

ORIGINAL RESEARCH

Off-Label Explorations: Beta Blockers Misuse among University Students in Jordan

Off-Label Explorations: uso indebido de betabloqueantes entre estudiantes universitarios en Jordania

Shaima' Zaben. The University of Jordan, Amman, Jordan.

Email: shimaazaben2000@gmail.com, <https://orcid.org/0009-0000-6635-1135>

Layla Nazzal. The University of Jordan, Jordan.

Email: lailahnaazzal1@gmail.com, <https://orcid.org/0009-0009-5251-4314>

Toqa Awaisheh. The University of Jordan, Jordan

Email: toqaawaisheh@gmail.com, <https://orcid.org/0000-0002-0503-8265>

Raneem Alzu'bi. The University of Jordan, Jordan.

Email: raneemziad1234@gmail.com, <https://orcid.org/0009-0007-3402-1378>

Yara Almadani. The University of Jordan, Jordan.

Email: yaraferasalmadani@gmail.com, <https://orcid.org/0009-0009-6271-4352>

Ja'far Zaben. The University of Jordan, Jordan.

Email: jafar.zaben.md@gmail.com, <https://orcid.org/0009-0004-2888-8360>

Latefa Dardas. The University of Jordan, Jordan.

Email: L.dardas@ju.edu.jo, <https://orcid.org/0000-0001-5437-4778>

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Abstract

Background and purpose. The off-label use of beta-blockers among university students for cognitive enhancement and stress reduction has raised concerns due to potential health risks and implications for educational institutions. This study aims to explore the prevalence, patterns, and perceptions of the use of beta-blockers among university students in Jordan, and to examine the associated demographic factors and health outcomes. **Methods.** A cross-sectional survey was conducted in Jordan, involving students from seven public and private universities. The survey included demographic questions and detailed inquiries about the use of beta-blockers. A total of 1,248 students participated in the study. **Results.** Of the participants, 4.29% reported using beta-blockers, with Propranolol being the most common. Usage was occasional, primarily before stressful academic events. While 75.7% of users reported achieving their desired outcomes, there was a significant trend of self-adjusting doses without medical consultation. Side effects were reported by 25.6% of users, and a substantial portion relied on informal networks for information about beta-blockers. **Conclusions.** The study underscores a modest but significant engagement in use of beta-blockers among university students in Jordan for non-medical purposes, primarily driven by academic stress. The findings highlight the need for increased awareness of the risks of unsupervised use, the importance of reliable information sources, and alternative stress management strategies. Educational institutions, in collaboration with healthcare providers, should promote healthier coping mechanisms and implement policies to regulate and monitor prescription medication distribution among students, emphasizing the importance of professional medical advice.

Keywords: propranolol, Jordan, university students, beta blockers

Resumen

Antecedentes y objetivo. El uso no indicado de betabloqueantes entre los estudiantes universitarios para la mejora cognitiva y la reducción del estrés ha suscitado preocupación debido a los posibles riesgos para la salud y las implicaciones para las instituciones educativas. Este estudio tiene como objetivo explorar la prevalencia, los patrones y las percepciones del uso de betabloqueantes entre los estudiantes universitarios en Jordania, y examinar los factores demográficos asociados y los resultados de salud. **Métodos.** Se realizó una encuesta transversal en Jordania, en la que participaron estudiantes de siete universidades públicas y privadas. La encuesta incluía preguntas demográficas e indagaciones detalladas sobre el uso de betabloqueantes. Un total de 1.248 estudiantes participaron en el estudio. **Resultados.** De los participantes, el 4,29% declaró utilizar betabloqueantes, siendo el Propranolol el más frecuente. El uso era ocasional, principalmente antes de acontecimientos académicos estresantes. Aunque el 75,7% de los usuarios declararon haber obtenido los resultados deseados, se observó una tendencia significativa a autoajustar las dosis sin consultar al médico. El 25,6% de los usuarios declararon efectos secundarios, y una parte sustancial recurrió a redes informales para obtener información sobre los betabloqueantes. **Conclusiones.** El estudio subraya un compromiso modesto pero significativo en el uso de betabloqueantes entre los estudiantes universitarios de Jordania con fines no médicos, impulsado principalmente por el estrés académico. Los resultados ponen de relieve la necesidad de una mayor concienciación sobre los riesgos del uso no supervisado, la importancia de las fuentes de información fiables y las estrategias alternativas de gestión del estrés. Las instituciones educativas, en colaboración con los proveedores de atención sanitaria, deberían promover mecanismos de afrontamiento más saludables y aplicar políticas para regular y supervisar la distribución de medicamentos con receta entre los estudiantes, haciendo hincapié en la importancia del asesoramiento médico profesional.

Palabras clave: propranolol, Jordania, estudiantes universitarios, betabloqueantes

Introduction

The off-label use of pharmaceuticals, particularly for non-medical purposes, has become a pressing issue among university students, raising concerns about the motivations behind and risks associated with such practices (1). "Off-label use" refers to the utilization of medications for conditions or purposes not approved by regulatory authorities (2,3). Among the various classes of drugs, beta-blockers have attracted significant attention in this context. Originally developed to manage cardiovascular disorders, beta-blockers are increasingly misused by students seeking cognitive enhancement or stress relief (4,5). This trend is especially concerning within health profession programs, where students' misuse of beta-blockers poses potential health risks and carries implications for educational institutions and public health policies (6).

A major concern regarding the off-label use of beta-blockers is the potential for serious physical side effects. As beta blockers directly influence the cardiovascular system, their unsupervised use can disrupt heart function, leading to decreased heart rate and blood pressure (7,8). Such disruptions can result in adverse effects, including dizziness, fainting, or even life-threatening cardiac complications in some cases (9,10). Additionally, the risks are further elevated when beta-blockers interact with other medications or exacerbate pre-existing health conditions, increasing the likelihood of adverse outcomes (11,12).

Another critical issue is the potential for misuse of beta-blockers to delay or obscure the diagnosis and treatment of underlying health conditions. When students self-administer these medications without a proper medical evaluation, they may inadvertently mask symptoms that require professional attention, thereby neglecting essential healthcare needs.

Psychologically, there is a growing need to acknowledge the increased vulnerability to mental health issues among students who misuse beta-blockers, especially before exams. Heightened stress levels combined with inappropriate medication use warrant special consideration and intervention. A study by Butt et al. (13)

highlighted the alarming consequences associated with beta-blocker use among students, revealing a significantly higher risk of subsequent antidepressant use and increased rates of suicide attempts in users compared to non-users.

The prevalence and patterns of off-label beta-blocker use, as well as the associated health outcomes, can vary widely across different regions due to factors such as regulatory frameworks, cultural norms, healthcare infrastructure, and the availability of resources (14-16). Recognizing these regional differences is essential for implementing targeted healthcare interventions, enhancing patient safety, and addressing health disparities. This study aims to explore the prevalence, patterns, and outcomes of beta-blocker use among university students in Jordan to contribute to a better understanding of these issues in a regional context.

Methods

This study is grounded in the Theory of Planned Behavior (TPB), which provides a framework for understanding health-related behaviors, including medication use. According to TPB, an individual's intention to engage in a behavior is influenced by their attitudes toward the behavior, subjective norms, and perceived behavioral control (17). This theoretical approach is relevant for examining the off-label use of beta-blockers among university students, as it considers the role of personal motivations (e.g., perceived benefits of cognitive enhancement), social influences (e.g., peer pressure or academic culture), and perceived control over accessing and using the medication (18). Employing this framework supports the choice of a cross-sectional survey design to capture the prevalence and patterns of beta-blocker use, as well as the demographic and psychosocial factors associated with this behavior. The TPB informs the development of the survey questionnaire, which includes questions related to beliefs about medication effects, social influences, and behavioral control (19-21).

Design

This study employed a robust cross-sectional design in Jordan, an Arab nation situated in the

Middle East. The sample was drawn from a diverse set of seven universities, strategically selected to represent various regions within the country, and to encompass both public and private sectors. In order to account for the uneven population distribution in Jordan, where a significant proportion resides near the capital city of Amman where most universities are concentrated, data collection was stratified accordingly. Specifically, 62% of data collection occurred in the central region, 25% in the northern region, and 13% in the southern region.

Within the participating universities, a random selection process was employed to ensure representation from different academic disciplines. Specifically, schools were randomly chosen to encompass health sciences, scientific disciplines, humanities, and postgraduate programs. The health sciences schools included medicine, nursing, pharmacy, dentistry, and rehabilitation. Scientific disciplines were represented by schools of science, engineering, information technology, and agriculture. The humanities domain was covered by schools of educational sciences, literature, law, religion (sharia), art, and business. All academic years, from first to sixth, were included in the study, allowing for a comprehensive examination of beta-blocker use among students across different stages of their academic journeys. This approach ensures that the findings reflect the diversity of academic disciplines and academic levels within the university student population. Students were approached and invited to voluntarily participate in the study by completing a standardized paper-based questionnaire. The questionnaires were personally distributed to the participants. Rigorous measures were taken to ensure the validity of the questionnaire. A pilot testing and cognitive interviewing phase were conducted, involving 40 students who represented the health sciences, scientific, and humanistic schools. The pilot participants were asked to provide feedback on their overall impression of the questionnaire, the time required to complete it, and the clarity of the questions.

Measures

The survey questionnaire encompassed three distinct sections, each focusing on specific aspects

related to beta-blocker use among the participants. The first section of the questionnaire aimed to gather demographic information from the participants. This included data such as their age, gender, university attended, specific school within the university, current year of study, GPA, as well as any history of psychiatric or physical health conditions. The second part of the questionnaire delved into the prevalence of beta-blocker use among the participants for non-medical purposes. In this section, participants were asked to provide information about their beta-blocker usage, including the types of beta-blockers they used and their reasons for using them. The third section of the questionnaire was specifically designed for participants who reported using beta-blockers. It included questions on various aspects related to their beta-blocker use. Participants were asked about the dosage of beta-blockers they consumed, the source of their knowledge about the drug, any experienced side effects, the perceived impact of the medication on their daily activities, and their willingness to discontinue its use.

Results

Participants' Characteristics

A total of 1,248 students (response rate=94%) participated in the study. These students were drawn from a diverse range of schools within seven public and private universities in Jordan: 33.8% from scientific schools, 38.7% from health sciences schools, 24.1% from human sciences schools, and 3.4% from postgraduate programs. Among the participants, 56.8% were female. Regarding academic performance, 49.1% of the participants had a very good grade point average. A small proportion of students (2.4%) reported being diagnosed with psychiatric diseases, while 1.1% reported using antidepressants. Additionally, 6.5% of the participants had a chronic medical disease. In terms of general medication use without a prescription, 32.1% of participants reported using antibiotics, 58.2% used acetaminophen, 13.5% used non-steroidal anti-inflammatory drugs, 2.6% used sedatives, 21% used antihistamines, and 31.1% were taking vitamins. Table 1 details all sociodemographic characteristics.

Table 1. Participant's characteristics (N=1,248)

Characteristic	n (%)
School	
Humanities	299 (24.1%)
Health	481 (38.7%)
Scientific	420 (33.8%)
Graduate	42 (3.4%)
Year of Study	
First year	218 (17.6%)
Second year	350 (28.2%)
Third year	280 (22.6%)
Fourth year	219 (17.7%)
Fifth year	160 (12.9%)
Sixth year	12(1%)
Gender	
Female	698(56.8%)
Male	531(43.2%)
Grade point average	
Fair	38 (3.2%)
Good	236 (19.9%)
Very good	581(49.1%)
Excellent	328(27.7%)
Diagnosed with a psychiatric disease	
No	1214 (97.6%)
Yes	30 (2.4%)
Diagnosed with chronic medical disease	
No	1161(93.5%)
Yes	81(6.5%)
Antibiotics use	
Yes	398(32.1%)
No	842(67.8%)
Acetaminophen use	
Yes	722 (58.2%)
No	519 (41.8%)
NSAID use	
Yes	168 (13.5%)
No	1073 (86.5%)
Sedatives use	
Yes	32 (2.6%)
No	1209 (97.4%)
Antihistamines use	
Yes	260(21%)
No	981(79%)
Vitamins use	
Yes	386 (31.1%)
No	855 (68.9 %)

Footnote: Data are self-reported by university students across various disciplines in Jordan, collected through a cross-sectional survey conducted in 2023.

Beta Blockers Use: Prevalence, Patterns and Associated Factors

Of the total participants, 53 (4.29%) reported using beta-blockers. Propranolol was the most commonly used type of beta-blocker with 78.9% of users reporting taking it. Further, 116 (9.4%) reported they have been advised to take beta-blockers at some point in their time at university. When asked about beta-blocker usage within families, it was found that 12.6% of students reported that their families use beta-blockers for medically prescribed purposes, while 3.4% reported family use of beta-blockers for non-medical reasons. Further, 24 (60%) of the users reported some knowledge of beta-blocker side effects, and 16 (40%) recommended using it.

The results also revealed that of the total beta-blocker users, 8 (23.5%) expressed a desire to discontinue their use. Furthermore, 15 participants (44.1%) reported having the ability to stop using beta-blockers for non-medical reasons. Regarding perceptions, 12 users (36.4%) felt a sense of insecurity or viewed their use of beta-blockers as indicative of a character weakness. Additionally, 10 individuals (30.3%) encountered difficulties in discussing their non-medical use of beta-blockers with others.

Among individuals using beta-blockers for non-medical purposes, 28 (75.7%) reported achieving their desired outcomes. 18 users (54.5%) noted an increase in calmness, 9 (23.1%) observed a faster memory recall time, and 13 (34.2%) experienced improved communication skills.

When exploring how students learned about beta-blockers, it's evident that personal networks played a crucial role, with friends (12, 31.6%) and coworkers (11, 27.5%) being the primary sources. This reliance on social and professional circles, over more formal or digital sources of information, underscores the personal and anecdotal nature of beta-blocker knowledge dissemination.

Regarding usage patterns, the majority report using beta-blockers "sometimes" (25, 64.1%), indicating a tendency to reserve these drugs for

particular occasions, possibly linked to stress or anxiety-inducing situations. This sporadic use suggests a strategic approach to medication, aimed at specific outcomes rather than routine consumption. The data on perceived dependence further supports this, with a significant portion of users feeling relatively independent from the drugs, reflecting a controlled use scenario.

The dosage preferences of users lean towards the moderate range, with 21 individuals (53.8%) opting for 10-20mg. Yet, there's a concerning trend of self-adjustment in dosage without medical consultation, as reported by 11 respondents (26.8%), highlighting a proactive but potentially risky approach to dosage management.

Beta-blockers see particular use in scenarios expected to induce stress or require concentration, such as before oral exams (18, 43.9%) and presentations (13, 32.5%), suggesting a reliance on these drugs to enhance performance or alleviate anxiety in critical moments. Despite these benefits, the incidence of side effects cannot be overlooked, with 10 out of 40 users (25.6%) experiencing issues ranging from nausea and weakness (6, 18.2%) to sleep disturbances (5, 19.2%) and coldness in extremities (6, 18.2%), pointing to the physical compromises some are willing to make for the perceived mental benefits.

Discussion

This study is the first to explore the prevalence and patterns of beta-blocker use among university students in Jordan using a representative sample. The findings provide valuable insights into the prevalence, associated factors, and specific patterns of this practice. With 53 participants (4.29%) reporting the off-label use of beta-blockers, the study identifies a significant, albeit relatively small, segment of the student population engaging in this behavior. Propranolol emerged as the most frequently used beta-blocker, accounting for 78.9% of the usage among those who specified their medication, highlighting its perceived effectiveness or familiarity within this demographic.

Table 2. Prevalence and Patterns of Beta-blocker usage (N=53)

Name of beta-blocker	n(%)
Propranolol	30(78.9%)
Nebivololol	2(5.2%)
Metoprolol	1(2.6%)
Cannot recall the name	5(13.15%)
Sources of information about beta blockers	
Social media	3(7.7%)
Friends	12(31.6%)
Coworkers	11(27.5%)
Family	6(15.4%)
Curriculum	8(21.1%)
Physician	7(18.4%)
The internet	2(5.3%)
Frequency of usage	
Regularly	12(30.8%)
Sometimes	25(64.1%)
Only once	2 (5.2%)
Perceived Dependence	
1 strongly independent	9(23.1%)
2	9(23.1%)
3	10(25.6%)
4	7(17.9%)
5 Strongly dependent	4(10.3%)
Perceived performance without beta-blockers	
Same outcome without use	11(27.5%)
Worse than without use	18(45%)
Dose	
<10mg	15(38.5%)
10-20mg	21(53.8%)
30-40 mg	2 (5.1%)
>40mg	1 (2.6%)
Increasing the dose without telling the physician	
Yes	11 (26.8%)
No	30 (73.2%)
Other usage reasons	
Anxiety	2(.2%)
Daily/drivers	2(.2%)
High Blood Pressure/HTN	2(.2%)
Palpitations	1(.1%)
Usage time	
Before written exams	10 (25%)
Before oral exams	18 (43.9%)
Before presentations	13 (32.5)
Exam periods	7(17.5%)
Before gatherings	1(2.6%)
Before hospital rounds	1(2.6%)
Experienced any side effects (can choose more than one answer)	
Lowering BP	4 (12.1%)
Sexual dysfunction	2(6.1%)
Nausea and weakness	6(18.2%)
Shortness of breath	3(9.1%)
Sleep disturbances	5(19.2)
Coldness in the extremities	6(18.2%)

Footnote:Data on beta-blocker use were gathered from students reporting non-medical use of beta blockers, primarily for stress and cognitive enhancement purposes.

In comparison, other studies have reported similar patterns of beta-blocker usage among university students globally. For instance, a national survey conducted in the Netherlands among 1,572 students from government-supported universities found that 36 students used beta-blockers, with 61.1% of them admitting to non-medical use, accounting for 1.5% of the total respondents. Additionally, 80.8% of these students also reported using methylphenidate for non-medical purposes, indicating a broader trend of prescription drug misuse for cognitive enhancement and stress management, with an overall non-medical prescription drug usage rate of 4.0% (22).

In a national cross-sectional study conducted in Saudi Arabia, 6.4% of 3,326 female medical and pharmacy students reported using beta-blockers, primarily before exams and presentations (23). Similarly, a study in Riyadh found that 12% of 680 dental students used propranolol, further emphasizing its popularity in academic contexts where high-stakes performance is involved (24). Another study conducted at King Saud bin Abdulaziz University found an even higher prevalence, with 14.5% of 234 medical students reporting propranolol usage, primarily before objective structured clinical examinations (OSCE), presentations, and, to a lesser extent, written exams (25).

These comparisons demonstrate that the prevalence of off-label beta-blocker use among Jordanian university students aligns with patterns observed in other regions, where beta-blockers are commonly used for non-medical purposes in high-pressure academic settings. The consistency of these findings across different cultural and educational contexts underscores the global nature of this issue and the need for targeted interventions to address off-label prescription drug use among students.

Interestingly, our study revealed that 116 students (9.4%) reported being recommended beta-blockers at some point during their university life. This figure, combined with data showing that 12.6% of students reported family usage for medical purposes and 3.4% for non-medical reasons,

highlights important contextual factors influencing beta-blocker consumption. These statistics suggest that there may be a social and familial component to medication practices, reflecting broader societal attitudes toward stress management and the normalization of pharmaceutical interventions.

We further explored the motivations and outcomes of beta-blocker use, finding that 75.7% of users reported achieving their desired effects, such as increased calmness and enhanced memory recall. This may contribute to the appeal of beta-blockers in academic settings, where students seek cognitive or emotional enhancement to manage the pressures of exams and presentations. However, a significant number of users also expressed concerns about dependence, with some desiring to quit due to self-image concerns and social stigma surrounding their use. These findings highlight the complex psychological and social dynamics underpinning beta-blocker use among university students in Jordan.

The role of social networks in disseminating knowledge about beta-blockers proved pivotal in our study, with friends and coworkers being the primary sources of information. This reliance on informal channels, rather than medical advice, raises concerns about the accuracy of the information shared, and potentially increases the risk of misinformation. Similar trends were observed in a cross-sectional study involving 9,161 undergraduate students in the Mid-Western United States, which showed that peer networks were the primary source of knowledge and access to prescription medications (26). This dynamic points to the broader issue of informal drug prescription behaviors among students, where social connections often facilitate access to medications without professional oversight.

Our findings align with previous research that explored the sources of prescriptions for sleep aids, stimulants, anxiolytics, and pain medications among students, categorizing these sources into peer, family, and other channels. That study revealed that peer sources were the most common, and students who obtained prescriptions through peers exhibited significantly higher rates of alcohol and substance use (26). This correlation

between peer-sourced prescriptions and substance misuse underscores the need for targeted interventions. Efforts should focus on raising awareness about the dangers of non-prescribed drug use, promoting accurate health information, and encouraging reliance on professional medical guidance to mitigate the risks associated with unsupervised consumption.

Usage patterns in our study suggest a strategic approach to beta-blocker use, with most students reporting occasional use, specifically "sometimes" (64.1%) in anticipation of stress-inducing academic events. Jordanian university students frequently experience heightened stress during oral and written examinations, similar to patterns reported in other regional contexts. For instance, a study conducted at the University for Health Sciences in Jeddah, Saudi Arabia, found that the primary reasons for propranolol use were anxiety reduction and performance enhancement, particularly before Objective Structured Clinical Examinations (OSCE) at 70.6% and before oral presentations at 38.2% (25). This situational use of beta-blockers reflects a perception of these drugs as tools for academic performance enhancement or stress management, rather than substances of daily dependence.

However, our study also identified a concerning trend of self-adjusted dosing, with 26.8% of users reporting that they altered their doses without professional guidance. This highlights a significant gap in medical oversight and the potential risks of unsupervised beta-blocker consumption. The contexts in which beta-blockers are most frequently used—predominantly before oral exams, presentations, and exam periods—underscore the academic pressures students face and their reliance on pharmaceutical aids for performance enhancement and anxiety reduction.

A systematic review published in 2021 supports these findings, revealing that the most common reasons for using beta-blockers were to increase alertness, enhance memory, and improve academic performance during study and examination periods (5, 6). These parallels between our study and international research emphasize the need for continued investigation and interventions to

address the growing trend of off-label pharmaceutical use among students, particularly in high-pressure academic environments.

The findings from this study highlight the nuanced aspects of beta-blocker use among university students in Jordan, underscoring the need for increased awareness of the risks associated with non-prescription beta-blocker use. Specifically, the study points to the importance of ensuring that students have access to reliable information about the implications of off-label medication use and the need for developing alternative, non-pharmaceutical stress management strategies within academic settings. The prevalence of self-medication is a significant concern, particularly for healthcare providers, and warrants immediate attention (26, 27).

It is imperative that educational institutions take proactive steps to enhance students' awareness of the potential risks associated with unsupervised propranolol use. Encouraging students to seek professional medical advice before considering beta-blocker treatment is crucial (25). Universities, in collaboration with healthcare entities, should implement educational campaigns aimed at raising awareness about the dangers of non-prescribed medication use. These campaigns should focus on the importance of using medications strictly as prescribed and seeking professional guidance.

Given that this study revealed stress and anxiety related to academic performance as key motivators for non-medical beta-blocker use, universities should prioritize the enhancement of mental health services and stress management programs. By offering healthier coping mechanisms and easier access to psychological support, universities could reduce students' reliance on pharmaceutical interventions for stress and performance-related issues. Faculty members, in particular, must take a more active role in engaging with students and offering the necessary support to alleviate academic pressures.

Furthermore, incorporating health literacy into university curricula is an essential step toward empowering students to make informed health decisions, including recognizing the dangers of

drug misuse. This initiative should emphasize how to critically assess health information, particularly sources obtained from social media or peer networks. Ensuring that professional counseling services are accessible and approachable would provide students with a confidential and judgment-free space to discuss stress, performance anxiety, and other challenges that might drive them to consider non-medical drug use.

At a national policy level, stricter regulations should be enforced regarding the distribution of beta-blockers, classifying them among medications that require a prescription. Stricter monitoring is necessary to identify and limit non-medical sources of supply. Healthcare providers should also be educated about the growing trend of prescription drug misuse among university students, ensuring they adopt informed prescribing practices that account for the potential for misuse among young adults.

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