

# Prevalence and Predictors of Self-Medication with Antifungal Drugs and Herbal Products Among University Students: A Cross-Sectional Study from Egypt

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**Background and Purpose:** Irrational use of drugs for self-medication (SM) is a worldwide public health problem which results in treatment failure, economic loss, and increased burden of morbidity and mortality. Thus, the purpose of this study was to explore SM with antifungal drugs and herbal products among university students in Egypt.

**Methods:** A cross-sectional sectional study was conducted over 7 months among 403 university students in Egypt. The students were invited to complete a self-administered questionnaire through an online Google form. Questionnaire items included socio-demographic characteristics of the students, practice of and attitude towards SM with antifungal drugs, and SM with herbal products.

**Results:** Prevalence of SM with antifungal drugs among students stood at 38.2%. The main reasons for SM with antifungal drugs were perceiving their health problem as being minimal, followed by having fears of a doctor's visit. About 73% of the students thought that SM was not a safe practice. Older age (AOR = 1.5, 95% CI= 1.3–1.8), affiliation to a private university (AOR = 3.7, 95% CI= 2.2–6.4), and being a medical student (AOR = 2.4, 95% CI= 1.3–4.5) were the significant predictors of SM with antifungal drugs. A high prevalence of SM with herbal products (70.7%) was reported, with most students having used some form of herbal weight loss preparation (64%). Being a Cairo resident (AOR= 2.4, 95% CI =1.5–3.8, P<0.05) and being a medical student (AOR= 2.1, 95% CI=1.3–3.4, P<0.05) were the significant predictors of SM with herbal products.

**Conclusion:** In the current study, SM was common among Egyptian university students. Providing counseling and public health education to university students with regards to SM is crucial. Implementing strict regulations and the full enforcement of excitant laws pertaining to the use of medication supplies is also needed. Herbal products should face the scrutiny of evidence-based medicine. Further studies are needed to evaluate the impact of SM among university students.

**Keywords:** self-medication, antifungal, herbal, university, Egypt

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## Introduction

Self-medication (SM) refers to the consumption of drugs without medical prescription or consultation for the treatment of self-identified medical conditions or symptoms. It includes the use of leftover medicines already present at home, and the purchase of drugs through resubmitting previously dispensed prescriptions. The

most frequently self-medicated are analgesics, antibiotics, multivitamins, as well as cough and common cold medicines.<sup>1</sup>

Over-the-counter (OTC) drugs are the most commonly self-medicated drugs, due to their accessibility without the need for a physician's prescription. However, due to unregulated access in developing countries, SM practices may also involve prescription-only medications (POMs).<sup>2</sup> SM with either POMs or OTC drugs is a global health problem with serious public health consequences, including drug interactions, drug resistance, organ failure, and even death.<sup>3</sup> The prevalence of SM has been rising recently all over the world with marked variability across developed and developing countries, with rates ranging from 12.1% to 92.8%, respectively.<sup>4,5</sup> Several studies have shown that SM represents a common problem among university students with prevalence rates ranging from 64.8% to 77.2% in the Middle East,<sup>6,7</sup> 71.7% to 95.3% in Asia<sup>8,9</sup> and 24% to 91.4% in Africa.<sup>10,11</sup> In a study conducted in Egypt, the prevalence of SM among university students stood at 62.9%.<sup>12</sup>

Factors contributing to SM practices among university students include their higher exposure to social media and pharmaceutical advertisements,<sup>13</sup> perceptions of encountered health problems as being trivial, lack of time to seek medical care, a sense of having adequate information to self-medicate, and cost-effectiveness considerations.<sup>14–16</sup> Moreover, these practices vary according to each student's socio-demographic characteristics including age, gender, socio-economic status, educational level, residence, and field of study.<sup>17</sup>

In the past three decades, invasive life threatening opportunistic fungal infections have markedly increased from 18% to over 60% due to antibiotic abuse, widespread use of anticancer therapy, and the high prevalence of immunosuppressive infections, which in turn led to a higher consumption of antifungal agents.<sup>18</sup> Moreover, switch from POMs to OTC drugs has facilitated the misuse of antifungal drugs and emergence of antifungal resistant strains, resulting in a higher probability of inappropriate treatment, inaccurate diagnosis, drug interactions and increased morbidity.<sup>19</sup>

Herbal medicine consumption is widely practiced all over the world as a form of alternative therapy for the treatment of a large number of health problems, including heart disease, diabetes, high blood pressure and even certain types of cancer. The US Food and Drug Administration requires that pharmaceutical drugs be

guaranteed as safe before being released to the market. This, however, this is not the case with herbal products, which do not fall under the category of medicines if they are not explicitly labeled as treatment for a certain disease. Herbal medicines are considered as food supplements and are easily accessed in the market without prescription.<sup>20</sup> According to the World Health organization (WHO), 70–80% of the world population depends on non-conventional medicine, mainly herbs, for their primary health care (PHC) needs. In developing countries, herbs are mainly reserved as alternative treatments to the more expensive POMs.<sup>21</sup> However, various studies have illustrated that herbal medicines, taken irrationally or in combination with other medicines, may lead to delayed or missed diagnosis, unfavorable side effects and toxicities.<sup>22,23</sup>

Unlike most previous studies which either conducted a general investigation of SM or focused on the abuse of antibiotics or analgesics,<sup>12,24,25</sup> the current study is novel study which addressed SM with antifungal drugs and herbal products among university students in Egypt. This represents a serious problem that needs tailored interventions. Moreover, this study should be regarded as a starting point for researchers to further probe the area of SM with antifungal drugs and herbal products; a topic of limited published work worldwide.<sup>19,26</sup>

## Methods

### Study Design, Setting, and Participants

This cross-sectional study was conducted over 7 months to explore the SM practice of antifungal drugs and herbal products among Egyptian undergraduate university students. It was conducted in two randomly selected universities in Cairo (one private: Heliopolis University; and one public: Cairo University). The study targeted both medical and non-medical students during the first semester of the academic year 2019/2020.

### Sample Size

The sample size was calculated using Epi Info program, version 7. Based on the findings of the study conducted by Helal and Abou-Elwafa,<sup>12</sup> where the prevalence of SM practice among undergraduate university students in Mansoura city in Egypt was estimated to have stood 62.9%, and after employing a 95% confidence interval precision of  $\pm 5\%$ , the minimal required sample size was estimated to be 358 participants. An additional 20% were

added in order to compensate for potential non-responses and incomplete questionnaires. The final sample size was adjusted to 430 participants. The sample size was proportionally allocated to each university according to their corresponding average number of enrolled students, whereby the designated share of Cairo University stood at two thirds of the total sample. Inclusion criteria for the current study were: (i) an age of 18 years or above; (ii) university student status; (iii) mental stability; and (iv) willingness to participate in the study. On the other hand, there were no exclusion criteria. Students were recruited through an online Google form after approval of the ethical committees of the two target universities namely: Research Ethics Committee of Cairo University (approval number: F-11-2018) and the Institutional Review Board of Heliopolis University (approval number: 201809010.3).

## Data Collection Tool

The data were collected using an online self-administrated, anonymous and structured Arabic language questionnaire. The questionnaire was adapted from the available literature.<sup>5,12,27</sup> Accordingly, it included three sections. The first section included items covering background characteristics of the students, namely; age, gender, residence (within or outside Cairo), type of university (public or private), and type of education (medical/non-medical). The second section explored the practice of SM with antifungal drugs during the year preceding the study covering self-prescribing of antifungal drugs either for themselves or for family and friends; reading the pamphlet instructions and seeking information about antifungal drugs before use; interest in following social media drug advertisements; frequency and reasons of SM practices with antifungal drugs; and the most frequently utilized antifungal drugs for SM. The third section assessed attitudes of participants towards SM with antifungal drugs and their readiness to discontinue SM if they knew they had dangerous side effects; whether or not they considered SM a safe practice; and if they encouraged family or friends to self-medicate. Finally the last section addressed the utilization of herbal products for the treatment of self-reported medical conditions or symptoms in the year prior to the survey. Items covered self-prescribing of herbal products; the most frequently self-medicated herbal products; and the main sources of knowledge of herbal products. All items in the questionnaire were designed as close-ended questions, with the multiple options format being employed for the design of questions addressing

the reasons for SM with antifungal agents and the sources of knowledge of herbal products.

## Pilot Testing

The preliminary questionnaire was tested on 40 students to assess comprehension, clarity and time required to complete the questionnaire. Accordingly, some questions were modified to be more concise, while others were omitted in order to avoid repetition, leading to the final questionnaire form.

## Procedures

The participants were approached during their scheduled elective course classes (at the end of each class) by study coordinators. They were invited to fill in the study questionnaire via the online Google forms link, after receiving a complete orientation of the objectives and expected outcomes of the study, with emphasis on their right not to participate, and assuring them of the confidentiality of data. The first section in the online form included all relevant information about the study including the purpose and objectives of the work in addition to the contact number and e-mail address of the principal investigator, in case of any inquiries. The first section ended with the following statement: "By completing this questionnaire, you agree to participate with us in this study." Continuing to respond to items beyond this statement was considered as an indication of informed consent to participate in the study (as it was unfeasible to sign the questionnaire online). Study procedures were carried out according to the ethical requirements of the Declaration of Helsinki.

## Statistical Analysis

Pre-coded data were statistically analyzed using the Statistical Package for Social Sciences (SPSS) software, version 21. Qualitative variables were displayed as numbers and percentages. Quantitative variables were presented as means  $\pm$  standard deviations (SD). Univariate logistic regression analysis was carried out using Pearson's chi-square test to calculate the crude association between the SM practice with antifungal drugs and herbal products with the study's independent variables. Finally, two multivariate logistic regression models were built in order to decide on the significant predictors for SM with antifungal drugs and herbal products among the independent variables by using the binary logistic regression test. Results were presented as adjusted odds ratios (AOR) and 95% confidence intervals (CI). P values of  $\leq 0.05$  were considered statistically significant.

## Results

### Background Characteristics of the Studied Group

A total of 403 out of 430 questionnaires were completed and returned with a response rate of 93.7%. The mean age of respondents was  $21.1 \pm 1.7$  years, with a range of 18–25 years. About two thirds of respondents (65.5%) were residents of Cairo, and more than half were males (55.3%). More than three quarters of respondents (77.2%) were medical students at the faculties of Medicine, Dentistry and Pharmacy. About 60% of respondents were public university students (Table 1).

### Practice of SM with Antifungal Drugs

The practice of SM with antifungal drugs and herbal products among the respondents is summarized in [Supplementary Table 1](#). One hundred fifty-four students (38.2%) reported SM with antifungal drugs during the past year. The most commonly self-medicated antifungal drug, as reported by 70.1% of respondents who were self-medicating, was Diflucan (fluconazole). The most frequently reported reasons for SM with antifungal drugs (Figure 1) were perceiving the health problem as being minimal, followed by fears of the doctor's visit (54.5% and 37%, respectively), while the least frequently reported reasons were a desire to save time and cost-effectiveness considerations (3.2% each). The vast majority of the self-medicating students (95.5%) stated that it was easy to dispense antifungal drugs without a prescription. When

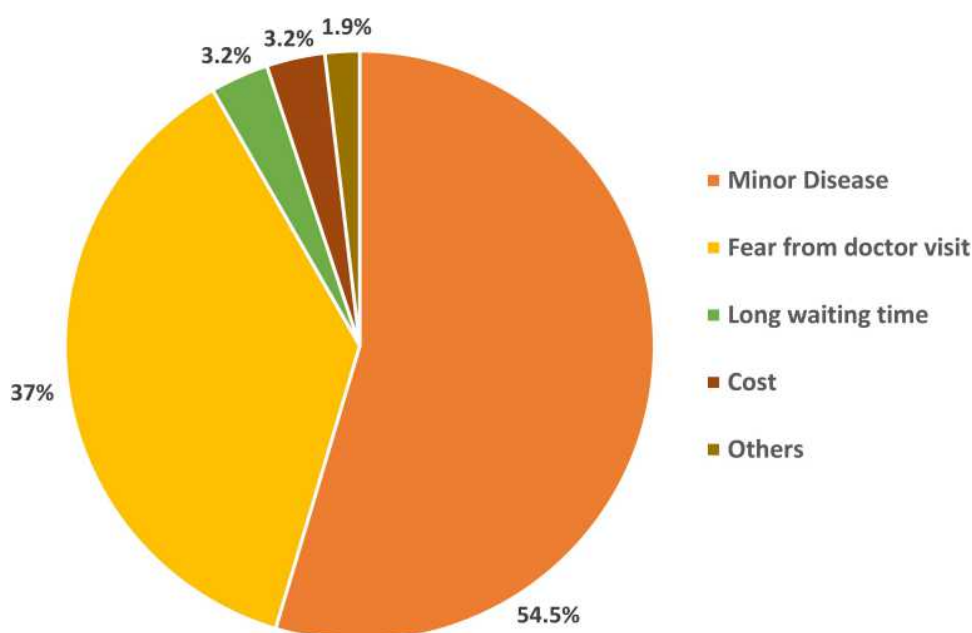
**Table 1** Socio-Demographic Characteristics of Participants, University Students in Egypt

Socio-Demographic Characteristics	Category	Number (n=403)	Percent
Sex	Male	223	55.3
	Female	180	44.7
Residence	Inside Cairo	264	65.5
	Outside Cairo	139	34.5
University	Private	160	39.7
	Public	243	60.3
Education	Medical	311	77.2
	Non Medical	92	22.8

the respondents were asked about the frequency of SM practice with antifungal drugs during the past year, most of the respondents (88.9%) reported occasional use on need, while only 7.8% and 3.2% reported regular monthly and weekly use, respectively. On the other hand, approximately half of the medical students (50.5%) admitted to prescribing antifungal drugs to their families and friends.

### Attitudes Towards SM with Antifungal Drugs

Attitudes of self-medicating students towards SM with antifungal drugs are presented in [Table 2](#). About 73% of the students thought that SM was not a safe practice and



**Figure 1** Percent distribution of reported reasons of self-medication with antifungal drugs.

**Table 2** Attitudes Towards Self-Medication with Antifungal Drugs Among Self-Medicated University Students

Attitudes Towards SM	Number (154)	Percent (100%)
I think that SM with antifungal drugs is not a safe practice	112	72.7
I will stop SM with antifungal drugs immediately if I knew it has dangerous side effects	127	82.5
I do not encourage my family or friends to self-medicate with antifungal drugs	105	68.2
I am willing to increase my knowledge about SM with antifungal drugs	149	96.8

82.5% mentioned they would discontinue SM if they knew it had dangerous side effects. Nearly 68% of the students claimed that they did not encourage their family or friends to self-medicate and the majority (96.8%) expressed their willingness to seek additional information about SM with antifungal drugs and its possible side effects.

## Predictors of SM with Antifungal Drugs

Sex, age, residence, type of university and education, reading medication pamphlets and seeking information regarding antifungal drugs prior to use, as well as an interest in following social media drug advertisements were the variables tested for potential association with SM with antifungal drugs (Table 3). Results of chi-square statistical analysis revealed that sex, residence, type of university and interest in following antifungal drug advertisements were significantly associated with the practice of SM with antifungal drugs ( $P < 0.05$ ). Male respondents self-medicated more frequently than female respondents ( $COR = 1.7$ , 95%  $CI = 1.2-2.6$ ). Private university students more commonly self-medicated compared with those attending a public university ( $COR = 6.1$ , 95%  $CI = 3.9-9.6$ ). In addition, respondents interested in following social media drug advertisements self-prescribed more frequently than their peers ( $COR = 0.5$ , 95%  $CI = 0.3-0.8$ ). No significant association was detected between SM practice with antifungal drugs and reading medication pamphlets before use ( $P < 0.05$ ).

**Table 3** Univariate and Multivariate Logistic Regression Analysis of Self-Medication Practice with Antifungal Drugs Among the Respondents

Tested Variables	Category	Self-Medication Practice with Antifungal Drugs		COR (95% CI) <sup>a</sup>	AOR (95% CI) <sup>b</sup>
		Yes	No		
		N (%)	N (%)		
Sex	Male Female	98 (43.9) 56 (31.1)	125 (56.1) 124 (68.9)	1.7 (1.2, 2.6)*	0.9 (0.6, 1.5)
Age (years), mean $\pm$ SD		22 $\pm$ 1.7	20.6 $\pm$ 1.4	N/A**	1.5 (1.3, 1.8)*
Residence	Inside Cairo Outside Cairo	85 (32.2) 69 (49.6)	179 (67.8) 70 (50.4)	0.5 (0.3, 0.7)*	0.8 (0.5, 1.3)
University	Private Public	101 (63.1) 53 (21.8)	59 (36.9) 190 (78.2)	6.1 (3.9, 9.6)*	3.7 (2.2, 6.4)*
Education	Medical Non Medical	125 (40.2) 29 (31.5)	186 (59.8) 63 (68.5)	1.5 (0.9, 2.4)	2.4 (1.3, 4.5)*
Read antifungal drug pamphlet before use	Yes No	133 (38.9) 21 (34.4)	209 (61.1) 40 (65.6)	1.2 (0.7, 2.1)	2.2 (0.9, 5.4)
Seek information about antifungal drug through internet or other sources before use	Yes No	126 (39.1) 28 (34.6)	196 (60.9) 53 (65.4)	1.2 (0.7, 2)	0.7 (0.3, 1.4)
Interested in following social media drug advertisements	Yes No	122 (42.7) 32 (27.4)	164 (57.3) 85 (72.6)	0.5 (0.3, 0.8)*	0.6 (0.3, 1)

**Notes:** <sup>a</sup>Univariate logistic analysis based on the results of chi square test. <sup>b</sup>Multivariate logistic regression analysis based on the results of binary logistic regression test.

\*Significant variables at  $P$  value  $\leq 0.05$ .

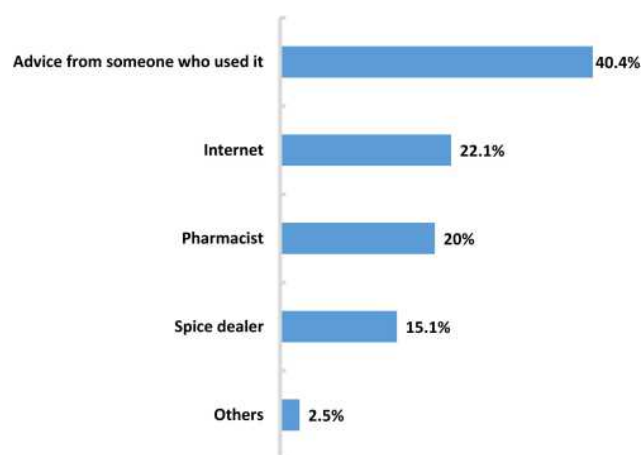
**Abbreviations:** COR, crude odds ratio; AOR, adjusted odds ratio; 95% CI, confidence interval; \*\*N/A, not applicable.



Multivariate logistic regression analysis was performed to single out significant predictors associated with SM with antifungal drugs as shown in Table 3. Older age was independently associated with the likelihood of SM with antifungal drugs (AOR = 1.5, 95% CI= 1.3–1.8). Students affiliated to a private university were nearly four times more likely to practice SM with antifungal drugs than their counterparts in a public university (AOR = 3.7, 95% CI= 2.2–6.4). Medical students were almost two and half times more likely to self-medicate with antifungal drugs compared with non- medical students (AOR =2.4, 95% CI= 1.3–4.5).

## Utilization of Herbal Products for Treatment of Self-Reported Medical Conditions or Symptoms

Two hundred eighty-five students (70.7%) reported having used herbal products for the treatment of self-reported medical conditions or symptoms during the past year. The most commonly reported self-medicated herbal products were weight-loss products (64%) and cough and cold medicines (30%). Figure 2 displays the main sources of knowledge regarding utilized herbal products, where advice from family or friends, internet websites, and pharmacists were the most prevalent sources (40.4%, 22.1% and 20%, respectively). Results of multivariate logistic regression analysis revealed that living in Cairo and being a medical student were the two significant predictors of SM with herbal products (AOR=2.4, 95% CI= 1.5–3.8 and AOR = 2.1, 95% CI= 1.3–3.4, respectively) (Table 4).



**Figure 2** Percent distribution of main sources of knowledge regarding herbal products.

## Discussion

Irrational use of drugs for SM is a worldwide public health problem which results in treatment failure, economic loss, and increased burden of morbidity and mortality.<sup>28</sup> The understanding of consumer characteristics associated with SM is crucial for proper planning of public health awareness efforts and the implementation of effective management strategies. Additionally, searching the literature revealed that the prevalence of fungal infections in Egypt is alarming. One study conducted by Abdel Fattah et al, for example, showed that the prevalence of fungal infections stood at 18.6%. Dermatophyte infections were more common than non-dermatophyte infections (51.2% vs 37.2%) among infected cases. The Egypt-wide prevalence of onychomycosis reportedly stood at 6.4%, whilst it stood at 1.2% among study participants. The most common type of superficial fungal infections was *Candida* (5.2%), followed by *Tinea pedis* (3.6%), *T. cruris* (2.1%), and *T. capitis* (1.7%).<sup>29</sup> Hence, this study was conducted in order to assess the practice SM with antifungal drugs and herbal products among Egyptian university students. In the current study, about 38% of undergraduate students reported self-prescribing antifungal drugs, and nearly half of medical students indicated having prescribed these for families and friends. The majority of students (95.5%) claimed that it was easy to dispense antifungal drugs without prescription. Higher SM practices were observed in a study conducted by Mushi et al, where more than half of the patients surveyed (55.5%) reported self-medicating with OTC antifungal drugs.<sup>19</sup> Prevalence of SM was also high among Egyptian university students in studies conducted by Helal and Abou-Elwafa and Kamal Elden et al; 62.9% and 77.7%, respectively.<sup>12,24</sup> Variability in prevalence rates of SM could be explained by the different study populations and methodologies used. Moreover, some studies inquired about SM practices in general,<sup>12</sup> while others assessed SM with specific drugs such as antibiotics<sup>24</sup> or antifungal agents.<sup>19</sup>

SM with OTC antimicrobial agents has been linked with increased antimicrobial resistance. The effectiveness of azole agents, the most commonly prescribed antifungal drugs worldwide, has been reduced by the emergence of azole resistant strains. This represents a great challenge to the proper management of fungal infections.<sup>19</sup> In the present study, the most commonly used self-medicated antifungal drug was fluconazole, as reported by 70.1% of the respondents. Similarly, in a study conducted in Tanzania,

**Table 4** Univariate and Multivariate Logistic Regression Analysis of Self-Medication with Herbal Products

Tested Variables	Category	Utilization of Herbal Products for Treatment of Fungal Infections		COR (95% CI) <sup>a</sup>	AOR (95% CI) <sup>b</sup>
		Yes	No		
		N (%)	N (%)		
Sex	Male Female	162 (72.6) 123 (68.3)	61 (27.4) 57 (31.7)	1.2 (0.8, 1.9)	1.3 (0.8, 2.1)
Age (years), mean $\pm$ SD		21.1 $\pm$ 1.7	21.2 $\pm$ 1.7	N/A**	1 (0.9, 1.2)
Residence	Inside Cairo Outside Cairo	202 (76.5) 83 (59.7)	62 (23.5) 56 (40.3)	2.2 (1.4, 3.4)*	2.4 (1.5, 3.8)*
University	Private Public	113 (70.6) 172 (70.8)	47 (29.4) 71 (29.2)	1 (0.6, 1.5)	1.2 (0.7, 2.2)
Education	Medical Non Medical	231 (74.3) 54 (58.7)	80 (25.7) 38 (41.3)	2 (1.2, 3.3)*	2.1 (1.3, 3.4)*

**Notes:** <sup>a</sup>Univariate logistic analysis based on the results of chi square test. <sup>b</sup>Multivariate logistic regression analysis based on the results of binary logistic regression test. \*Significant variables at P value  $\leq$  0.05.

**Abbreviations:** COR, crude odds ratio; AOR, adjusted odds ratio; 95% CI, confidence interval; \*\*N/A, not applicable.

the commonest class of dispensed antifungal drugs was azoles, whereas fluconazole was the commonest OTC antifungal drug used.<sup>19</sup>

In the present study, the most common reasons for SM with antifungal drugs were believing in the mildness of illness and fears regarding the doctor's visit. This finding goes in line with other studies conducted in Ethiopia,<sup>10</sup> United Arab Emirates<sup>7</sup> and Saudi Arabia.<sup>14</sup> However, in contrast to other studies which reported that previous experience,<sup>30</sup> lack of time,<sup>15</sup> and cost-effectiveness<sup>16</sup> were the most common reasons for SM; these were the least commonly reported reasons in ours. The variability between studies could be attributed to cultural variations, socio-economic factors and different healthcare systems.

Most of the students in the current study (68.2%) claimed that they did not encourage their family or friends to self-medicate and the majority (96.8%) expressed their willingness to seek more information regarding SM with antifungal drugs and its possible side effects. This goes in line with another study conducted in Egypt where 87.4% of the students mentioned that they discouraged family and friends from self-medicating.<sup>12</sup> Moreover, 72.7% of students in the present study believed that SM with antifungal drugs was not a safe practice. Similarly, in a study conducted in Saudi Arabia, 69.7% of students thought that SM was not safe.<sup>31</sup> Despite recognizing that SM was not a safe practice, frequent use was reported by student who

explained that using these drugs relieved symptoms that they were suffering from and were easily accessible.

A number of findings from the current study with regards to the practice of SM are worth noting. Male students were found to have self-medicated more frequently than females (COR=1.7, 95% CI=1.2–2.6, P<0.05). A possible explanation is that males may have faced more fungal infections than their female counterparts which resulted in higher SM practices. In contrast, studies in Saudi Arabia,<sup>6</sup> Ethiopia,<sup>28</sup> and Ghana<sup>32</sup> found relatively higher rates of SM among females and justified these findings by stating that females have relatively lower immunities than males and also probably have a greater need for pain-killers due to the monthly attacks of dysmenorrhea. Also, we found that students that were interested in following social media drug advertisements had practiced SM more significantly than their peers (COR=0.5, 95% CI=0.3–0.8, P<0.05), which could be explained by the high influence of advertisements on the attitudes and behavior of this age group.

In this study, older age, affiliation to a private university, and being a medical student were three significant predictors of SM with antifungal drugs. The finding that older age students had practiced SM more frequently could be explained by their deeper knowledge of drugs and diseases which possibly led to a higher uptake and purchase of medications without prescriptions; a practice

which is particularly easy in a developing country such as Egypt, where the access to drugs is not controlled. Similarly, previous studies done in Malaysia,<sup>33</sup> Ethiopia,<sup>34</sup> and Uganda<sup>35</sup> reported higher SM practices among students in their senior years compared with their freshmen and sophomore counterparts. A possible explanation for higher SM practices among students attending private universities found in the present study is that they most likely enjoy higher incomes compared with public university students, who usually attain free healthcare services provided by the health insurance system. Studies conducted in Pakistan and Southern China found that income and SM have direct relationship.<sup>15,36</sup> Medical students in our study were almost two and half times more likely to self-medicate compared with their non-medical counterparts (AOR=2.4, 95% CI=1.3–4.5,  $P<0.05$ ). This could be attributed to the medical knowledge gained through their studies which might have provided them with a perceived confidence to make their own decisions regarding SM.<sup>37</sup> Similar findings were observed in a study conducted in Saudi Arabia, where medical students practiced SM more frequently than non-medical students. Authors of that study justified their findings by noting the medical students' medical knowledge and the easy access to hospital facilities.<sup>31</sup>

SM with herbal products is increasing steadily in both developed and developing countries despite the lack of studies regarding their effectiveness, and despite the lack of control over the quality and safety of these preparations.<sup>20</sup> The general community perception that herbal products are safe may result in inappropriate use and improper intake, leading to undesirable side effects and toxicities.<sup>38</sup> In the current study, a high prevalence of SM with herbal products (70.7%) was reported among university students. Unfortunately, most people are attracted to the use of herbal weight loss products because of the faulty perception that these are safe.<sup>39</sup> These products may however contain FDA-banned ingredients which have many side effects that could induce heart failure, cancer, and other life-threatening conditions.<sup>40</sup> In addition, they contain stimulants such as caffeine that may cause insomnia, depression, addiction, suicidal thoughts, and heart attacks, which could be fatal.<sup>41</sup> The consumption of herbal products to induce weight-loss is a common practice globally, ranging from 10% to 98%.<sup>42</sup> In the current study, most of the students who had practiced SM with herbal products had used herbal weight loss preparations (64%). This prevalence was higher than that

reported in a study conducted in Central Mexico,<sup>42</sup> where the prevalence of SM with herbal preparations for weight loss stood at only about 43%. The recommendation of a family member or friend markedly affects the decision to use herbal products for weight loss.<sup>43</sup> The most common sources of knowledge for SM practice with herbal products as reported by students in the present study were advice from family or friends (40.4%), internet websites (22.1%), and pharmacists (20%). The study conducted in Mexico by Alonso-Castro et al found that 67% of patients consumed herbal weight-loss products based on the recommendations of relatives and friends.<sup>42</sup> In one study conducted in Jordan,<sup>44</sup> the primary sources of knowledge regarding SM were pharmacists (52.6%), the internet (44.2%), and family members (36.9%). Significant predictors of SM with herbal products revealed by the current study were being a Cairo resident (AOR= 2.4, 95% CI =1.5–3.8,  $P<0.05$ ) and being a medical student (AOR= 2.1, 95% CI =1.3–3.4,  $P<0.05$ ). The significant association between residing in Cairo and SM of herbal products could be explained by the accessibility of these products in the city which is also the capital of Egypt. Age and gender were not significantly associated with SM with herbal products. In contrast, female gender was a common factor associated with this practice in many studies, possibly owing to the great influence of media and society on body appearance, especially for women.<sup>42,45</sup>

This study is the first to assess SM practice with antifungal drugs and herbal products among university students in Egypt; however, it has some limitations. The questionnaire was self-reported which may have led to the inconsistent understanding of questions between students on the one hand, and underreporting of SM practice on the other. Enquiring about SM practices in the past year may have resulted in recall bias.

## Conclusion

The current study highlights the importance of providing counseling and public health education to university students with regards to the possible side effects of SM. Implementing strict regulations, and enforcing existent laws pertaining to pharmaceutical advertisements and medication supplies is crucial. Providing quality medical services to university students with appropriate diagnoses, prescriptions and treatments is also needed. Licensing of herbal products should only come after these products had passed the scrutiny of evidence-based medicine, including clinical trials, which are essential in order to provide



convincing evidence of the safety and effectiveness of these products. Further studies are needed to evaluate the impact of this high SM rate among university students as well as more in-depth probing of the different aspects of SM with antifungal drugs and herbal products.

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