

# UNDERSTANDING AND APPLICATION OF ANTIBIOTICS: ANALYSIS AMONG STUDENTS OF HEALTH SCIENCE IN SARAJEVO WITH AN EMPHASIS ON GENDER DISTRIBUTION

**Abstract:** Antibiotics are medications that inhibit bacterial growth and are used in the treatment of bacterial infections, both gram-positive and gram-negative. Antibiotics also represent products of metabolism of certain microorganisms that adversely affect the development and reproduction of other microorganisms. They are one of the greatest discoveries of modern medicine; however, in today's age, the greatest challenge is the resistance of bacteria to antibiotics. There are numerous reasons for the emergence of antibiotic resistance. One reason lies in inadequate education about antibiotics, their application, and usage. The aim of this study was to survey students of the University of Sarajevo's Faculty of Health Sciences about their general knowledge of antibiotics and their methods of application. A total of 151 students participated in this study, including 125 females (83%) and 26 males (17%). The questions consisted of two parts: the first part covered general knowledge about antibiotics, while the second part addressed bacterial resistance to antibiotics.

**Keywords:** students, antibiotics, knowledge, resistance, male population, female population

## 1. INTRODUCTION

Antibiotics are among the most commonly utilized medications worldwide. However, bacterial resistance to antibiotics has become an evolutionary inevitability, with an increasing number of resistant bacterial strains due to higher antibiotic demand (Higuera-Gutiérrez et al., 2020). Bacterial evolution has led to their ability to adapt to various factors, including antibiotics. Numerous scientific sources are focused on the paradoxical decrease in the discovery of new antibiotics (Pilipović, 2022). Whereas in the past century, considered the golden age of antibiotics, the current focus is on their resistance. There are many factors and reasons influencing resistance, with one of the main ones being the irrational use of antibiotics (Shahpawee et al., 2022). Additionally, economic factors, particularly political influences, physician knowledge and experience, diagnostic uncertainty, and pharmaceutical marketing, also play significant roles (Nogueira-Uzal et al., 2020). Numerous patient-focused studies have shown that patient expectations or the perception of these expectations by physicians greatly influence antibiotic prescribing. Medical staff education, including physicians, nurses, technicians, and related fields, has proven beneficial in increasing patient understanding and awareness, significantly reducing inappropriate antibiotic prescribing by physicians (Kutlesic & Jovanovic, 2020). Furthermore, alongside insufficient education, another irrational factor in antibiotic use is the uncontrolled sale of antibiotics without a prescription.

## 2. MATERIALS AND METHODS

The knowledge and usage of antibiotics in the everyday life of 151 students from the Faculty of Health Sciences, University of Sarajevo, were anonymously surveyed. The study included 125 (83%) female respondents and 26 (17%) male respondents, with an average age of  $22.07 \pm 2.51$  years. Within this survey, data on the assessment of their knowledge and attitudes towards antibiotic usage were covered. The questionnaire consisted of 38 questions divided into two parts. In the first part of the survey,

respondents marked or wrote down their answers to the posed questions. The second part of the survey focused on assessing knowledge and attitudes regarding the proper treatment of antibiotic usage. Statistical data analysis was performed using IBM SPSS Statistics 26.00 (IBM Corporation, Armonk, NewYork).

### 3. RESULTS

Within *Table 1*, the results regarding the knowledge of antibiotic application and usage among participants were analyzed. Correctly, 110 participants (88%: 72%) identified antibiotics as medicines capable of killing bacteria. Additionally, when asked if antibiotics could treat viral infections, as well as all infections, affirmatively, 89:80 participants (girls and boys in ratios: 71,2%: 53,8% and 64,0:72,0%) confirmed. It was accurate that antibiotics are prescribed to alleviate pain and inflammation, as confirmed by a total of 85:104 participants (girls and boys in ratios of 68,5%: 53,8% and 83,8%: 80,8%). Antibiotics being prescribed to reduce elevated body temperature were affirmed by 71 participants (57,3%: 57,7%). Penicillin being an antibiotic was confirmed by 113 participants, comprising 90,4% girls and 80,8% boys. Additionally, affirmatively answering that desloratadine is a new generation antibiotic (20 participants), and that ciprofloxacin does not belong to the antibiotic group (45 participants), was done by 16% of girls and 3,8% of boys. Regarding the latter question, the ratio was 36%: 26,9%. In this context, 102 participants correctly identified paracetamol as belonging to the antibiotic group (81,6%: 80,8%). Lastly, on the question of whether antibiotics can cause allergic reactions, 121 participants provided the correct answer (96,8%: 100%). The summary of the responses in *Table 1*, concludes that female participants are significantly more knowledgeable about antibiotics, their application, and usage compared to male participants, where  $X^2$  ranged from 0,0 to 4,26, while  $p$  varied from 0,03 to 0,96.

**Table 1.** Analysis of responses from female and male participants regarding knowledge and application of antibiotics

QUESTION	Answer	Female		Male		$\chi^2$
		N	%	N	%	
<i>The antibiotics are drugs that can kill bacteria</i>	Incorrect	15	12,0%	7	28,0%	<b>4,261</b>
	Correct	110	88,0%	18	72,0%	
<i>Antibiotics are medications that cannot treat viral infections (correct, they cannot)</i>	Incorrect	36	28,8%	12	46,2%	2,989
	Correct	89	71,2%	14	53,8%	
<i>Antibiotics can't cure all infections (it is true that they cannot treat all infections)</i>	Incorrect	45	36,0%	7	28,0%	0,589
	Correct	80	64,0%	18	72,0%	
<i>Antibiotics are prescribed to alleviate pain (it is true that this is not the reason)</i>	Incorrect	39	31,5%	12	46,2%	2,07
	Correct	85	68,5%	14	53,8%	
<i>Antibiotics are prescribed to alleviate inflammation</i>	Incorrect	20	16,1%	5	19,2%	0,149
	Correct	104	83,9%	21	80,8%	
<i>Antibiotics are prescribed to reduce elevated body temperature (it is true that this is not the reason)</i>	Incorrect	53	42,7%	11	42,3%	0,002
	Correct	71	57,3%	15	57,7%	
<i>Penicillin is an antibiotic</i>	Incorrect	12	9,6%	5	19,2%	1,998
	Correct	113	90,4%	21	80,8%	
<i>Desloratadine is antibiotic (he is not)</i>	Incorrect	105	84,0%	25	96,2%	2,655
	Correct	20	16,0%	1	3,8%	
<i>Paracetamol belongs to the group of antibiotics (it does not belong)</i>	Incorrect	23	18,4%	5	19,2%	0,01
	Correct	102	81,6%	21	80,8%	
<i>Ciprofloxacin does not belong to the group of antibiotics (it does belong)</i>	Incorrect	80	64,0%	19	73,1%	0,785
	Correct	45	36,0%	7	26,9%	
<i>Antibiotics can cause allergic reactions</i>	Incorrect	4	3,2%	0	0,0%	0,855
	Correct	121	96,8%	26	100,0%	

Within *Table 2*, the results of participant responses regarding bacterial resistance to antibiotics are presented. Affirmatively, 117 participants (93,6%: 84,6%) acknowledged bacterial resistance to antibiotics as a public health issue worldwide. Furthermore, in line with the preceding question, 123 participants also confirmed that irrational antibiotic use can cause bacterial resistance to antibiotics (98,4%: 92,3%). In this context, it was also affirmed by 125 participants (100%: 100%) that adhering to antibiotic usage instructions is extremely important. Finally, it was affirmed by 112 participants (86,9%: 84,6%) that as consumers of antibiotics, we can contribute to the growth or reduction of antibiotic resistance in bacteria through appropriate usage. The summary of participant responses in *Table 2* concluded that there is no significant difference in responses regarding bacterial resistance to antibiotics and that knowledge about antimicrobial resistance among participants is high. Additionally,  $X^2$  ranged from 0,535 to 3,098, while  $p$  varied from 0,078 to 0,464.

**Table 2.** Analysis of respondents' attitudes towards resistance in relation to gender distribution

Question	Answer	Female		Male		X <sup>2</sup>
		N	%	N	%	
<i>Antibiotic resistance is a major public health issue worldwide</i>	Incorrect	8	6,4%	4	15,4%	2,375
	Correct	117	93,6%	22	84,6%	
<i>The irrational use of antibiotics can lead to bacterial resistance to antibiotics</i>	Incorrect	2	1,6%	2	7,7%	3,098
	Correct	123	98,4%	24	92,3%	
<i>It is extremely important to adhere to the instructions for taking antibiotics</i>	Incorrect	0	0,0%	0	0,0%	-
	Correct	125	100,0%	26	100,0%	
<i>As consumers of antibiotics, we can contribute to the growth or reduction of bacterial resistance to antibiotics through appropriate usage</i>	Incorrect	13	10,4%	4	15,4%	0,535
	Correct	112	89,6%	22	84,6%	

#### 4. DISCUSSION

Antibiotics are medications used to treat bacterial infections. Additionally, they are ineffective against viral infections and most other types of infections. Antibiotics work by either killing microorganisms or preventing their multiplication, allowing the body's natural defenses to eliminate them. Given that the most significant problem today is bacterial resistance to antibiotics, which arises from multiple reasons. The results are covered by one reason, which is how familiar students belonging to natural sciences, healthcare, dentistry, and medicine are with the application and use of antibiotics. Many literary sources record various results; according to Glavaš (2021), final year undergraduate students from various fields expressed their views on handling antibiotics. The study was conducted with 731 respondents, including 603 females and 128 males, of whom a total of 40.2% believe that antibiotics can be used for various inflammations and pains, while 62.4% believe that paracetamol belongs to the antibiotic group, with 71.9% of students believing that paracetamol is an antibiotic. Additionally, during self-administration of antibiotics, approximately 16.7% of students experienced contraindications, while 30.6% of students believed that antibiotics could help with any inflammation, including minor ailments like colds. According to the study by Di Gennaro et al. (2020), medical faculty students expressed their views on the use of antibiotics, where out of 1050 students, 876 were females and 174 were males. Females demonstrated much better and more productive knowledge compared to the male population. The questions with the least knowledge were whether viral infections could be treated with antibiotics, with as many as 68% answering yes, and whether antibiotics could be used for all inflammations and pains, with 57.9% answering yes. Also, within this study, it was shown that women are more inclined to take antibiotics only on the advice of a doctor, unlike the male population, where 51.7% take antibiotics on

their own. The conclusion of this research is that there is a significant gap in the education of the medical profession, as well as generally in knowledge and use of antibiotics, and which groups belong to antibiotics, what is not an antibiotic, when it can be used, what it helps with, and when it should not be taken indiscriminately.

## 5. CONCLUSION

The results of the study demonstrate a high level of knowledge among participants regarding antibiotics and their usage, with girls generally being better informed than boys. Most participants (88%) correctly identified antibiotics as medicines that kill bacteria. However, a significant number of participants mistakenly believe that antibiotics can treat viral infections. A large number of participants correctly recognize penicillin as an antibiotic, while there are errors in identifying other drugs like desloratadine and ciprofloxacin. Nearly all participants are aware that antibiotics can cause allergic reactions. Participants are highly aware of the issue of bacterial resistance to antibiotics and the importance of rational antibiotic use. There are no significant differences between genders in knowledge about antibiotic resistance, indicating a high level of awareness among all participants. These results highlight the need for continuous education to reduce remaining misconceptions and improve proper antibiotic usage.

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