



The prevalence of self-medication and its associated factors among college students: Cross-sectional study from Saudi Arabia

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ABSTRACT

Background: Self-medication with OTC or prescription drugs is widespread, may impair health, and leads to microbial resistance. Self-medication treats symptoms without a prescription. Self-medication is common among students across disciplines. Thus, this study evaluates medical and non-medical students' self-medication prevalence, knowledge, and variables.

Methods: 352 people completed a verified 25-item online questionnaire from September 5 to November 17, 2021. Self-medication and demographic characteristics such as gender, professional college, and family income were examined using a chi-square test of independence.

Results: 210 (59.6 %) participants were from the College of Medicine, and 142 (40.34 %) were from other professional health colleges. Health professional students self-medicated 55.9 %. This research found substantial connections between self-medication knowledge, gender, and family income. With a p-value of 0.0001, 32 % of women agreed that self-medication is safe, compared to 15.8 % of men. Female students were more likely than boys (61.9 % vs 38.1 %, p-value = 0.0291) to self-medicate as their initial therapy. Family income was also related to self-medication; 69.6 % of low-income pupils self-medicated to reduce doctor visits, p-value = 0.0477.

Conclusion: Students of all majors self-medicate. Medical students were more informed about generic drug safety and administration. There were substantial unfavorable sentiments regarding self-medication, highlighting the need for educational health activities to raise student understanding of its risks.

1. Introduction

Self-medication with prescription or OTC drugs is a big problem worldwide (WHO, 2023). Self-medication identified by utilizing previously prescribed or OTC drugs to without the assistance of a certified medical professional (Baracaldo-Santamaría et al., 2022; Cooper, 2011). Self-medication is often associated with OTC medications, including analgesics or painkillers (opioids and non-opioids) (Cooper, 2011; Power, 2011). Non-opioid analgesics such as non-steroidal inflammatory drugs or acetaminophen treat minor illnesses like the common cold, headaches, menstrual pain, and joint pain (Papich, 1997; Alshahrani et al., 2019; Rauschert et al., 2022). The overconsumption of

prescription-only drugs can result in some disadvantages and complications for human well-being, such as liver and kidney dysfunction, allergic reactions, rash, and diarrhea (Al-Ameri et al., 2017; Sánchez-Sánchez et al., 2021). Furthermore, drug interactions, the development of drug tolerance, and antibiotic resistance are common complications of unsupervised drug use. (Vacher et al., 2020; Indermitte et al., 2007).

The overuse and misuse of antibiotics in recent decades have accelerated the creation of resistant bacterial species (Wu et al., 2021; Wang et al., 2020). Antibiotics are essential in treating bacterial illnesses; children receive these treatments more often than any other therapy (Nicolini et al., 2014). Antibiotic self-medication in children is a serious public health problem contributing to antibiotic resistance. Parents who

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reused antibiotics to medicate their children were at risk, as were those who obtained antibiotics without a prescription (Esposito et al., 2022; Mubasher Rehman et al., 2020; Eltom et al., 2022). Faqihi et al. reported time savings, hospital anxiety, prior success with self-medication, availability of OTC medications, and family recommendations as the main drivers of self-medication at the student level (Faqihi and Sayed, 2021; Hong et al., 2005; Young et al., 2012). Additionally, descriptive research showed that self-medication to treat acne breakouts is widespread among undergraduate students in Saudi Arabia. This practice is made easier by the availability of topical antibiotics, acne medications, and knowledge obtained from peers or past prescriptions. Almost sixty percent of medical students have the appropriate information regarding acne treatment (Alrabiah et al., 2023).

A survey conducted in the United States of America found that 71 % of men and 82 % of women in the United States used previous medications in the six months prior (Manandhar, 2022; Brener, 2001). In addition, 75 percent of health conditions in the USA were managed with OTC opioids. The irrational use of these drugs has risen significantly, particularly among students (Hanauer et al., 2004; Noblin et al., 2020). According to a Baghdad study, college students' foremost medications were antipyretics and antibiotics (Sánchez-Sánchez et al., 2021). Perrot et al. reported that analgesics are frequently used without a prescription globally. Medication misuse or inappropriateness risks vary depending on the patient's frailty, such as the elderly and pregnant (Perrot et al., 2019). Therefore, pharmacists were encouraged to participate in future training programs and pain management standards. Also, Kiza et al., in a meta-synthesis, reported that young adults often use OTC analgesics to manage pain and other non-medically indicated disorders, such as anxiety and stress (Kiza et al., 2021).

Several studies illustrate that college students' willingness to contact health practitioners to pursue health-related treatment or access other health services is extremely poor (Alshogran et al., 2018). Another strong trigger for using over-the-counter drugs is social media's increased influence. Thus, students rely more on the Internet than on consulting healthcare practitioners for knowledge about their health (Kumar et al., 2013). Surprisingly, a study showed that 78.6 % of medical students in Ethiopia practice self-medication. This indicates that medical students indulge in self-medication despite knowing the ethics of drug consumption in clinical practice (Kumar et al., 2013; Bai and Ravikumar, 2016; Tesfaye et al., 2020). A previous study at Slovenia University aimed to compare self-medication prevalence among students, concluding that the prevalence among non-medical students was high (Klemenc-Ketis et al., 2010; Chautrakarn et al., 2021). In the United Arab Emirates, a study evaluated antibiotic utilization attitudes and behaviors among students who reported high consumption rates regardless of the student's specialty; comparable results were reported in Saudi Arabia (Albusalih et al., 2017; Al-Kubaisi et al., 2022; Sung and Chi, 2020). A single study, to the best of our knowledge, in Western Saudi Arabia compared the self-medication practice among university students [348]. The absence of similar studies in our population and the insufficient data regarding the prevalence, knowledge, and determinants of self-medication among medical and non-medical students were fundamental aspects of conducting this study, which aimed to investigate those areas.

2 Materials and methods

This cross-sectional study was done at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS)Jeddah campus in Saudi Arabia. A structured questionnaire was used to determine how common self-medication. The people in this study are full-time students in the College of Medicine, College of Nursing, and College of Applied Medical Sciences. The study was carried out between September and November 2021.

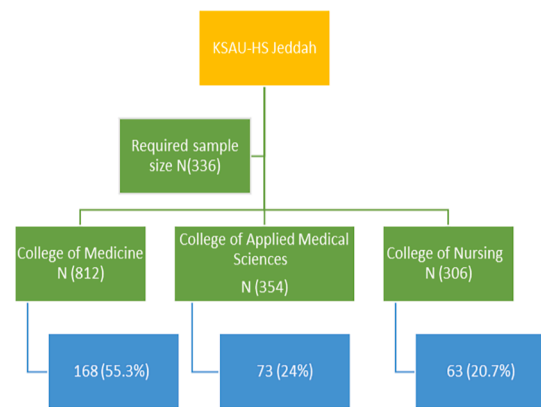


Fig. 1. The flow diagram depicting the sample size and quota sampling technique adopted in carrying out this study. The required sample size was 336; 168 (55.3%) students were selected from COM-J, 73 (24%) students were selected from CAMS, and 63 (20.7%) were from CON-J.

Table 1

Participants' Demographic Characteristics, including age, gender, professional colleges, academic level, and family income, presented in Saudi Arabian Riyal (SAR).

Demographic Characteristics	Variables	N (%) 352
Age category (years)	18–20	41 (11.65)
	21–23	284 (80.68)
	>24	27 (7.67)
Gender	Female	200 (56.82)
	Male	152 (43.18)
Professional Colleges	College of Medicine	210 (59.66)
	College of Applied Medical Sciences	79 (22.44)
	College of Nursing	63 (17.90)
Academic Level	4th year	235 (66.76)
	5th year	60 (17.05)
	6th year	18 (5.11)
	Medical Intern	39 (11.08)
Family Income (SAR)	<5.000	37 (10.51)
	5.000–10.000	54 (15.34)
	10.000–20.000	115 (32.67)
	>20.000	146 (41.48)

Saudi Arabian Riyal (SAR); 3.75 SAR = 1 USD

2.1. Sample size and sampling technique:

The required student number was determined using the proportion method, with 50 % of the proportion from a previous study in Saudi Arabia (Alshahrani et al., 2019). The estimated number was calculated with a 95 percent confidence level and % a margin of error to be 336 based on $(n = Z / (2) 2 pq/d^2)$. The required minimum sample size was determined to be. Thus, the quota sampling method was used for the selection from all three colleges, as shown in Fig. 1.

Table 2
Students' responses to the knowledge questions of self-medication and its relation to gender and professional colleges.

Knowledge questions		Gender			Colleges			P-value
		Male	Female	P-value	College of Medicine	College of Applied Medical Sciences	College of Nursing	
Self-medication is considered a safe practice	Agree	24 (15.8)	64 (32.0)	<0.0001	42 (20.0)	18 (22.8)	28 (44.4)	0.0002
	Neutral	67 (44.1)	106 (53.0)		102 (48.6)	41 (51.9)	30 (47.6)	
	Disagree	61 (40.1)	30 (15.0)		66 (31.4)	20 (25.3)	5 (8.0)	
Self-medication may lead to the risk of using the incorrect medicine	Agree	140 (92.1)	178 (89.0)	0.550	195 (92.9)	71 (89.9)	52 (82.5)	0.130
	Neutral	10 (6.6)	20 (10.0)		13 (6.2)	7 (8.9)	10 (15.9)	
	Disagree	2 (1.3)	2 (1.0)		2 (1.0)	1 (1.3)	1 (1.6)	
Self-medication may delay the diagnosis of diseases	Agree	117 (77.0)	150 (75.0)	0.880	169 (80.5)	53 (67.1)	45 (71.4)	0.057
	Neutral	25 (16.5)	37 (18.5)		33 (15.7)	18 (22.8)	11 (17.5)	
	Disagree	10 (6.6)	13 (6.5)		8 (3.8)	8 (10.1)	7 (11.1)	
Self-medication may lead to might result in dangerous drug responses.	Agree	139 (91.5)	161 (80.5)	0.005	185 (88.1)	64 (81.0)	51 (81.0)	0.080
	Neutral	13 (8.6)	33 (16.5)		24 (11.4)	13 (16.5)	9 (14.3)	
	Disagree	0 (0.0)	6 (3.0)		1 (0.5)	2 (2.5)	3 (4.8)	
Self-medication can lead to substance abuse.	Agree	122 (80.3)	163 (81.5)	0.690	172 (82.0)	64 (81.0)	94 (77.8)	0.890
	Neutral	20 (13.2)	28 (14.0)		27 (12.7)	10 (12.7)	11 (17.5)	
	Disagree	10 (6.6)	9 (4.5)		11 (5.2)	5 (6.3)	3 (4.8)	
Overuse of some drugs can result in drug resistance	Agree	137 (90.1)	187 (93.5)	0.370	192 (91.4)	74 (93.7)	58 (92.1)	0.620
	Neutral	13 (8.6)	10 (5.0)		15 (7.1)	5 (6.3)	3 (4.8)	
	Disagree	2 (1.3)	3 (1.5)		3 (1.4)	0 (0.0)	2 (3.2)	
One can use the same drug for a similar ailment anytime	Agree	21 (13.8)	44 (22.0)	0.019	35 (16.7)	12 (15.2)	18 (28.6)	0.0289
	Neutral	31 (20.4)	54 (27.0)		43 (20.5)	24 (30.4)	18 (28.6)	
	Disagree	100 (65.8)	102 (51.0)		132 (63.0)	43 (54.4)	27 (43.0)	
Reading medication instructions sheets is mandatory	Agree	134 (88.2)	182 (91.0)	0.520	185 (88.1)	74 (93.7)	57 (90.5)	0.570
	Neutral	13 (8.6)	15 (7.5)		18 (8.6)	5 (6.3)	5 (7.9)	
	Disagree	5 (3.3)	3 (1.5)		7 (3.3)	0 (0.0)	1 (1.2)	
In case of side effects, physicians' help must be sought	Agree	145 (95.4)	188 (94.0)	0.220	202 (96.2)	73 (92.4)	58 (92.1)	0.390
	Neutral	4 (2.6)	11 (5.5)		6 (2.7)	5 (6.3)	4 (6.4)	
	Disagree	3 (2.0)	1 (0.5)		2 (0.9)	1 (1.3)	1 (1.6)	
You can stop treatment as soon as the symptoms have disappeared	Agree	22 (14.5)	73 (36.5)	<0.0001	36 (17.1)	31 (39.2)	28 (44.4)	<0.0001
	Neutral	39 (25.7)	53 (26.5)		54 (25.7)	24 (30.4)	14 (22.2)	
	Disagree	91 (59.9)	74 (37.0)		120 (75.1)	24 (30.4)	21 (33.3)	

2.2. Data collection and analysis

A pre-designed structured questionnaire was developed based on Kumar et al., 2013, and (Uppal et al., 2014) and distributed using official emails (Kumar et al., 2013; Uppal et al., 2014). The questionnaire had six sections: demographic variables, practice, reasons, indications, knowledge, practice, attitude towards self-medication, and categories of drugs commonly self-prescribed. The questionnaire was validated utilizing eighty-seven responses, and Cronbach's alpha value was 0.84. The p-value will be considered significant at <0.05. JMP Statistics version 15. (JMP, Pro 15) was used for data analysis. This study was conducted based on ethics reference number SP21J/106/03, and informed consent was obtained from all subjects involved.

3 Results

3.1. Participants' demographic characteristics

In this study, of the 352 participants, 210 (59.7 %) were medical students, and 142 (40.3 %) were non-medical students from four professional colleges in Jeddah. Participants' median (Interquartile range) age was 20 (3), with slightly more females, 200 (56.5 %), than males, 152 (43.1 %). Most students (66.76 %) were in the fourth year of the medical program. Regarding family income, 261 (74.15 %) of the students reported having a family income of \$1000 or more. In this study, most respondents were single, 343 (97.44 %). Additionally, 40 subjects reported having chronic illnesses such as depression, pulmonary diseases, hypertension, and diabetes mellitus. Essential study characteristics are summarized in Table 1.

Table 3
Students' responses to the practice questions regarding self-medication.

Questions		N (%)
1. Do you use self-medication as a first form of treatment?	Yes	197 (55.97)
	No	155 (44.03)
2. When do you start using self-medication?	Immediately	114 (32.39)
	1–2 day	142 (40.34)
	One week	47 (13.35)
	More than a week	49 (13.92)
3. Do you check for the expiry date of the medications you use?	Yes	292 (82.95)
	No	60 (17.05)

3.2. Prevalence and knowledge regarding self-medication

The prevalence of self-medication was 55.9 %. Regarding knowledge, most students (90.3 %) agreed that self-medication might lead to administering the wrong medication, and three-fourths (74.9 %) reported that self-medication may delay the diagnosis of the disease. Most students (85.2 %) agreed that self-medication might lead to unexpected reactions. Of the study subjects, only 5.4 % disagreed that self-medication could lead to substance abuse. About (92.0 %) reported that overusing self-medication can result in drug resistance. More than 50 % of the students disagreed with the question, "One can use the same drug for similar ailments at any time." Most (89.8 %) agreed that reading medication instruction sheets is mandatory. Most subjects (94.6 %) agreed that physicians' help must be sought in cases of side effects. Knowledge regarding self-medication is summarized in Table 2.

Table 2 shows a statistically significant link between self-medication knowledge, gender, and professional college. Almost half of the participants (49.2 %) were neutral to the statement "self-medication is safe," and 64 females (32 %) showed a greater tendency to agree with the previous statement than 24 (15.8 %) males, p-value < 0.0001*. Additionally, the majority of 66 (31.4 %) medical students disagreed that self-medication is safe, in contrast to only 5 (8 %) non-medical students, p-value < 0.0002*. On the other hand, slightly more (59.9 %) of males than (37 %) of females disagree that treatment can be stopped as soon as symptoms have disappeared, p-value < 0.0001. However, 31 (39.2 %) medical students and 28 (44.4 %) nursing students agreed with the previously stated sentence in contrast to 36 (17.1 %) medical students' p-value < 0.0001*. Knowledge regarding self-medication concerning gender and professional college is summarized in Table 2.

3.3. The practice of self-medication

In this study, more than half of the students (55.9 %) utilized medication without a proper prescription as their first line of treatment. Most students (40.3 %) start self-medication within one to two days of becoming ill, while 32.4 % use unprescribed medication as soon as the first symptoms appear. In addition, the expiration date was checked by 82.9 % of the subjects before using it. Additionally, 77.8 % of students believed that using self-medication alone was sufficient to treat mild illnesses, while 78.7 % believed that time is saved by avoiding hospital visits for consultations. A chi-square test of independence was performed to examine the relationship between gender and the prevalence of self-medication. The relationship between these variables was significant: $X^2(1, N = 352) = 4.76, p = 0.0291$. Female students were more likely to practice self-medication than male students. More details are

Table 4
Students' responses to questions about factors associated with self-medication practices.

Questions	N (%)		
	Disagree	Neutral	Agree
1. Self-medication saves time	26 (7.4)	49 (13.9)	277 (78.7)
2. Self-medication is economical	51 (14.5)	88 (25.0)	213 (60.5)
3. Self-medication provides quick relief	32 (9.1)	52 (14.8)	268 (76.2)
4. Self-medication gives confidence	128 (36.3)	124 (35.2)	100 (28.4)
5. Self-medication minimizes physician visits	40 (11.4)	67 (19.0)	245 (69.6)
6. Self-medication is enough to treat Mild illnesses	17 (4.8)	61 (17.3)	274 (77.9)
7. Previous experience of the same ailment	26 (7.4)	72 (20.5)	254 (72.2)
8. Self-medication provides privacy	76 (21.5)	120 (34.1)	156 (44.3)
9. No hospital nearby	100 (28.5)	76 (21.6)	176 (50.1)

shown in Table 3.

3.4. Reasons for using self-medication

Most students (78.7 %) said self-medication eased their problems immediately. (72.2 %) of participants said their past experience with the same illness justified using the same medicine without renewing it. 69.6 % of students said self-medication reduces doctor visits, 60.5 % said it's inexpensive, and 45 % said they had a good family income. The association between family income and self-medication was examined using a chi-square test of independence. Self-medication was more common among high-income pupils (76.03 % vs 51.35). A statistically significant link between family wealth and considering limiting physician visits as a motive for self-medication was found: $X^2(6, N = 352) = 12.72, p = 0.0477$. About 30 % of students, mostly fourth-years (31.6 %), said self-medication provided them confidence. Academic level and "self-medication confidence" were linked. $X^2(6, N = 352) = 13.42, p = 0.0367$.

Over three-quarters of pupils said self-medication works quickly. About 72.2 % of participants say self-medication is justified by past experience with the same illness. 45 % of high-income students said self-medication reduces doctor visits, compared to 69.6 %. A statistically significant link between family income and reducing physician visits as a rationale for self-medication was found, 0.0477. About 60.5 % of students thought self-medication was cost-effective. Only 30 % of students, mostly fourth-years (31.6 %), said self-medication boosts confidence. Table 4 shows that "self-medication confidence" was associated with academic level with a p-value of 0.0367.

3.5. Indications, attitudes, and categories for self-medication:

Fig. 2 shows that headache, flu, and cough were the three most typical reasons for self-medication. Attitudes towards self-medication reflected that 40 % of the students agreed that self-medication could be advised to or taken from others. Most students (94 %) believed that self-medication needs monitoring, and almost half of the students were comfortable using self-medication. About 101 (28.69 %) of the fourth-year students believed that self-medication could be advised by and to others compared to students at other academic levels, such as the fifth, sixth, and intern years, who reported 15 (4.26), 10 (2.84), and 15 (4.26), respectively. The reported p-value was significant, = 0.0022, as presented in Table 5. Additionally, the most common categories of self-prescribed drugs were analgesics, followed by antipyretics, as shown in Fig. 3.

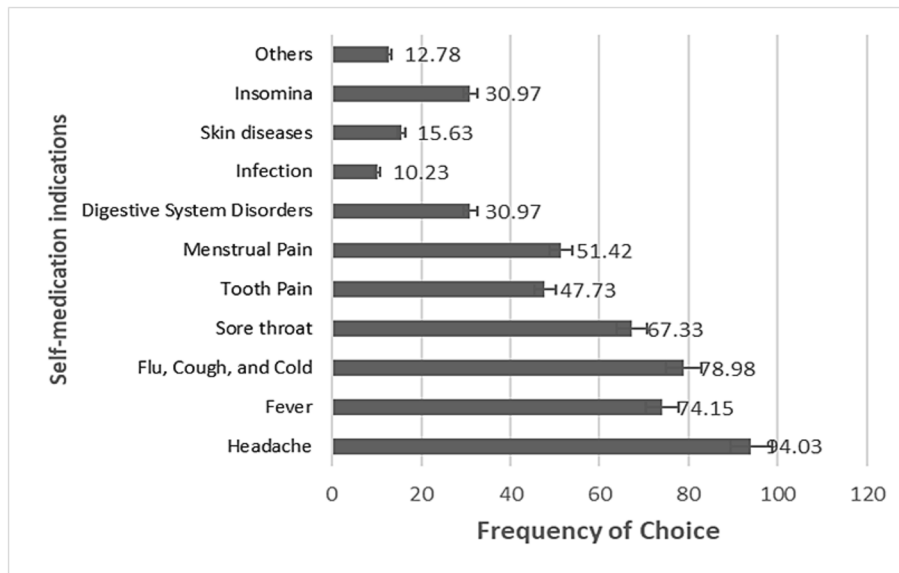


Fig. 2. Students’ responses to questions about the ailments they commonly self-medicated themselves. The top five ailments against which they self-medicated were headache, flu and cold, Fever, sore throat and menstrual pain.

Table 5
Participants’ responses to questions about their attitudes toward self-medication.

Questions		Academic level				P-value
		4th	5th	6th	Interns	
Self-medication can be advised to peers	Agree	101 (28.69)	15 (4.26)	10 (2.84)	15 (4.26)	0.0022*
	Neutral	64 (18.18)	17 (4.83)	3 (0.85)	19 (5.40)	
	Disagree	70 (19.89)	28 (7.95)	5 (1.42)	5 (1.42)	
Self-medication needs monitoring	Agree	225 (63.92)	57 (16.19)	15 (4.26)	37 (10.51)	0.0043*
	Neutral	9 (2.56)	3 (0.85)	1 (0.28)	1 (0.28)	
	Disagree	1 (0.28)	0 (0.00)	2 (0.57)	1 (0.28)	
Do you feel comfortable administering your medication?	Agree	118 (33.52)	30 (8.52)	11 (3.13)	25 (7.10)	0.2994
	Neutral	82 (23.30)	17 (4.83)	4 (1.14)	12 (3.41)	
	Disagree	35 (9.94)	13 (3.69)	3 (0.85)	2 (0.57)	

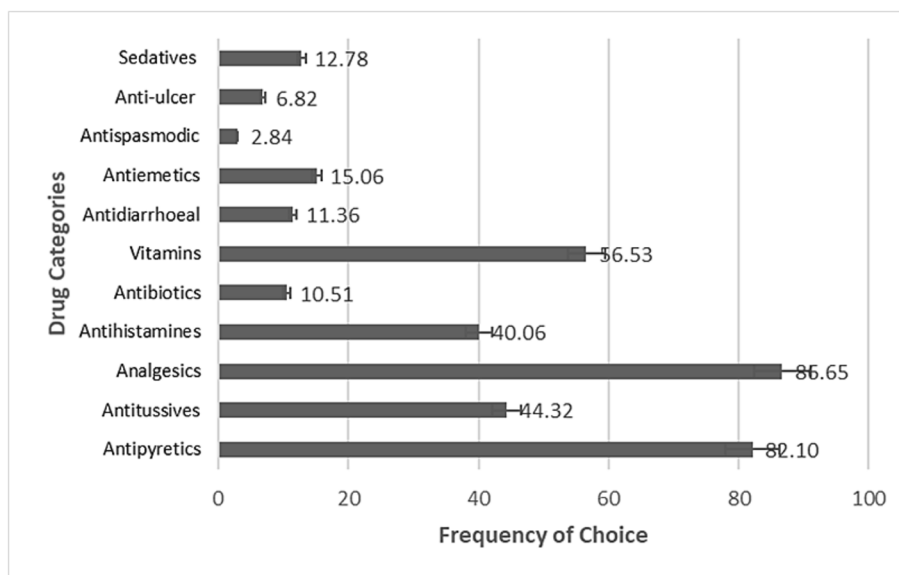


Fig. 3. Students’ responses to questions about the categories of drugs that they were commonly self-prescribed. The top five categories of drug were antipyretics, analgesics, vitamins, antitussives and antihistamines.

4 Discussion

Self-medication and misuse of OTC are considered global health-related problems. Differences in sociodemographic factors and the functional definition of self-medication likely explain the disparity in self-medication rates (Hughes, 2003). This study aimed to measure the prevalence of self-medication among medical and health profession students at KSAU-HS, Jeddah campus, Saudi Arabia. The prevalence of self-medication among medical and health professional students was reported to be 55.9 %. Depending on the target demographic and location, the worldwide prevalence rate of self-medication varies from as low as 11.2 percent to 93.7 percent (Behzadifar et al., 2020).

The pooled estimator showed an important connection between self-medication and salary. Nevertheless, the relationship between participant, gender, and self-medication was inconsequential. Tesfamariam et al. reported that, on average, 93.7 % of their samples (609) used OTC for self-medication at least once a month. Students were almost three times more likely than other workers. Cold and flu remedies, painkillers, and antipyretics were the most used OTC medicines (Tesfamariam et al., 2019). Xu et al. assess the prevalence of self-medication among university students by conducting a meta-analysis of studies on the occurrence of self-medication in college students worldwide. Non-medical students (44.7 %) exhibited lower self-medication rates compared to medical students (97.2 %) (Xu et al., 2019). Another study documented a 96.8 % rate of self-medication among medical and non-medical students compared to a survey done in Dammam, with a rate of only 26 % as the prevalence of the use of self-medication among pharmacy and medical students (Faqihi and Sayed, 2021; Bai and Ravikumar, 2016). This variation could be explained by the difference in study settings, sample size, and medical students' level of knowledge (Uppal et al., 2014).

Medical students are more aware of medication safety and its side effects, unlike students at the College of Medicine and College of Applied Medical Sciences, who take pharmacology confined to their specialty with much fewer details. A similar finding was demonstrated in a study conducted in India, reporting that many non-medical students considered self-medication safer than medical students (Uppal et al., 2014). Furthermore, female students are twice as likely as male students to agree with "Self-medication is safe" and "You can stop treatment as soon as the symptoms have disappeared." This could be due to females' regular familiarity with and use of OTC drugs, such as ibuprofen to control menstrual pain and cramps, birth control pills for women of childbearing age, and multivitamin supplements for females' hair, skin, and nails. However, medical and non-medical students showed appropriate awareness regarding the rest of the knowledge aspects.

The students had several reasons for using self-medication; time-saving is one factor. Similar results were found in another study regarding how self-medication saves time, where 64.2 % of students agreed with the previous statement. Another reason is that self-medication gives confidence to the user. It is considered effective in treating mild illnesses and providing quick relief, according to 51.7 % of non-medical students from King Khalid University in Abha (Alshahrani et al., 2019). This could be attributed to the fact that there are fewer medical centers in Abha, and most clinics are private. Therefore, patients will spend less money using self-medicating methods than visiting expensive and less accessible clinics to visit a physician (Klemenc-Ketis et al., 2010).

These study findings showed negative behavior toward using self-medication, as more than half of the students used this method as their first line of treatment. This could be related to the fact that OTC drugs are widely available as they can be used without a physician's prescription. However, students showed a positive attitude as they were conscious about checking the expiration date before using the drug. As reported in another study, the most common indications for which students take medications were headaches, followed by flu and cough (Young et al., 2012). Attitudes towards self-medication showed that

almost half of the students agreed that others could advise or take self-medication. This negative attitude could be explained by having high confidence and trust among colleagues, as some claim to have extensive experiences regarding self-medication that enable them to prescribe their medications to others. Since the students' community is more aware of the adverse effects of drug abuse, 94 % of the students believe that self-medication needs monitoring.

5. Conclusions

This study revealed that self-medication is widely practiced among college students. Both are aware to some extent of self-medication, with medical students showing more excellent knowledge regarding the safety of OTC drugs. However, high negative attitudes towards self-medication were noted, indicating the need for educational health programs to spread awareness about the harmful effects of the risky practice. It is advised that a comprehensive strategy be adopted to address this issue, including sufficient knowledge and education about self-medication and strictness surrounding pharmaceutical advertising.

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Data availability statement

Data are available from the corresponding author for researchers upon request.

Author contributions

Israa Abdullah Malli: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Rahaf Ahmed Hubayni:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Amirah Mohammed Marie:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Dhahi Yahya Alzahrani:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Elaf Ismeal Khshwry:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Raghad Abdulmohsen Aldahas:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Rahaf Fayeze Khan:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Syed Faisal Zaidi:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

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

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2023.102457>.

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