Journal of Trends in Medical Investigation

J Trends Med Invest 2025;1(3):84-96
https://doi.org/10.64512/jtmi.2025.19

Research Article

University students' knowledge and attitudes toward rational antibiotic use: implications for public health education

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ABSTRACT

Background: The correct implementation of Rational Drug Use and Rational Antibiotic Use principles is crucial for public health both globally and nationally. The development of effective policies and interventions requires studies evaluating societal perspectives on this issue. Therefore, this study aimed to assess the knowledge, behaviors and attitudes of university students toward the rational antibiotic use, and to contribute to awareness raising when necessary.

Methods: A questionnaire comprising a demographic information form, items on medication use characteristics, and a scale assessing knowledge and attitude toward rational antibiotic use was administered to university students during the 2021-2022 academic year.

Results: A total of 1046 university students participated in the study. Most students reported reading medication instructions (77.1%) and using antibiotics only upon a physician's recommendation (80.0%). Painkillers were the most frequently used medications (47.3%), followed by antibiotics (18.1%). Knowledge scores regarding rational antibiotic use did not differ significantly by gender, class level, economic status or parental education; however, students from the Faculty of Education demonstrated significantly higher knowledge levels ($p<0.05$). In contrast, attitude scores showed significant differences with male students, third-year students, and those with higher income levels exhibiting more positive attitudes toward rational antibiotic use ($p<0.05$). Additionally, students who used antibiotics only with a physician's recommendation and those who avoided using medications prescribed to family members had significantly higher attitude scores ($p<0.001$).

Conclusion: These findings indicate that strengthening rational medication practices among university students requires not only theoretical education but also continuous awareness programs, which may contribute to improved medication use practices within similar academic settings.

Keywords: rational drug use, anti-bacterial agents, health knowledge, attitudes, practice, students, universities, surveys and questionnaires

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Received: 20.11.2025 ▪ Accepted 20.12.2025

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Introduction

The correct implementation of Rational Drug Use (RDU) and Rational Antibiotic Use (RAU) principles is essential for effective healthcare delivery and public protection. RDU encompasses appropriate drug selection based on clinical need, correct dosing and duration, cost effectiveness, and adequate patient information, aiming to ensure safe and effective pharmacotherapy (1,2).

Antibiotics play a vital role in the treatment of infectious diseases; however, their inappropriate use remains a major contributor to antimicrobial resistance increased morbidity and mortality rates, and rising healthcare costs (3-5). Antibiotic resistance arises primarily from inappropriate indications, insufficient dosage, inadequate duration, and incorrect administration routes (5-7). Despite global initiatives promoting rational medication practices, inappropriate antibiotic use continues to be widely reported (8-11).

In Türkiye, studies on RDU and RAU have largely focused on healthcare professionals (12-18), while investigations targeting university students remain limited (19-21). This population is particularly important because a substantial proportion of university students are enrolled in health-related programs and will become future healthcare providers. Early identification of their medication use behaviors, knowledge, and attitudes may help inform educational interventions before graduation (9).

Inappropriate antibiotic use is not limited to the physician–patient interaction but reflects broader behavioral and educational factors (22). Therefore, evaluating knowledge and attitudes toward RAU among university students represents an important step toward improving future prescribing behaviors and public awareness.

Accordingly, this study aimed to assess general drug use behaviors and knowledge and attitudes related to RAU among university students at a single university. By addressing this specific population, the findings are expected to contribute to the development of targeted educational strategies and inform future research in similar academic settings.

Material and Methods

This study is a descriptive cross-sectional survey. The study population consists of all students enrolled at Biruni University during the fall semester of the 2021-2022 academic year. According to the Student Affairs Office of our Faculty, there were 3459 students during the planning dates of the study. Using the sample calculation formula below, assuming the prevalence of drug use and antibiotic use knowledge and attitudes is unknown in our population, it was calculated that at least 384 students should be reached with 95% confidence and 5% deviation. Therefore, the goal was to reach at least 384 students. To improve precision and reduce sampling error, we continued recruitment beyond the minimum target and included all eligible and willing students available during data collection, resulting in a larger final sample.

The study was conducted in accordance with the ethical principles of the Helsinki Declaration. Ethical approval was obtained from the Non-Interventional Research Ethics Committee of Biruni University (decision number 2022/69-18, dated 29.04.2022). Written informed consent was obtained from the participating students. This study was conducted in accordance with the Declaration of Helsinki, and all ethical procedures, including informed consent and confidentiality of participant data, were strictly observed.

In this study, students from health-related and non-health-related fields at our university in Istanbul were surveyed. We used stratified sampling based on a known (finite) population frame, with departments as strata, and students were recruited proportionately where feasible. A total of 1046 students participated in the study. Detailed distributions by faculty and

gender are presented in the results and tables. All students, regardless of gender, age, or department, were included in the study.

Data were collected using a demographic information form (9 questions), the "Evaluation of University Students' Drug Use" Survey (17 questions) and the "Knowledge and Attitudes Towards Rational Antibiotic Use" scale (42 questions) developed and validated by Dr. İsmet Çelebi (23). This survey was used to assess students' knowledge and attitudes regarding rational antibiotic use (23). The scale consists of two subscales: a knowledge subscale comprising 12 items and an attitude subscale comprising 16 items, both rated on a five-point Likert scale. Total scores range from 12 to 60 for the knowledge subscale and from 16 to 80 for the attitude subscale, with higher scores indicating better knowledge and more positive attitudes toward rational antibiotic use. In the original validation study, the Cronbach's alpha coefficients were 0.87 for the knowledge subscale and 0.89 for the attitude subscale, indicating high internal consistency. The scale is open-access and was used with appropriate citation.

Statistical analysis

Data were analyzed using SPSS software (IBM SPSS Statistics, version 25.0, IBM Corp., Armonk, NY, USA). Continuous variables were summarized using mean and standard deviation or median and interquartile range, as appropriate, while categorical variables were presented as frequencies and percentages. The normality of continuous variables was assessed using the Shapiro–Wilk test and visual inspection of histograms. For comparisons between two independent groups, the Student's t-test was used for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables. Comparisons among more than two groups were performed using one-way ANOVA or the Kruskal–Wallis test, followed by appropriate post hoc analyses when applicable. Associations between knowledge and attitude scale scores and medication-related behaviors were evaluated using Pearson's correlation coefficient for normally distributed variables and Spearman's rank correlation coefficient otherwise. Effect sizes were calculated using Cohen's d for pairwise comparisons and eta-squared (η^2) for multi-group comparisons. Ninety-five percent confidence intervals were reported where appropriate. A two-tailed p-value <0.05 was considered statistically significant.

Results

A total of 1046 university students participated in the study. The sociodemographic characteristics of the sample are summarized in Table 1. Detailed percentage distributions are presented in the tables and are not repeated in the text. The study population consisted predominantly of female and single students, with participants representing various academic programs and class levels.

Students' medication-related behaviors and antibiotic-use attitudes are presented in Table 2. The most prominent findings included high rates of reading medication instructions and using antibiotics only upon a physician's recommendation. The majority of students reported appropriate medication-related behaviors, including avoiding the use of medications prescribed to others and not experiencing harm due to incorrect medication use. The most prominent findings included high rates of reading medication instructions and using antibiotics only upon a physician's recommendation. The majority of students reported appropriate medication-related behaviors, including avoiding the use of medications prescribed to others and not experiencing harm due to incorrect medication use. Other behavioral details are provided in Table 2.

Comparisons of Rational Use of Antibiotics Knowledge Scale (RUAKS) scores across demographic and behavioral variables are presented in Table 3. No statistically significant

Table 1. Sociodemographic characteristics of the study population (n=1046)

Features		n	%
Gender	Male	266	25.4
	Female	780	74.6
Marital Status	Single	1022	97.7
	Married	24	2.3
Which Program/Department are you studying?	Vocational School	333	31.8
	SABİF	144	13.8
	Faculty of Education	28	2.7
	Faculty of Engineering	80	7.6
	Faculty of Pharmacy	127	12.1
	Faculty of Dentistry	139	13.3
	Faculty of Medicine	195	18.6
Your Class	1st Grade	454	43.4
	2nd Grade	403	38.5
	3rd Grade	154	14.7
	4th Grade	35	3.3
What is your economical situation?	Our income does not cover our expenses	163	15.6
	Our income equals our expenses	571	54.6
	Our income is more than our expenses	312	29.8
What is your mother's educational level?	Illiterate	37	3.5
	Primary education	246	23.5
	Secondary education	438	41.9
	University	263	25.1
	Postgraduate	62	5.9
What is your father's educational level?	Illiterate	18	1.7
	Primary education	183	17.5
	Secondary education	427	40.8
	University	302	28.9
	Postgraduate	116	11.1

Percentages may not total 100 due to rounding.

differences were observed according to gender, class level, economic status, or parental education ($p>0.05$). Knowledge scores differed significantly among academic units, with students from the Faculty of Education demonstrating higher scores compared with other faculties ($p=0.029$). Other observed differences in knowledge scores were not statistically significant and are therefore not emphasized in the text.

Table 4 presents the comparison of Rational Use of Antibiotics Attitude Scale (RUAAS) scores. Several variables showed statistically significant associations with attitude scores. Male students had higher attitude scores than females ($p=0.003$). Attitude scores differed significantly across academic units ($p<0.001$), with the highest scores observed among students from the Faculty of Engineering and SABİF. Class level was also associated with attitudes ($p=0.016$),

Table 2. Evaluation of university students' drug use status and their knowledge levels and attitudes towards rational antibiotic use

Features		n	%
Do you read the instructions for use before using the medicine?	Yes	806	77.1
	No	240	22.9
Do you only use antibiotics when your doctor recommends them?	Yes	837	80.0
	No	209	20.0
Do you use your family members' medications?	Yes	315	30.1
	No	731	69.9
Have you ever suffered any harm due to the wrong use of medication?	Yes	128	12.2
	No	918	87.8
Do you care about the color, smell, packaging and taste of the medicine when using it?	Yes	643	61.5
	No	403	38.5
Do you do research on the drugs to be used?	Yes	750	71.7
	No	296	28.3
Have you used any medication in the last month?	Yes	816	78.2
	No	228	21.8
Did you get your last medication with a prescription?	Yes	596	57.0
	No	449	43.0
Do you use any medications regularly?	Yes	247	23.6
	No	799	76.4
What types of medications have you used?*	Painkiller	660	47.3
	Antibiotic	253	18.1
	Antidepressant	64	4.6
	Muscle relaxant	142	10.2
	Other	276	19.8
How do you use medicine for when you get sick?*	Doctor's referral	908	52.4
	Pharmacist referral	240	13.9
	Family-Environment advice	214	12.4
	Previous experiences	370	21.4
What are the sources of information you get about medicine?*	Doctor	838	29.9
	Pharmacist	585	20.8
	Prospectus	443	15.8
	Internet	603	21.5
	Family-Friends-Environment	337	12.0
Which criteria do you pay attention to when reusing medicine at home?*	Suitability for disease	874	34.9
	Expiration date	851	34.0
	Not exceeding the specified period after opening	546	21.8
	Packaging design	195	7.8
	None of them	39	1.6

*More than one option was marked. Percentages are taken from the respondents.
Percentages may not total 100 due to rounding.

Table 2. Continued

Features		n	%
When do you use medication?*	Cold-flu	781	33.3
	Headache	699	29.8
	Menstruation	301	12.8
	Stomach ache	295	12.6
	Chronic disease	169	7.2
	Before or after sports	31	1.3
	When exams approach	69	2.9
What is your reason for stopping the medication?*	Recovery	837	38.4
	Feeling better	612	28.0
	Forgetting	176	8.1
	Side effects	158	7.2
	Boredom	90	4.1
	Thinking the drug is not effective	159	7.3
	Thinking it is harmful	150	6.9
How do you act if you experience side effects while using the medicine?*	I will see a doctor	854	53.2
	I will stop taking the medication	632	39.4
	I will change the medication	90	5.6
	I will continue taking the medication	30	1.9

*More than one option was marked. Percentages are taken from the respondents.
Percentages may not total 100 due to rounding.

Table 3. Comparison of rational antibiotic knowledge scale mean scores (n=1046)

Features		n	x ± SD	z/x^2	p
Gender	Man	266	65.27±9.48	-0.818	0.413
	Women	780	66.12±8.89		
Which program/department are you studying in?	Vocational School	333	66.59±10.13	14.071	**0.029***
	SABİF	144	66.15±7.65		
	Education Faculty	28	69.14±9.72		
	Engineering Faculty	80	65.51±7.63		
	Pharmacy Faculty	127	66.35±9.14		
	Dentistry Faculty	139	65.53±7.51		
	Medical Faculty	195	64.22±9.25		
Your Class	1st Grade	454	65.62±9.38	3.164	0.367
	2nd Grade	403	66.52±8.86		
	3rd Grade	154	65.01±8.13		
	4th Grade	35	66.34±10.43		
What do you think your economic situation is?	Our income does not cover our expenses.	163	66.93±10.31	4.122	0.127
	Our income is equal to our expenses.	571	65.83±9.01		
	Our income is more than our expenses.	312	65.49±8.41		

* $p < 0.05$ was considered statistically significant. z: Mann–Whitney U test; χ^2: Kruskal–Wallis test.
More than one option could be selected. Percentages are calculated based on the total number of participants and may not sum to 100 due to rounding.

Table 3. Continued

Features		n	x ± SD	z/x²	p
What is your mother's educational level?	Illiterate	37	64.10±8.29	3.649	0.456
	Primary Education	246	65.58±9.43		
	Secondary Education	438	66.49±8.37		
	University	263	65.60±9.81		
	Postgraduate	62	65.33±9.20		
What is your father's educational level?	Illiterate	18	62.61±10.86	5.331	0.255
	Primary Education	183	65.30±8.75		
	Secondary Education	427	66.69±8.89		
	University	302	65.60±9.34		
	Postgraduate	116	65.25±8.90		
Do you have a relative who works in any health field?	Yes	675	65.75±9.19	-1.356	0.174
	No	371	66.20±8.82		
Do you read the instructions before using a medicine?	Yes	806	65.81±8.48	-0.444	0.657
	No	240	66.21±10.82		
Do you use antibiotics only when recommended by a doctor?	Yes	837	65.83±8.93	-0.783	0.434
	No	209	66.20±9.54		
Do you use your family members' medicines?	Yes	315	66.48±9.56	-1.161	0.246
	No	731	65.65±8.82		
Have you ever been harmed by using the wrong medicine?	Yes	128	65.91±8.77	-0.224	0.822
	No	918	65.90±9.09		
Do you care about the color, smell, packaging and taste of the medicine?	Yes	643	66.05±8.67	-0.654	0.513
	No	403	65.65±9.64		
Do you do research on the medicines to be used?	Yes	750	65.82±8.92	-0.658	0.51
	No	296	66.12±9.40		
Have you used any medicine in the last month?	Yes	816	66.15±8.89	-1.324	0.185
	No	228	65.03±9.60		
Did you get the last medicine you used with a prescription?	Yes	596	65.86±8.85	-0.484	0.628
	No	449	65.94±9.33		
Are there any medicines you use regularly?	Yes	247	66.18±8.71	-0.347	0.729
	No	799	65.81±9.17		

* $p < 0.05$ was considered statistically significant. z: Mann–Whitney U test; χ^2: Kruskal–Wallis test.
More than one option could be selected. Percentages are calculated based on the total number of participants and may not sum to 100 due to rounding.

with third-year students exhibiting the highest mean scores. Students whose income exceeded their expenses demonstrated significantly more positive attitudes toward rational antibiotic use (p<0.001).

Regarding medication-related behaviors, students who used antibiotics only upon a doctor's recommendation and those who avoided using medications prescribed to family members had significantly higher attitude scores (p<0.001). Students who had previously experienced harm due to incorrect medication use exhibited significantly lower attitude scores (p=0.011). No other behavioral variables were significantly associated with attitude scores.

Table 4. Comparison of rational antibiotic knowledge scale scores according to selected variables (n=1046)

Features		n	x ± SD	z/x²	p
Gender	Male	266	60.78±11.57	-2.936	**0.003***
	Female	780	62.97±10.72		
Marital Status	Single	1022	62.42±10.96	-0.107	0.915
	Married	24	61.63±12.10		
Which Program/Department are you studying?	Vocational School	333	60.49±9.49	37.908	**<0.001***
	SABİF	144	65.70±9.48		
	Education Faculty	28	64.57±9.15		
	Engineering Faculty	80	65.85±9.73		
	Pharmacy Faculty	127	62.87±10.48		
	Dentistry Faculty	139	62.07±12.17		
	Medicine Faculty	195	61.49±11.89		
Your Class	1st Year	454	61.86±10.72	10.311	**0.016***
	2nd Year	403	62.15±10.83		
	3rd Year	154	64.41±11.84		
	4th Year	35	63.77±11.43		
What is your economic situation?	Our income does not cover our expenses	163	61.19±11.62	14.204	**<0.001***
	Our income is equal to our expenses	571	61.66±11.14		
	Our income is more than our expenses	312	64.42±10.08		
What is your mother's education level?	Illiterate	37	61.32±13.10	5.868	0.209
	Primary Education	246	62.95±10.26		
	Secondary Education	438	62.15±10.56		
	University	263	63.28±11.23		
	Postgraduate	62	59.06±13.50		
What is your father's education level?	Illiterate	18	62.22±11.79	0.760	0.944
	Primary Education	183	62.01±11.23		
	Secondary Education	427	62.92±10.34		
	University	302	62.09±11.45		
	Postgraduate	116	62.05±11.58		
Do you have any relatives who work in the healthcare field?	Yes	675	62.72±11.25	-1.088	0.276
	No	371	61.78±10.69		
Do you read the instructions for use before using the medicine?	Yes	806	62.74±10.54	-1.895	0.058
	No	240	61.33±12.29		
Do you use antibiotics only when recommended by a doctor?	Yes	837	63.45±11.02	-7.020	**<0.001***
	No	209	58.31±9.74		
Do you use your family members' medications?	Yes	315	60.61±10.57	-3.961	**<0.001***
	No	731	63.19±11.07		

* $p < 0.05$ was considered statistically significant. z: Mann–Whitney U test; χ^2: Kruskal–Wallis test.

Table 4. Continued

Features		n	x ± SD	z/x²	p
Have you ever suffered any harm due to the wrong use of medication?	Yes	128	60.22±10.53	-2.541	**0.011***
	No	918	62.72±11.01		
Do you care about the color, smell, packaging and taste of the medicine when using it?	Yes	643	62.45±10.98	-0.220	0.826
	No	403	62.36±11.01		
Do you do research on the drugs to be used?	Yes	750	62.75±10.93	-1.914	0.056
	No	296	61.57±11.08		
Have you used any medication in the last month?	Yes	816	62.38±10.84	-0.318	0.751
	No	228	62.58±11.49		
Did you get your last medication with a prescription?	Yes	596	62.72±11.21	-1.375	0.175
	No	449	62.00±10.68		
Are there any medications that you use regularly?	Yes	247	62.90±10.97	-1.093	0.275
	No	799	62.24±11.02		

* $p < 0.05$ was considered statistically significant. z: Mann–Whitney U test; χ^2: Kruskal–Wallis test.

Discussion

The rational use of medicines and the rational use of antibiotics principles are essential components of effective healthcare and for public health protection. University students represent a critical target group for evaluating these principles, particularly because many will become future healthcare professionals (10). This study provides a comprehensive assessment of drug use behaviors and knowledge and attitudes toward rational antibiotic use among university students from both health-related and non-health-related fields.

One of the main findings of this study is that overall knowledge levels regarding rational antibiotic use showed limited variation across most demographic characteristics. Similar observations have been reported in previous studies, suggesting that demographic factors alone may not be strong determinants of rational drug use knowledge (13,15). However, differences were observed across academic units, indicating that educational context may influence awareness and understanding of rational antibiotic use, as also suggested in earlier literature (18,19).

In contrast to knowledge scores, attitudes toward rational antibiotic use demonstrated greater variability across demographic and behavioral factors. This finding is consistent with previous studies showing that attitudes may be more sensitive to personal experiences and behavioral patterns than knowledge alone (24). Students who adhered to physician recommendations and avoided using medications prescribed to others exhibited more positive attitudes, highlighting the importance of appropriate medication-related behaviors in shaping rational use practices.

Economic status has been reported as an important determinant of access to healthcare and medication use behaviors in the literature (9,25). While some studies have identified associations between income level and rational drug use (24,26), our findings suggest that economic status was not a major determinant of knowledge levels. However, students whose income exceeded their expenses demonstrated more favorable attitudes toward rational antibiotic use, indicating that economic comfort may indirectly influence behavioral orientation rather than knowledge acquisition.

Medication-related behaviors observed in this study align with previous findings indicating that university students frequently rely on physicians and pharmacists as primary information sources (12,15,17,27,28). Nevertheless, non-prescription drug use and early discontinuation of treatment remain important concerns, as reported in earlier studies (29-31). Such behaviors reflect ongoing gaps between awareness and practice and underscore the need for targeted educational interventions focusing on appropriate medication adherence and antibiotic stewardship.

Beyond general medication-related behaviors, several specific patterns observed in this study further illustrate ongoing challenges in rational drug and antibiotic use among university students. In this study, non-prescription drug use remained common among university students, consistent with previous reports (29,31). A substantial proportion of students reported obtaining medications without a physician's prescription or using drugs prescribed to family members, indicating ongoing challenges in rational drug use behaviors. Similar rates of non-prescription drug use have been reported among university students in Türkiye, suggesting that this pattern is persistent despite increased awareness efforts (29,31). Such behaviors may reflect barriers to accessing healthcare services, reliance on previous treatment experiences, and underestimation of potential risks associated with unsupervised medication use.

Regular medication use was reported by a minority of students, and these individuals demonstrated higher knowledge and more favorable attitudes toward rational drug use. While some studies have associated frequent drug use with lower levels of rational use (32), this discrepancy may be explained by differences in study populations and educational exposure. Individuals requiring regular medication, particularly for chronic conditions, may be more engaged with healthcare systems and therefore more knowledgeable about appropriate medication practices. Increased dissemination of public awareness messages in recent years may also have contributed to improved knowledge among this subgroup.

Analgesics and antibiotics were identified as the most commonly used drug groups, in line with national pharmaceutical consumption data and previous studies (30). The widespread use of analgesics is not unexpected given their accessibility and frequent indication for common complaints. However, the continued prominence of antibiotics underscores the importance of reinforcing principles of appropriate antimicrobial use, including correct indication, dosing, and treatment duration, to prevent resistance and related complications (32,33).

Patterns of drug procurement further highlight challenges in rational drug use. A considerable proportion of students reported obtaining medications without prescriptions or recommending drugs to others, behaviors that have been widely documented in both national reports and previous studies (2, 12,13,16,17). Although regulatory measures and awareness campaigns have reduced non-prescription access to antibiotics, some students continue to obtain antibiotics without medical consultation, indicating that irrational antibiotic use persists despite policy interventions.

Physicians and pharmacists were identified as primary sources of medication-related information, consistent with existing literature (12,15,17). Nevertheless, reliance on family members, peers, and prior experience remains evident and may contribute to inappropriate medication practices. These findings emphasize the need for continued educational initiatives that strengthen trust in professional guidance and discourage informal medication sharing (34).

Medication use was most commonly reported for self-limiting conditions such as upper respiratory tract infections and headache, which is consistent with community-based patterns of drug consumption. Premature

discontinuation of treatment upon symptom improvement was also frequently reported, reflecting gaps in understanding treatment completion and adherence, as highlighted in previous studies (33). Although awareness of rational antibiotic use was high, a substantial proportion of students were unable to accurately define the concept, underscoring the need for targeted educational strategies to improve both conceptual understanding and practical application (25).

Another important observation was the association between previous harm due to incorrect drug use and less favorable attitudes toward rational drug use. This finding suggests that negative experiences may influence perceptions and behaviors, emphasizing the importance of preventive education before adverse outcomes occur. Educational strategies aimed at improving rational medication practices may therefore benefit from addressing both knowledge gaps and experiential learning.

The findings of this study should be interpreted in light of several limitations. First, the study was conducted at a single university, which may limit the representativeness of the sample and the generalizability of the results to other student populations in Türkiye. Second, the use of a self-administered questionnaire may have introduced self-report and recall bias, as participants' responses relied on personal reporting rather than objective measures. Third, the cross-sectional design precludes causal inference and limits the ability to assess changes in knowledge, attitudes, or behaviors over time. In addition, although comparisons across demographic and academic subgroups were performed, potential confounding factors were not controlled through multivariable analyses, and therefore observed associations should be interpreted cautiously. Finally, voluntary participation may have introduced selection bias, as students with greater interest in rational drug use may have been more likely to participate.

Conclusion

In conclusion, this study demonstrated that university students generally exhibit appropriate medication-related behaviors; however, gaps persist between knowledge and attitudes toward rational antibiotic use. While knowledge levels showed limited variation across most demographic characteristics, attitudes were more strongly influenced by behavioral factors such as adherence to physician recommendations and avoidance of non-prescription medication use. These findings highlight the importance of integrating targeted educational content and practical awareness initiatives into university curricula, particularly for students in health-related fields. Addressing attitude-related aspects of rational antibiotic use may help strengthen responsible medication practices within similar academic settings.

Ethical approval

Ethical approval was obtained from the Non-Interventional Research Ethics Committee of Biruni University (decision number 2022/69-18, dated 29.04.2022). Written informed consent was obtained from the participating students.

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: ASD, YEM; data collection: ASD, AOT, EY, EA; analysis and interpretation of results: ASD, BAS, HB, YEM; draft manuscript preparation: ASD, BAS, YEM. All authors reviewed the results and approved the final version of the manuscript.

Source of funding

This study was supported by TÜBİTAK (The Scientific and Technological Research Council of Turkey) within the scope of the 2209 Program (Number: 1919B012110022).

Conflict of interest

The authors declare that there is no conflict of interest.

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