Clinical and Experimental Health Sciences

Non-medical Use of Prescription Psychostimulants and Academic Performance in Medical Students

Sümbül Şekerci[1], Muhammed Yunus Bektay[2], Özlem Bildik[3]

[1] Bezmialem Vakif University, Faculty of Pharmacy, Department of Clinical Pharmacy, Istanbul, Türkiye.
[2] Istanbul University-Cerrahpasa, Faculty of Pharmacy, Department of Clinical Pharmacy, İstanbul, Türkiye.
[3] Bezmialem Vakif University, Faculty of Medicine, Department of History of Medicine and Ethics, Istanbul, Türkiye.

Correspondence Author: Sümbül Şekerci
E-mail: bsekerci@bezmialem.edu.tr
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ABSTRACT

Objective: It is well-known that healthy medical students use psychostimulants to improve their cognitive functions and reduce their need for sleep. The main motivation behind this cognitive enhancement is to increase academic performance. However, the literature is not clear enough to support this situation.

Methods: This cross-sectional study was conducted through an online questionnaire, with 585 students participating. The grade point average number was used to assess the student' academic performance. Additionally, a self-evaluation scale was employed to assess levels of pharmaceutical knowledge, study performance, academic success, academic anxiety, and study habits.

Results: Out of 585 healthy students surveyed, 40 (7.3%) stated that using psychostimulants to enhance their academic performance. However, there was no significant difference in grade point average scores and perceived academic success levels between users and non-users. Nevertheless, most of the users reported benefiting from taking psychostimulant drugs. Risk factors for non-medical use of prescription psychostimulants included high levels of pharmacology knowledge, smoking, and poor academic performance.

Conclusion: Although the non-medical use of prescription psychostimulants did not appear to significantly impact academic performance, most students reported positive subjective experiences, which could have a motivational effect. Therefore, it is crucial to conduct more in-depth investigations into the benefits and side effects of psychostimulants in healthy young individuals and provide them with up-to-date information on this issue

Keywords: Psychostimulant, academic performance, medical student, methylphenidate

1. INTRODUCTION

Prescription medications such as methylphenidate, modafinil, amphetamine, and atomoxetine are used to treat attention deficit hyperactivity disorder (ADHD), narcolepsy, etc. These psychologically active substances work on various molecular targets in the brain and can alter mood, behavior, and consciousness (1). However, recent data suggests that healthy individuals are increasingly interested in using these drugs to enhance their cognitive performance (2). Cognitive enhancement is the name given to methods that aim to improve cognitive capacities like memory or attention in healthy people (3).

Medical students are one of the most significant healthy populations who prefer to use psychostimulants (4-6). Several studies have reported that the incidence of psychostimulant usage among medical students in different countries ranges from 8 to 19 percent (7, 8). Medical education is a demanding and competitive field, and the high probability of psychostimulant use among medical students may be related to this competitive nature (9). Recent findings suggest that high levels of stress related to concerns for academic success and feeling under pressure are related to increased psychostimulant use among medical students (10). The primary rationale for using these drugs is to enhance cognitive performance, such as attention, memory, and concentration, and to gain an advantage in overcoming challenging tasks in medical school. It's reported in the literature that one of the most important motivations for the use of psychostimulants is to improve academic performance (11, 12).

The aim of this study is to investigate the non-medical use of psychostimulants (NMUPS) in medical students. The primary research topic of our study is to question the relationship between academic performance and NMUPS.

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2. METHODS

2.1. Participants and Procedure

This cross-sectional study involved undergraduate medical students from different cities in Turkey, who were selected through a non-probabilistic snowball sampling method. An online questionnaire was conducted, which was distributed to medical student groups in various faculties and university medical students through social media platforms (WhatsApp, Facebook, and e-mail) in February – March 2020. The sample size has been made considering a 5% margin error and a 95% confidence level with a 50% response rate. It is determined that a minimum of 246 participants should be included. A total of 660 students participated in the questionnaire, but 75 participants who provided incomplete or inappropriate responses were excluded from the study. Additionally, 35 medical students who reported being diagnosed with narcolepsy or ADHD were also excluded (see Figure 1). The participants provided their informed consent, and the Ethics Committee of Bezmialem Vakif University approved the study (approval number 03.02.2020-03/50).

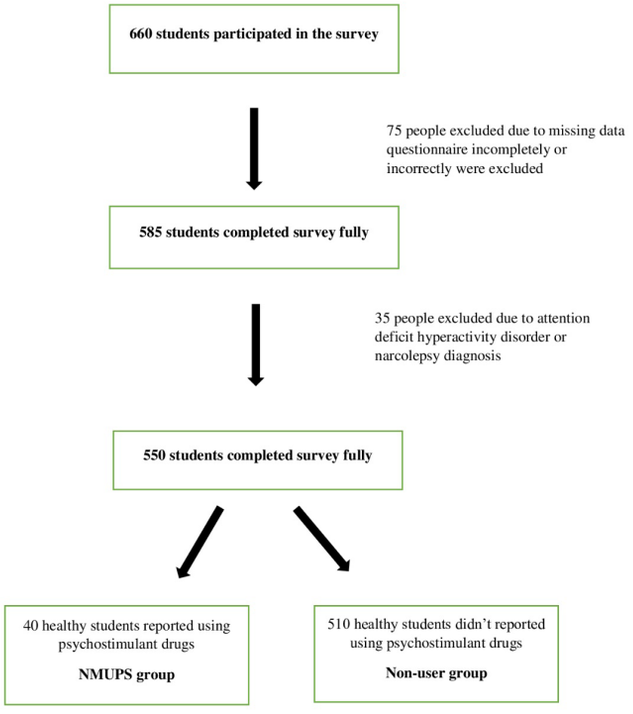

Figure 1. *Study Flowchart*
NMUPS: Non-medical Use of Prescription Psychostimulant

2.2. Online Questionnaire

The Google Forms platform was utilized to create and distribute a structured questionnaire. Prior literature was examined and used to develop the questionnaire, which was then reviewed by a panel of four experts. In a pilot study with 20 students, the clarity of the questionnaire items was assessed, and based on their feedback, the questions were revised. The data collected during the pilot study were not included in the statistical analysis.

The questionnaire consisted of 37 questions, which were divided into seven sections: demographic information, medical history, patterns of psychostimulant use and experiences, self-evaluation of academic success, anxiety levels, study performance, and sleep quality. In the self-evaluation section, people were asked to evaluate themselves between 1-5 points on a Likert scale. Participants were asked to report their Grade Points Average (GPA) as an indicator of academic success. In the questionnaire, participants were asked whether they had previously been diagnosed with ADHD or narcolepsy. Participants who declared a diagnosis of ADHD or narcolepsy were excluded from the final analysis.

At the beginning of the online questionnaire, the concept of Non-Medical Use of Prescription Stimulants (NMUPS) was explained thoroughly to the participants. They were informed that the use of psychostimulants for medical diagnosis was not considered NMUPS and was not intended for academic purposes.

2.3. Statistical Analysis

IBM software (SPSS 26.0 for Windows; IBM Corp, Armonk, NY) was used for statistical analyses. Descriptive statistics were calculated, Pearson chi-square analyses and Fisher's exact test were used between groups for categorical comparisons. The distribution of normality was assessed by the Kolmogorov-Smirnov test. The use of the Mann-Whitney U test to compare age differences across groups was made. The level of significance was set at ≤ 0.05. The parameters that had the greatest impact on NMUPS were determined using binary logistic regression with the entry method. Applying logistic regression and correlation, the hypothesis is tested. Variables with significant differences were included in the regression model after univariate analyses.

3. RESULTS

A total of 585 students completed the questionnaire, with 35 individuals (5.9%) who had a diagnosis of ADHD or narcolepsy being excluded. Of the 585 participants, 356 (64.7%) were female, and the mean age was 23.32 (SD 4.38) years. In terms of academic status, 225 students (40.9%) were in the basic medical sciences term (years 1-3), 218 students (39.6%) were in the clinical term, and 106 students (19.2%) were graduate students (either in residency or preparing for the residency exam).

The NMUPS group consisted of 40 healthy students who reported using psychostimulants to enhance their academic performance without a diagnosis. The prevalence of NMUPS was found to be 7.3% among the participants. There was no significant difference in gender or academic status between users and non-users. However, age (p=.01), smoking (p<.001), and alcohol use (p<.05) showed significant differences between the two groups (Table-1).

Table 1. *Characteristics of the medical students who were non-medical users of psychostimulant (n = 40) and non-user (n = 510)*

	User n (%)	Non-user n (%)	p
Gender			0.759
Female	25 (4.5)	331 (60.2)	
Male	15 (2.7)	179 (32.5)	
Age (mean ± SD)	24.55 ± 3.35	23.23 ± 4.44	**.001***
Semester			.055
1-3	11 (2)	214 (39)	
4-6	16 (2.9)	202 (36.8)	
Graduate/Resident	13 (2.4)	93 (16.9)	
Grade Points Average (0-4)			.959
<2.5	7 (1.3)	82 (14.9)	
2.5-3	15 (2.7)	188 (34.2)	
>3	18 (3.3)	240 (43.6)	
Smoking			**<.001 **
Yes	17 (3.1)	23 (4.2)	
No	59 (10.7)	451 (82)	
Alcohol			**.03 **
Yes	12 (2.2)	84 (15.3)	
No	28 (5.1)	426 (77.5)	
Herbal Product /Supplement use			.069
Yes	10 (1.8)	73 (13.3)	
No	30 (5.5)	437 (79.5)	

** The Mann Whitney U test, **Chi-Squa*

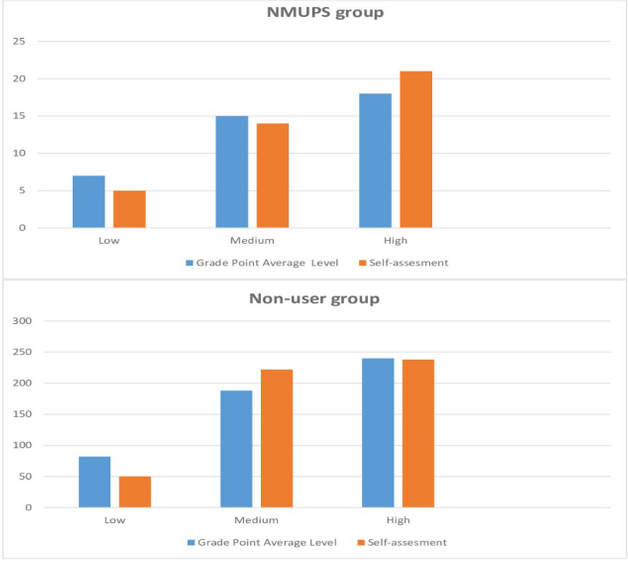

Figure 2. *Evaluation of academic success in NMUPS and non-user groups.*
NMUPS: Non-medical Use of Prescription Psychostimulant

We employed both subjective and objective criteria to assess academic success. The objective criterion was the GPA score, which reflects the student's performance on medical school exams. The subjective criterion was based on the students' self-assessment of their success. However, we did not observe a significant difference between the user and non-user students in terms of their GPA scores or perceived academic success levels (p>.05), as depicted in Figure 2. Furthermore, there was no significant difference between the groups in terms of self-assessment of academic anxiety and sleep quality (p>.05). However, there was a statistically significant difference between the groups in terms of study performance levels (p<.05) and pharmacological knowledge levels (p<.05).

We aimed to identify the patterns of NMUPS in medical students, and therefore, we investigated the frequency, duration, and timing of psychostimulant use, among other factors. Out of the participants, 21 (52.5%) reported using psychostimulants several times in their life, while 4 (10%) used them several times a month, 2 (5%) used them several times a week, 5 (12.5%) used them once a day, and 8 (2%) used them regularly during exam periods.

The purposes of the students to use psychostimulants were as follows; to enhance cognitive function (n: 29, 72.5%), to provide alertness (n:18, 45%), motivation (n:13,32.5%), request to try (n: 7,17.5%), to reduce anxiety (n: 6, 15%). Most of the users (n: 34, 85%) stated that they benefited from psychostimulant drugs. The positive experiences of the students related to using psychostimulants were as follows; Cognitive functions (attention, memory) increased in 23 (57.5%) students, 20 (50%) students became better focused, 10 (25%) students increased their motivation, 14 (35%) students' need for sleep decreased. The side effects reported were palpitation, insomnia, anxiety, tremor, gastrointestinal problems, and headache, respectively. 9 students (22.5%) reported no side effects related to psychostimulants.

Of the 510 students not using psychostimulants, 200 (39.2%) cited concerns regarding addiction and side effects as the reason. 68 (13.3%) students reported that consuming coffee/tea was sufficient for their study needs and did not require psychostimulants. Additionally, 76 (14.9%) students believed that psychostimulants would not be effective in enhancing cognition in healthy individuals.

A binomial logistic regression was performed to identify risk factors associated with the use of psychostimulants. The constructed binary logistic regression model was tested using the Omnibus Tests of Model Coefficients, and it was determined statistically significant. (p<.001). The model achieved a success rate of 92.7 percent. The model explained 14.4% (Nagelkerke R2) of the variance in NMUPS. Based on the regression analysis, smoking, increased knowledge of pharmacology, and study performance were identified as risk factors (Table 2).

Table 2. *Risk factors associated with a non-medical user of psychostimulant in medical students (user vs non-user)*

Predictor				95%Confidence Interval	
	B	OR	p	Lower	Upper
Smoking	-1.693	**0.184**	**<.001**	0.078	0.433
Alcohol	0.294	1.341	.534	0.532	3.381
Pharmacological Knowledge	-0.594	**0.552**	**.007**	0.359	0.849
Study Performance	3.810	45.160	.083	0.948	2.394
Age	-0.20	0.980	.554	0.916	1.048

4. DISCUSSION

This study has investigated the effects of psychostimulants on academic performance. Socio-demographic, health status, lifestyle characteristics, and prevalence of the users were obtained. The results indicate that the prevalence of NMUPS among undergraduate Turkish medical students was 7.3%.

This study found that the use of NMUPS did not have a significant effect on academic performance, as there was no significant difference between users and non-users in terms of objective (GPA score) and subjective (self-report) evaluation of academic performance. Contrary to our finding some studies have reported an impact of NMUPS on school performance (1, 13). Similar findings emphasized that the expectation of academic benefits from psychostimulants is likely illusory (12). A previous study reported short-term improvement in alertness and energy levels, rather than long-term academic benefits (14). Thus, there is controversy surrounding the use of psychostimulants to enhance cognitive function, and the evidence for their effectiveness in individuals without ADHD is not conclusive. Based on a meta-analysis of several randomized controlled trials, some positive effects on long-term memory consolidation were found with the use of psychostimulants for cognitive enhancement. However, there were no significant effects observed on attention, cognitive control, mood, or executive functions (15, 16). A study showed that psychostimulant use reduces the magnitude of neurochemical regional activation of the brain during a task (17). The study concluded that methylphenidate restricted the use of attention resources in the healthy human brain to achieve similar performance levels in a task. While this may be beneficial for individuals with ADHD, it could be harmful for those whose brain activity is already optimally focused.

Academic achievement did not appear to be related to non-medical use of prescription stimulants (NMUPS), although it is noteworthy that the majority of students reported having favorable subjective experiences with these drugs. Psychostimulants affected self-assessment of cognitive enhancement. It can strengthen the idea that psychostimulants have a motivational component in addition to their sole therapeutic actions (18). This motivation mainly depends on an expectation of cognitive enhancement. In the field of education, the motivation concept has become an important topic, and the term 'motivation' can be defined as the reasoning for an action or behavior in a particular way. There are different motivations that shape students' behavior. A similar study highlighted the significant disparity between subjective experiences and the acquired objective academic outcomes (19). A qualitative interview with university students suggested that the effects of NMUPS that help individuals are not as purely cognitive as often seems to be assumed. The student claimed that these drugs served as an emotional coping strategy for dealing with loss of fun, confidence, and interest (20).

In our research, we found that knowledge level about psychostimulants is a risk factor for NMUPS. However, psychostimulants can be addictive, and their long-term effects on healthy individuals are not well known. These drugs are highly addictive and have the potential to cause cardiovascular, neurological, and psychiatric complications (21, 22). So why do hardworking students use them more? We believe that there is a lack of information or misinformation about NMUPS. While the cognitive effects of these drugs are often emphasized, their side effects are often ignored. According to in-depth interviews with university students, the majority of users perceive psychostimulants as generally safe substances (23). Risks of NMUPS are well explained, but poorly evaluated by users (2).

According to our findings in terms of GPA, there was no statistically significant difference, in academic success, academic anxiety perception, and sleep quality between the user and non-user students. However, the differences between users and non-users were age, smoking, alcohol, study performance, and knowledge level. According to the present literature, users were more likely to use cigarettes and alcohol, had different normative values, and had a lower risk perception. (24, 25). Therefore, we suggest that this issue should be discussed together with addiction and health risk perception beyond academic success and cognition.

The small number of participants using NMUPS in our study can be considered a limitation in terms of generalizability. Although our questionnaire was only sent to medical school students and their university groups, the use of an online questionnaire is a limitation of the research, and the data collected in this study is based on self-report of the participants, which may introduce selection bias. Also, we collected GPA scores, ADHD or narcolepsy diagnoses, and other relevant information from self-reports provided by the individuals themselves. However, this aspect presents a limitation in our research. Also, the standardization of GPA scores of students from different universities may not be provided. There may be differences between the difficulty levels of exam of the different universites. But we ignored this situation as there is a standard educational curriculum within the same country.

5. CONCLUSION

The use of psychostimulants for academic and cognitive-enhancing purposes is a controversial issue. We could not find a statistically relevant relationship between academic performance and NMPSU in healthy medical students. It was remarkable that most of the students had positive subjective experiences as opposed to objective data. Neuroimaging research to explore the impact of NMPUS on the brains of healthy young individuals, as well as future studies delving into its psychosocial effects, could offer more comprehensive insights into these matters. Giving greater emphasis to the side effects and addictive potential of psychostimulant drugs in pharmacology education among medical school students might act as a deterrent against the off-label use of such drugs by young individuals.

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Acquisition of data for the study: BSS, MYB, OB
Analysis of data for the study: BSS, MYB
Interpretation of data for the study: BSS, MYB
Drafting the manuscript: BSS, MYB
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