be generalizable to the broader university student population or to students from other universities with different characteristics from the study setting.

Conclusion

The crisis in healthcare services caused by the COVID-19 pandemic led students to do self-medication with various types of drugs. Vitamins and multivitamins are the most commonly used drugs by students. The majority of drugs used by students during the pandemic were obtained from pharmacies, and friends and family primarily provided information related to these drugs. The main reason students engage in self-medication is the availability of medicines at home, which facilitates easy access to medication when needed. More than 70% students reported that the symptoms improved after using the drugs.

Declarations

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Conflict of Interest
The authors declare no conflicting interest.

Data Availability
The unpublished data from this study are maintained by the researcher and are not publicly available in order to protect data confidentiality. Interested parties may contact the corresponding author to request access to the data, in accordance with ethical standards.

Ethics Statement
This study received ethical approval with number 221a/KE/XII/2021 from Institutional Ethical Committee of the University of Surabaya.

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Additional Information

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