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Inappropriate use of propranolol among medical students in Palestine: cross-sectional study

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Abstract

Introduction Medical students' inappropriate propranolol use, driven by exam stress, is a developing concern. This study examined propranolol misuse among Palestinian medical students at An-Najah National University.

Methodology This is a cross-sectional study that included second to sixth-year medical students at An-Najah National University in Palestine. An online self-administrated Arabic questionnaire was developed by researchers. This 29-question, three-section questionnaire was sent to eligible participants via university email and student Facebook groups. The data collection period extended from August to September 2023.

Results A total of 401 students participated in the survey. The majority of the respondents were females (227, 57%) and final-year medical students (137, 34%). The utilization of propranolol was identified in 12% in our study. About 60% engaged in self-prescribing doses ranging between 10 and 20 mg, with 56% falling within this range. The main motivation for self-prescribing was to alleviate anxiety symptoms (88%), particularly before objective structured clinical examinations (OSCEs) (89%) or presentations (39%). 68% of students expressed awareness of the potential side effects. Statistical analysis revealed significant associations between propranolol use and factors such as age ($p < 0.001$), academic year ($p < 0.001$), the presence of chronic diseases ($p = 0.011$), and psychoactive drug use ($p = 0.045$).

Conclusion Propranolol was used by 12% of the surveyed medical students, with 89% of its users taking it before OSCEs. Despite being aware of its potential side effects, many students still chose to self-medicate, highlighting the role of stress-induced behavior. This emphasizes the importance of stress management strategies before difficult occasions in medical students' journey.

Keywords Medical students, Stress, Self-prescribing, Developing country, Propranolol

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Introduction

Beta-blockers, as a family of drugs, are crucial first-line therapies for many acute and chronic disorders and are principally used for the management of cardiovascular disease and other illnesses [1, 2]. Beta-blockers are classified as nonselective or beta-1 selective. Nonselective propranolol, carvedilol, and sotalol are a few examples [3].

Propranolol's anxiolytic properties have been explored in psychiatry for various off-label uses. It has been studied for the treatment of high trait anxiety, substance use disorders, schizophrenia, and autism. Off-label studies have shown propranolol to reduce certain uncomfortable states like exam stress, nervousness on stage, performance anxiety among musicians, and anxiety during surgery. Propranolol shows promise as a treatment for these conditions [4].

Beyond the medical treatment, the inappropriate use of beta-blockers by medical students is a concerning phenomenon and reflects their academic strain [5, 6]. Many of these medical students self-medicate with beta-blockers due to academic stress, irregular sleep patterns, and the desire to improve academically [7].

A demanding curriculum and rigorous examinations can cause stress, especially in the later years of education. Therefore, some students take beta-blockers to reduce anxiety and tension before exams [8, 9]. These drugs may relieve symptoms and enhance exam performance, but they can cause hypotension and psychological morbidity [10].

Test anxiety is the discomfort students feel when taking performance or clinical exams [11]. Medical students sometimes have trouble sleeping due to concerns about studying and tests [12]. Consequently, some of them self-medicate because they know so much about medicines, including that nonselective beta-blockers like propranolol (inderal ®) are used to treat performance-related social anxiety disorder (SAD) [13]. Also, colleagues and friends provide convenient access to these drugs.

While propranolol is widely used for approved medical treatments and various off-label indications, its misuse among medical students remains an underexplored phenomenon, particularly in regions like Palestine. Academic pressures often lead medical students to self-medicate with propranolol, yet limited research exists on the prevalence, motivations, and awareness of the associated risks. This study aimed to address this gap by being the first in Palestine to investigate the inappropriate use of propranolol at An-Najah National University.

Table 1 Demographics and characteristics of the study sample

Variables	Frequency (%) or median [Q1-Q3] n = 401
Age	22 [20–23]
Gender	
Female	227 (56.6)
Male	174 (43.4)
Academic year	
Sixth year	137 (34.2)
Fifth year	95 (23.7)
Fourth year	71 (17.7)
Third year	56 (14.0)
Second year	42 (10.5)
GPA	
Less than 2	5 (1.2)
2.0–2.49	14 (3.5)
2.5–2.99	140 (34.9)
3.0–3.49	145 (36.2)
3.5–4.0	97 (24.2)
Smoker	
Yes	58 (14.5)
Energy drinks	
Yes	105 (26.2)
Number of sleep hours during exam week (hours per day)	
Less than 4 hours	31 (7.7)
4–6 hours	266 (66.3)
7–8 hours	96 (23.9)
More than 8 hours	8 (2.0)
Exercise	
Yes	111 (27.7)
Chronic Diseases	
Yes [a]	24 (6.0)
Allergies or asthma	
No	322 (80.3)
Allergies	66 (16.5)
Asthma	6 (1.5)
Both	7 (1.7)
Psychiatric disorder	
Yes [b]	12 (3.0)
Illegal or psychoactive drugs	
Yes [c]	7 (1.7)

Abbreviations: GPA: grade point average

[a] Asthma (6), migraine (4), hypertension (2), PCOS (3), familial hypercholesteremia, psoriasis, Diabetes mellitus, IgA nephropathy, Patellofemoral syndrome, GERD, IBS, Hashimoto thyroiditis, Allergic rhinitis, Hearing Loss (right side)

[b] Anxiety Disorder (6), Panic attacks, Depression (3), Bipolar disorder, OCD, Borderline, Personality Disorder, PTSD

[c] Paroxetine (2), fluoxetine, albuterol, cortisone, lorazepam, escitalopram, and revitalin

Methods and materials

Study design, settings and population

This was a cross-sectional study involving medical students ranging from the second year to the sixth year

enrolled at An-Najah National University in Nablus, Palestine. First-year medical students were excluded due to their limited exposure and experiences related to beta-blockers usage. The data collection period for this study spanned from August to September 2023. An invitation email was sent to all targeted students via the official university communication channels. The email included detailed information about the study objectives, voluntary participation, and assurances of confidentiality. Students were provided with a link to an online survey, which they could complete anonymously.

Sample size and sampling techniques

The sample size was determined using an online calculator developed by Raosoft. A target population proportion of 50% was assumed as the endpoint to ensure the maximum variability for estimating the required sample size. A confidence level of 95% and a margin of error of 5% were used, resulting in a required sample size of 338. Convenience sampling technique was used for data collection.

Study tool

The students were surveyed using an online self-administrated Arabic questionnaire developed by the researchers. The questionnaire was developed based on the studies conducted by Alkhatabi et al. and Abukhalaf et al. within the Arabic region, considering our shared cultural context [12, 13]. The Arabic version of the questionnaire was uploaded on Google Forms and distributed to eligible participants via electronic means, including the university email system and Facebook groups. The survey consisted of 29 multiple-choice questions that were categorized into three sections. The first section inquired about the demographic information of the participants, which included age, gender, academic level, GPA, smoking status, energy drink use, exercise, number of sleeping hours during exams, chronic diseases, psychiatric disorders, and use of illegal or psychoactive drugs. The last question of the first section was about the propranolol usage. Depending on the response to this question, students were thereafter referred to one of the subsequent sections. In the second section, questions focused on whether the students were offered or recommended the use of propranolol. In the third section, students were asked about the details regarding their propranolol usage, such as prescription, frequency, dose, side effects, reasons for using propranolol, and their source of knowledge about propranolol.

Smoking status, energy drink use, exercise, chronic diseases, psychiatric disorders and use of illegal or psychoactive drugs were measured using straightforward questions with "Yes" or "No" response options.

Statistical analysis

The data were entered and analyzed using the Social Sciences Statistical Package (SPSS) version 26. Categorical variables are described as absolute frequencies (percentages), and continuous variables are presented as medians and interquartile ranges. The chi-square test or Fisher's exact test, as appropriate, was used to test the significance between categorical variables, and the Mann–Whitney test was used to test for differences in the means between categories. Multivariate Analysis of Variance (MANOVA) was employed to explore the associations between propranolol use and various demographic and clinical factors. A p-value < 0.05 indicated statistical significance. Variables with multiple responses were analyzed using the multiple response analysis.

Participants with missing data on specific variables were still included in the analysis, as their analysis was descriptive, and the impact of missing data on the study findings was minimal because the majority of the study variables had complete responses.

Ethical approval

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of An-Najah National University, Nablus, Palestine (reference number: Med. August.2023/6). To ensure informed consent, all participants received a detailed explanation of the study objectives, the voluntary nature of their participation, and the confidentiality of their responses. Electronic written informed consent was obtained prior to participation through the online Google Forms platform. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

Results and analysis

Demographics and characteristics

Four hundred and one medical students responded to the questionnaire. A total of 227 (57%) participants were predominant for females. The median age of the students was 22 [20–23]. The largest proportion of participants in the study were final-year medical students, accounting for 137 students (34%), followed by fifth-year medical students, comprising 95 students (24%). A total of 58 students (15%) were identified as smokers, while 111 students (28%) reported engaging in regular exercise. Additionally, 105 (26%) students used energy drinks to improve their concentration (Table 1).

Table 2 Data regarding the usage of propranolol among students who utilize them ($n = 50$)

Variables	Frequency (%) or median [Q1-Q3] n = 50
Source of Knowledge about propranolol[a]	
Social Media	3 (6)
Internet surfing	4 (8)
Friends and classmates	30 (60)
Family	3 (6)
Study material	35 (70)
Prescription of propranolol	
Prescribed by a physician	15 (30.0)
Yourself	30 (60.0)
Friend	5 (10.0)
Family member	0 (0)
Frequency of propranolol use (per day)	1 [1–2]
Propranolol dose	
< 10 mg	18 (36.0)
10–20 mg	28 (56.0)
30–40 mg	3 (6.0)
> 40 mg	1 (2.0)
Increasing the dose without physician instructions	
Yes	8 (16.0)
Reasons for propranolol use[a]	
Performance enhancement	14 (28)
Anxiety relief	44 (88)
Peer pressure	3 (6)
Other	7 (14)
Time of propranolol use[a, b]	
Before written exams	14 (31.8)
Before OSCE	39 (88.6)
Before presentations	17 (38.6)
During exams period (studying)	9 (20.5)
Social gatherings	1 (2.3)
Other	0 (0)
Knowledge of the side effects of propranolol	
Yes	34 (68.0)
No	16 (32.0)
Side effects known about the use of propranolol[a, c]	
Hypotension	35 (94.6)
Sexual dysfunction	7 (18.9)
Fatigue	14 (37.8)
Sleep disturbances	14 (37.8)
Shortness of breath	0 (0)
Cold extremities	9 (24.3)
Other	2 (5.4)
Side effects experienced while using propranolol[a, d]	
Hypotension	7 (63.6)
Sexual dysfunction	0 (0)
Fatigue	6 (54.5)
Sleep disturbances	7 (63.6)
Shortness of breath	0 (0)
Cold extremities	2 (18.2)
Other	2 (18.2)

Table 2 (continued)

Variables	Frequency (%) or median [Q1-Q3] n = 50
Recommending propranolol to someone	
Yes	28 (56.0)

[a] The values within these variables are a result of multiple responses

[b] $n = 44$

[c] $n = 37$

[d] $n = 11$

Propranolol *use and students*

Of the total sample, 50 students (12%) reported using propranolol. Among the group of students who did not take propranolol (351, 88%), 77 students (22%) indicated that propranolol was recommended to them, and 95 students (27%) reported being offered propranolol. Of the 50 students who took propranolol, 35 (70%) students indicated that they acquired knowledge about them from the study materials, while 30 (60%) students indicated that friends and classmates told them about propranolol. A significant proportion of these students (30, 60%) reported self-prescribing propranolol at a dose of 10–20 mg (28, 56%). The predominant reason for using propranolol (44, 88%) was to relieve symptoms of anxiety, especially prior to the objective structured clinical examination (OSCE) (39, 89%). Seventeen (39%) students used this medication before giving presentations. Furthermore, the majority of these students (34, 68%) expressed awareness of the side effects (Table 2).

The associations between the use of propranolol *and medical student demographics*

Statistical analysis revealed significant associations between propranolol use and factors such as age ($p < 0.001$), higher academic year ($p < 0.001$), the presence of chronic diseases ($p = 0.011$), and psychoactive drug use ($p = 0.045$). Academic performance, psychiatric problems, smoking status, and energy drinks consumption were not associated with propranolol usage ($p > 0.05$) (Table 3).

The effect of propranolol use on demographic and clinical variables: results of multivariate analyses

The multivariate tests revealed a significant main effect of propranolol use, as indicated by Wilks' Lambda = 0.921, $F(8, 392) = 4.22$, $p < 0.001$, and Pillai's Trace = 0.079, $F(8, 392) = 4.22$, $p < 0.001$. Follow-up univariate analyses showed significant effects of beta-blocker use on age ($F(1, 399) = 18.50$, $p < 0.001$), academic year ($F(1, 399) = 21.25$, $p < 0.001$), chronic diseases ($F(1, 399) = 6.60$, $p = 0.011$), and psychiatric disorders ($F(1, 399) = 4.97$, $p = 0.026$). No significant effects were observed for gender ($F(1, 399) = 1.27$, $p = 0.261$), smoking status ($F(1, 399) = 0.28$, $p = 0.598$), GPA ($F(1, 399) = 0.11$, $p = 0.744$), or energy drink consumption ($F(1, 399) = 1.00$, $p = 0.319$) (Tables 4 and 5).

Discussion

According to the findings of our study, the prevalence of self-administrated propranolol among medical students at An-Najah National University was determined to be 12%. This finding is lower than the results of a separate study conducted in Saudi Arabia, which reported a prevalence of 22.4% [14]. The observed disparity may be ascribed to the adaptation of students in Palestine to stressful situations, suggesting that they do not require any treatment because they are accustomed to living in an occupied territory.

Propranolol was utilized predominantly by medical students in their last year of study. It is plausible that this heightened use is attributed to the increased stress experienced during this pivotal stage as graduation looms and anxiety levels increase. Consequently, these students may seek pharmaceutical interventions as a means to alleviate their stress [14, 15].

For more than three decades, researchers have closely examined coping, which refers to the thoughts and actions employed to navigate the challenges, both internal and external, of situations perceived as stressful [16]. The medical student journey is often stressful, and it is crucial for students to prioritize their well-being alongside patient care. Stress-relieving methods are essential for a smoother medical school experience and future career as a doctor. Some students adapt to stress, while others may develop mental health issues. Concurrently, the stress experienced during medical training drives students to cultivate coping skills, resources, and strategies for handling such challenges, which is referred to as the coping phenomenon [17]. Additionaly, peer pressure can create a permissive environment that normalizes behaviors like self-medication, especially for managing stress or improving academic performance, particularly among young adults and students [18]. In Palestine, propranolol is available without a prescription, allowing individuals to purchase it over the counter.

Table 3 The association between the use of propranolol and medical student demographics

Variables	Students utilizing propranolol Frequency (%) or median [Q1-Q3] n = 50 (12.5)	Students not utilizing propranolol Frequency (%) or median [Q1-Q3] n = 351 (87.5)	*P* value [a]
Age	22 [22–23]	21 [20–23]	**< 0.001**[b]
Gender			0.260[c]
Female	32 (64.0)	195 (55.6)	
Male	18 (36.0)	156 (44.4)	
Academic year			**< 0.001**[c]
Sixth year	27 (54.0)	110 (31.3)	
Fifth year	17 (34.0)	78 (22.2)	
Fourth year	4 (8.0)	67 (19.1)	
Third year	2 (4.0)	54 (15.4)	
Second year	0 (0)	42 (12.0)	
GPA			0.326[c]
Less than 2	1 (2.0)	4 (1.1)	
2.49–2.0	1 (2.0)	13 (3.7)	
2.99–2.5	14 (28.0)	126 (35.9)	
3.49–3.0	23 (46.0)	122 (34.8)	
4.0–3.5	11 (22.0)	86 (24.5)	
Smoker			0.597[c]
Yes	6 (12.0)	52 (14.8)	
No	44 (88.0)	299 (85.2)	
Energy drinks			0.317[c]
Yes	16 (32.0)	89 (25.4)	
No	34 (68.0)	262 (74.6)	
Number of sleep hours during exam week (hours per day)			0.717[c]
Less than 4 hours	4 (8.0)	27 (7.7)	
4–6 hours	35 (70.0)	231 (65.8)	
7–8 hours	11 (22.0)	85 (24.2)	
More than 8 hours	0 (0)	8 (2.3)	
Exercise			0.534[c]
Yes	12 (24.0)	99 (28.2)	
No	38 (76.0)	252 (71.8)	
Chronic Diseases			**0.011**[c]
Yes	7 (14.0)	17 (4.8)	
No	43 (86.0)	334 (95.2)	
Allergies or asthma			0.471[c]
No	40 (80.0)	282 (80.3)	
Yes, I have allergies	8 (16.0)	58 (16.5)	
Yes, I have asthma	0 (0)	6 (1.7)	
Yes, I have both	2 (4.0)	5 (1.4)	
Psychiatric disorder			0.050[d]
Yes	4 (8.0)	8 (2.3)	
No	46 (92.0)	343 (97.7)	
Illegal or psychoactive drugs			**0.045**[d]
Yes	3 (6.0)	4 (1.1)	
No	47 (94.0)	347 (98.9)	

[a] The bold values indicate $p < 0.05$

[b] Statistically significant values were calculated using the Mann–Whitney U test

[c] Statistically significant values were calculated using the Pearson chi-square test

[d] Statistically significant values were calculated using Fisher's exact test

Despite the fact that 68% of the 50 students who reported taking propranolol were aware of the side effects associated with the use of propranolol, they still chose to consume them prior to the Objective

Table 4 Multivariate tests

Multivariate Tests	Students utilizing propranolol				
	Value	F	Hypothesis df	Error df	*P* value [a]
Wilks' Lambda	0.921	4.22	8	392	**< 0.001**
Pillai's Trace	0.079	4.22	8	392	**< 0.001**
Hotelling's Trace	0.086	4.22	8	392	**< 0.001**
Roy's Largest Root	0.086	4.22	8	392	**< 0.001**

[a] The bold values indicate $p < 0.05$

Table 5 Results of MANOVA assessing the association between Beta-Blocker use and clinical and demographic variables

Dependent Variable	Sum of Squares	df	Mean Square	F	*P* value [a]
Age	46.93	1	46.93	18.50	**< 0.001**
Gender	0.31	1	0.31	1.27	0.261
Academic year	42.40	1	42.41	21.25	**< 0.001**
GPA	0.09		0.09	0.11	0.744
Chronic Diseases	0.37	1	0.37	6.60	**0.011**
Psychiatric disorder	0.14	1	0.14	4.97	**0.026**
Smoker	0.03	1	0.03	0.28	0.598
Energy drinks consumption	0.19	1	0.19	0.99	0.319

[a] The bold values indicate $p < 0.05$

Structured Clinical Examination (OSCE). This behavior can be attributed to the prolonged stress experienced by students during interactions with both their peers and the examiner. Additionally, the presence of a distinct evaluation station further contributes to the overall anxiety-inducing nature of this assessment.

Students opt to engage in a brief rehearsal session before their presentations, which includes real-time peer-to-peer observation and feedback. This practice not only improves students' oral presentation skills, but also helps in reducing the stress associated with such events [19].

In our dataset, we observed a correlation between an increasing number of academic years and the use of propranolol. This correlation is mostly attributed to the stress experienced by students during their last year, particularly in reference to their future prospects. Notably, similar findings were observed in both Turkey and Thailand [20, 21].

Strengths and limitations

This study marks the inaugural investigation conducted in Palestine to explore the usage patterns of propranolol among medical college students. Nevertheless, there are several limitations associated with the current study. One limitation is that the questionnaire used was administered electronically, which could potentially impact students' responses by hindering their willingness to share genuine experiences or causing apprehension about discussing the use of beta-blockers. Another limitation is the utilization of a cross-sectional design, which does not consider changes in student knowledge and attitudes over time. Additionally, the generalizability of the study findings is limited since it exclusively focused on medical college students at An-Najah National University t, did not proportionally allocate the sample size across different education levels, and had a low frequency of beta-blockers use in this population. Despite the importance of obtaining an adequate sample size, our samples were unevenly distributed among the medical years. If this study had collected and correlated exam outcomes, it could have enhanced our understanding and potentially established a significant relationship between the use of beta-blockers and exam performance. Nevertheless, this study represents an initial step in evaluating propranolol consumption and behaviors related to their use and misuse among university students in the medical field. Future studies should aim to establish correlations between the level of awareness, patterns of beta-blockers use, and sociodemographic and educational factors.

Conclusion

This study aimed to determine the prevalence of propranolol usage among An-Najah National University medical students. The findings indicate a prevalence of 12%, with a greater prevalence among students in their last year of study. Among those who used propranolol, 89% reported taking it prior to OSCEs, suggesting that stress-induced behavior was a key factor influencing its use. Although 68% of propranolol users were aware of its potential side effects, they still chose to self-medicate. Raising awareness among healthcare providers and educators about propranolol misuse among medical students underscores the significance of interdisciplinary collaboration in developing evidence-based interventions that integrate stress management practices and behaviors before challenging academic events in the journeys of medical students. We also recommend implementing targeted awareness campaigns to educate medical students about the risks of self-medication, even with commonly available drugs like propranolol. Academic institutions should consider integrating stress management into their curricula to equip students with healthier coping mechanisms.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-07094-x.

Supplementary Material 1

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Author contributions
All writers have contributed to their commitment to their work, including writing, analysis, and interpretation of the data.

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Data availability
The dataset supporting the conclusions of this article is included within the article and its additional file.

Declarations

Ethics approval and consent to participate
An-Najah National University institutional review board approved the study. All subjects involved in the study were invited to participate on a voluntary basis after the study purpose, risk, and advantage of participation were clarified. Informed consent was obtained from all participants. Interviews were carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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