Global Academic Journal of Medical Sciences

Available online at www.gajrc.com
DOI: 10.36348/gajms.2024.v06i03.003

OPEN ACCESS

ISSN: 2706-9036 (P)
ISSN: 2707-2533 (O)

Case Report

Assessment of Antibiotic Resistance Knowledge among Female Students in a Hostel Environment: A Concurrent Urine Culture Analysis

Dr Ebidor Lawani-Luwaji[1*], Molly Asamaowei[1]

[1]Department of Medical Laboratory Science, Faculty of Basic Medical Sciences, Niger Delta University. Wilberforce Island, Bayelsa

***Corresponding Author**
Dr Ebidor Lawani-Luwaji
Department of Medical Laboratory Science, Faculty of Basic Medical Sciences, Niger Delta University. Wilberforce Island, Bayelsa

Article History
Received: 11.04.2024
Accepted: 24.05.2024
Published: 29.05.2024

Abstract: Antibiotic resistance is a serious problem that is growing rapidly around the world due to the overuse and misuse of antibiotics. This issue threatens global health, and it is critical to assess awareness to confront the spread of antibiotic resistance. Undergraduate education can influence practices, so it is important to determine students' knowledge, attitudes, and behaviour. The study investigated the knowledge, attitudes, behaviour, and use of antibiotic resistance among female hostel students in a Nigerian university. The survey revealed that while most respondents were familiar with "antibiotic resistance," only 40.7% expressed confidence in their understanding of the concept. The study identified a correlation between the student's year of study and their knowledge of antibiotic resistance, indicating that students in higher study levels possessed greater knowledge than those in lower levels (chi-square = $p < 0.10$). The study also found that Streptococcus spp was the most common gram-positive bacteria isolated, while Escherichia coli was the most common gram-negative bacteria isolated. Ciprofloxacin was the most effective for Escherichia coli, while Ampiclox had high resistance for gram-positive isolates, and Augmentin had high resistance for gram-negative isolates. Educational systems should consider including awareness campaigns on antibiotic resistance as part of community service courses. This would help to educate students and the public about the potential impact of antibiotic resistance on antibiotic usage. Additionally, educators should develop a general course covering important health issues to benefit all students.

Keywords: Antibiotic Resistance, Undergraduate Education, Awareness Campaigns, Health Issues.

BACKGROUND

Antibiotic resistance (AR) is becoming a significant and rapidly growing problem resulting from the overuse and misuse of antibiotics, and it is a concern regarding the security of global health (Manyi-Loh *et al.*, 2018). One of the known risk factors for infection with resistant bacteria is the recent and inappropriate use of antibiotics [1].

Antibiotic resistance is a major challenge for public health. It is caused by bacteria developing resistance to commonly used antimicrobial compounds. This can occur due to mutations in the genome or through horizontal gene transfer. The inappropriate use and overuse of antibiotics are significant factors in expanding and disseminating

AMR worldwide, a top priority for the World Health Organization [2].

Many countries with low and middle income have limited resources to invest in public health. The high prevalence of infections, scarce prescribing guidelines, limited access to diagnostic tests, and availability of antibiotics lead to Antimicrobial Resistance (AMR), which can be fatal. Antibiotics are widely accessible in Nigeria, where purchasing medical options over the counter is habitual [3].

Among these, patient and healthcare provider education and communication are essential to minimising resistance by promoting awareness of the ideal use of antibiotics. An in-depth understanding of patients' knowledge and attitudes toward antibiotic resistance and use is important for effective teaching [1].

Umerous studies have shown that teaching undergraduate students about antibiotic use can positively influence their perspectives and practices as future healthcare professionals. It has also been observed that biases in this area may affect antibiotic usage. Therefore, several investigations have focused on assessing the knowledge, attitudes, and practices regarding antibiotic resistance, particularly among medicine and pharmacy students. These studies aim to identify shortcomings and generate valuable data to design future health programs and preventive strategies. To optimise such strategies, it is crucial to communicate strategic information, especially the link between antibiotic misuse and the emergence of antimicrobial resistance (AMR) [4-6].

Teaching undergraduate students about antibiotic use positively influences their perspectives and practices. Several past investigations focused on assessing knowledge, attitudes, and practices regarding antibiotic resistance among students to identify shortcomings and generate valuable data for designing future health programs. Communicating strategic information about the link between antibiotic misuse and antimicrobial resistance emergence is crucial to optimising preventive strategies [7-10].

Antibiotic resistance is a global issue, and Nigeria is no exception. Nigeria has a high prevalence of infectious diseases, and antibiotics play a vital role in treating these infections. However, the misuse and overuse of antibiotics can contribute to developing resistance. As the most populated African nation, raising awareness about antibiotic resistance can contribute significantly to combatting this issue [11].

Assessing student awareness of antibiotic resistance is of utmost necessity, given that this population constitutes a knowledgeable and health-conscious portion of society and the next generation of healthcare workers. If the extent of antibiotic resistance and the underlying causes are understood, various intervention methods will be feasible. Furthermore, it will promote the implementation of initiatives by policymakers for the community at large to utilise antibiotics more responsibly [1].

This study is centred around female students who are living in a hostel at Niger Delta University. The study's main objective is to understand the level of knowledge and awareness of antibiotic resistance among females living in a communal environment and determine the antibiotic resistance pattern in this communal environment. Although antibiotic resistance is a prevalent issue among both genders, this study concentrates on girls living in this specific setting to gain a better understanding of factors that may affect their antibiotic use and awareness. Hostel living has unique dynamics regarding hygiene practices, access to healthcare, and communal living, which can vary by gender.

METHODOLOGY

Study Design

The study was designed as a concurrent study where urine culture was performed simultaneously with assessing the female students' knowledge of antibiotic resistance. We collected data through an online survey [12], using a non-probability convenience sampling method between 21st February and 3rd April 2020. Electronic questionnaires collect information about people's knowledge, beliefs, attitudes, and behaviour. They also reduce the burden of data collection and ensure internally valid data by automatically screening participant responses for consistency. Multiple-choice and pre-defined answer questions were added to record participants' opinions on antibiotic resistance.

Sample size Determination

The Taro Yamane's method [13] of sample size determination was used

Formula n= N/(1+N(e)^2)

n- sample size

N- population of study (the population of female students in the hostel)

e - margin error

N = 100

e = 0.05

$n = 100/ 1+ 100(0.05)^2$

n = 100/1+ 100(0.0025)

n = 100/1+0.25

n = 100/1.25

n = 80

Microbiological Analysis of Urine Samples

The urine samples were cultured on Cysteine Lactose Electrolyte Deficient (CLED) and Blood agar. They were then incubated at a temperature of 37°C for 24 hours, as described by Faria *et al*., in 2017. Several biochemical tests were performed to characterise the bacterial isolates, including gram staining, oxidase, catalase, coagulase, citrate and the indole test, as described by [14].

Antibiotic Sensitivity Testing

Colonies were inoculated into peptone water and poured onto a Mueller Hinton plate. The plate was swirled to ensure the peptone water spread evenly and then discarded. A sensitivity disk was picked and placed onto the plate using sterilised forceps. The plates were then incubated at a temperature between 35-37°C for 24 hours. After the incubation period, the zone of inhibition was observed and measured [15].

Data Analysis: The data obtained was analysed using the statistical packaging for social science (SPSS) v25.

RESULT

A total of 80 participants were enrolled in the study to complete online forms and provide urine samples, and Figure 1 shows the age distribution of the respondents.

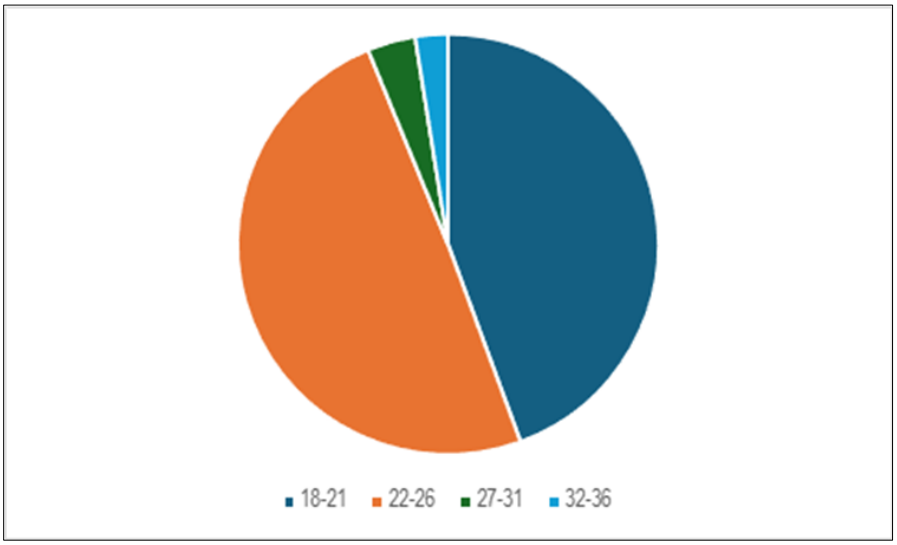

Figure 1: Age distribution of the respondents

The data show that most correspondents were between the ages of 22 and 26 (49.4%), followed by those aged 18 to 21 (44.4%).

The respondent's course of study is presented in Figure 2.

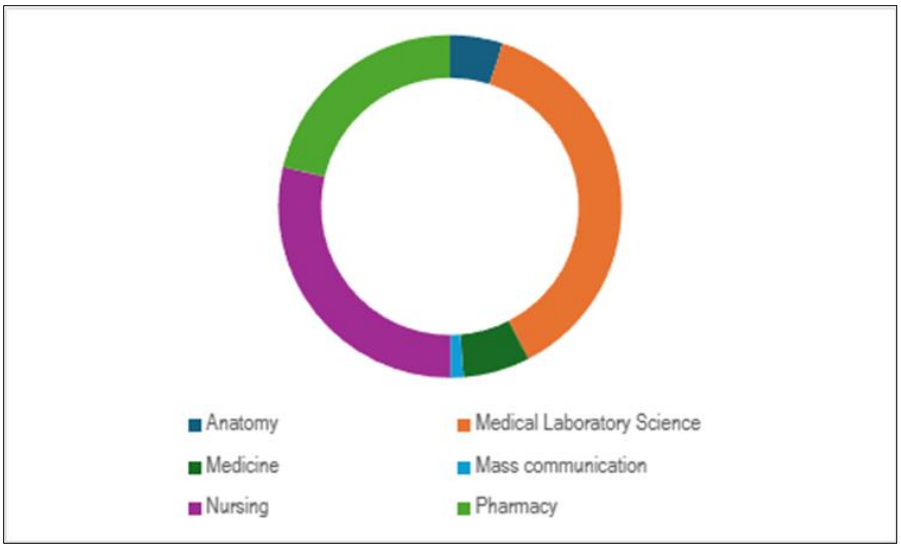

Figure 2 Course of study of the respondents

Figure 2 displays the distribution of the courses of study: 37% were studying Medical Laboratory Sciences, 28.4% were nursing, and 6.2% were studying Medicine, pharmacy, and Mass communication, representing 21.0%, 21.0%, and 1.2%, respectively.

Table 1: Knowledge of antibiotic resistance

	Yes	No
Knowledge of the term antibiotic resistance	93.8%	6.2%
Antibiotic resistance impacts the elimination of infections from the body.	88.8%	11.3%
Formal education on antibiotic use and resistance?	71.6%	28.4%
Do you believe antibiotics are overused?	91.4%	8.6%
Participation in an antibiotic awareness campaign	4.9%	95.1%
Antibiotic resistance makes it harder to eliminate infection from the body.	88.8%	11.3 %

According to Table 1, 93.8% of the respondents know the term "antibiotic resistance". 88.8% of them have received formal education on antibiotic use and resistance. Additionally, 71.6% of respondents believe that antibiotics are overused, and 91.4% have participated in an antibiotic awareness campaign. Most respondents, 95.1%, agree that antibiotic resistance makes it harder to eliminate infections from the body.

Students from caring year of studies participated in the study the Pearson Chi-Square test yielded a statistic of 21.653 with 3 degrees of freedom, indicating a highly significant association between variables ($p < .001$), while the Likelihood Ratio test resulted in a statistic of 11.425 with 3 degrees of freedom, also indicating a significant association ($p = .010$).

The respondents' source of knowledge on antibiotic resistance (figure 3) is mainly from healthcare professionals, with 56% indicating so. The second most common source is the internet, with 20% of respondents indicating that they learn about antibiotics from online sources. Family and friends, television, and magazines/newspapers are also mentioned as sources of knowledge, but to a lesser extent.

Figure 4 indicates that most respondents obtain antibiotics from a pharmacy with or without a prescription. However, few respondents obtain antibiotics from friends or family, online sources, or medicine shop stores without a prescription.

From the data obtained (figure 5), 30.9% of the correspondents always complete the full course of antibiotics prescribed by a healthcare professional, and 3.7% never complete the course while half of the respondents rarelt complete their dosage.

According to Figure 6, only 6.2% of correspondents regularly discuss antibiotic use with their healthcare professionals, while a significant portion of 23.5% never do.

The urine culture results in Figure 7 showed the isolation of gram-positive and gram-negative bacteria.

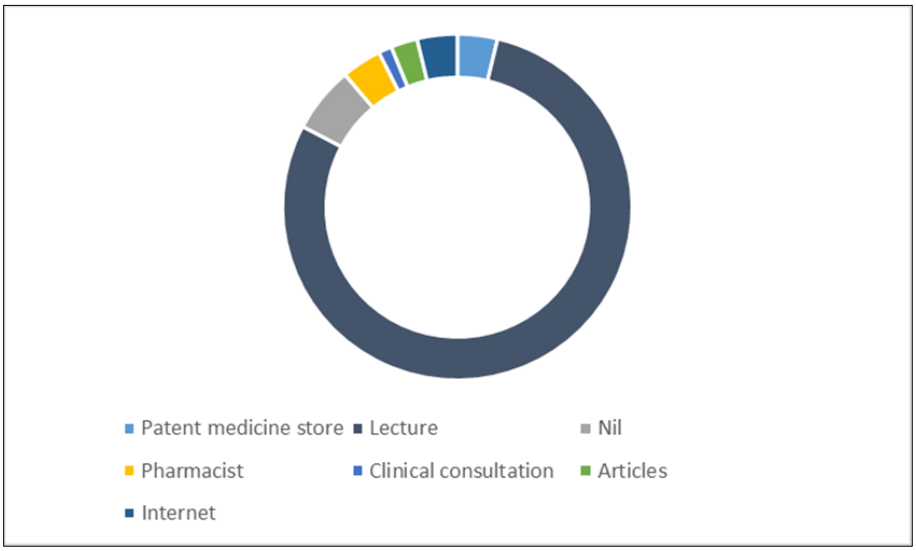

Figure 3: The source of antibiotic resistance knowledge

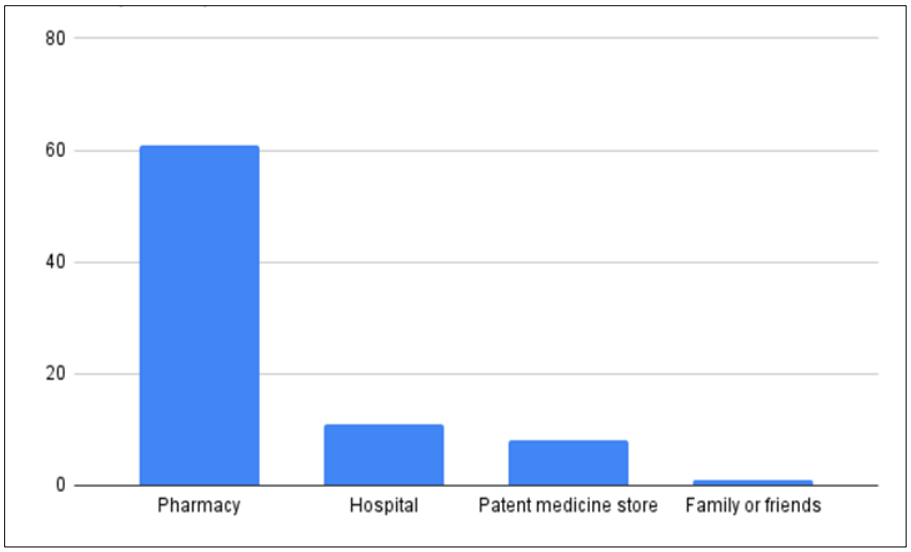

Figure 4: Where did you purchase the antibiotics?

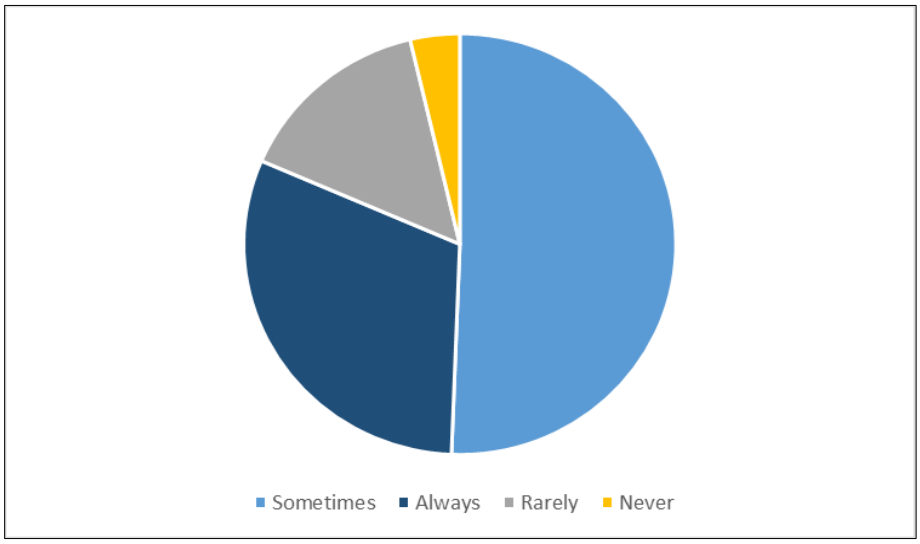

Figure 5: Attitude of respondents toward completion of antibiotic dosage

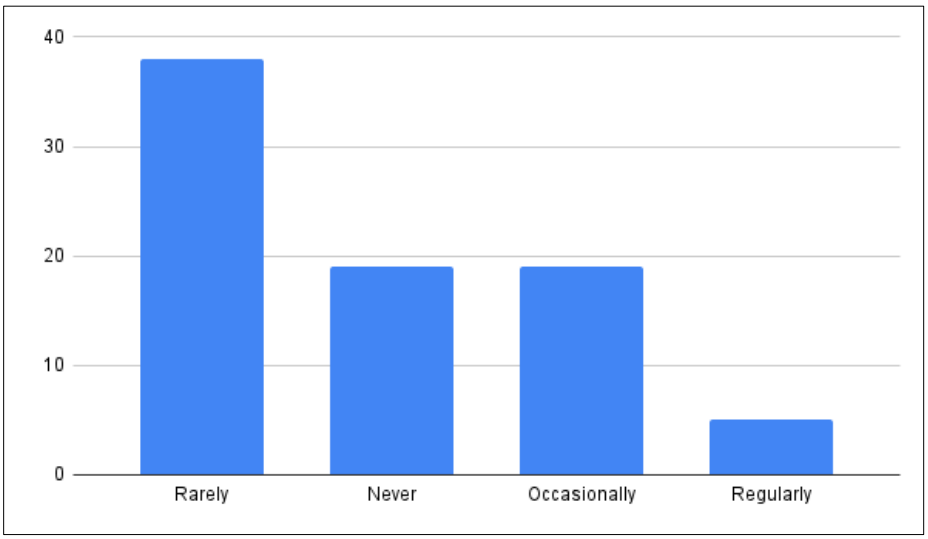

Figure 6: Interaction between respondent and healthcare professional

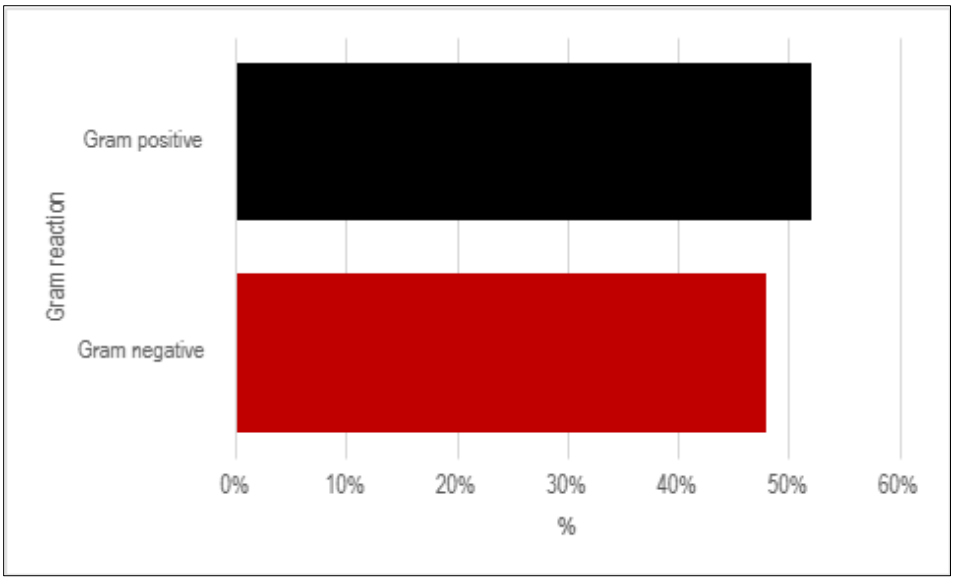

Figure 7: Gram reaction of isolates

The gram reaction of the isolates indicated that 51% of the bacteria were gram-positive, while 48% were gram-negative. Streptococcus species accounted for most isolates (33.3%), followed by E. coli (24%). Table 2 shows the distribution of isolates.

The isolates from the culture (Table 2) include Staphylococcus aureus (18.5%), Streptococcus spp (33.3%), Escherichia coli (22. 2%), Klebsiella pneumoniae (7.4%), Neisseria spp, and Salmonella spp (7.4%).

Table 2: Distribution of isolates

Bacteria	**Freq.**	**%**
Escherichia coli	24	22.2
Staph aureus	20	18.5
Neisseria spp	12	11.1
Klebsiella pneumoniae	8	7.4
Streptococcus spp	36	33.3
Salmonella spp	8	7.4
Total	**108**	**100**

Table 3: Antibiotic susceptibility pattern of the gram-positive isolate

	Staphylococcus aureus **Percentage(Frequency)**		***Streptococcus spp*** **Percentage(Frequency)**	
	Resistant	**Susceptible**	**Resistant**	**Susceptible**
Pefloxacin	40%(8)	60%(12)	55.56%(20)	44.44%(16)
Gentamycin	40%(8)	60%(12)	66.67%(24)	33.33%(12)
Ampiclox	100%(20)	0%(0)	100%(36)	0%(0)
Zinnacef	100%(20)	0%(0)	88.89%(32)	11.11%(4)
Amoxicillin	80%(16)	20%(4)	66.67%(24)	33.33%(12)
Rocephin	60%(12)	40%(8)	33.33%(12)	66.67%(24)
Ciprofloxacin	0%(0)	100%(20)	22.22%(8)	77.78%(28)
Streptomycin	60%(12)	40%(8)	66.67%(24)	33.33%(12)
Septrin	60%(12)	40%(8)	33.33%(12)	66.67%(24)
Erythromycin	40%(8)	60%(12)	66.67%(24)	33.33%(12)

For *Streptococcus spp*, high percentage of resistance to the following antimicrobial agents, Gentamycin (66.67%), Ampiclox (100%), Zinacef (88.89%), Amoxacillin (66.67%), Streptomycin (66.67%) and Erthomycin (66.67%) and for *Staphylococcus aureus*, the following antimicrobial agent, Ampiclox (100%), Amoxicillin (80%), Zinacef (100%), Rocephin (60%), Streptomycin (60%) and Septrin (60%) showed high percentage of resistance.

Table 4: Antibiotic susceptibility pattern of the gram-negative isolate

	Escherichia coli **Percentage(Frequency)**		***Neisseria spp*** **Percentage(Frequency)**		***Klebsiella pneumoniae*** **Percentage(Frequency)**		***Salmonella spp*** **Percentage(Frequency)**	
	Resistant	**Susceptible**	**Resistant**	**Susceptible**	**Resistant**	**Susceptible**	**Resistant**	**Susceptible**
Chloramphenicol	66.67%(16)	33.33(8)	33.33%(4)	66.67%(8)	50%(4)	50%(4)	100%(8)	0%(0)
Septrin	66.67%(16)	33.33(8)	33.33%(4)	66.67%(8)	0%(0)	100%(8)	50%(4)	50%(4)
Amoxacillin	0%(0)	100%(24)	66.67%(8)	33.33%(4)	50%(4)	50%(4)	50%(4)	50%(4)
Augmentin	83.33%(20)	16.67%(4)	33.33%(4)	66.67%(8)	100%(8)	0%(0)	100%(8)	0%(0)
Gentamycin	50%(12)	50%(12)	33.33%(4)	66.67%(8)	0%(0)	100%(8)	50%(4)	50%(4)
Pefloxacin	50%(12)	50%(12)	33.33%(4)	66.67%(8)	0%(0)	100%(8)	50%(4)	50%(4)
Tarivid	16.67%(4)	83.33%(20)	33.33%(4)	66.67%(8)	0%(0)	100%(8)	0%(0)	100%(8)
Streptomycin	16.67%(4)	83.33%(20)	33.33%(4)	66.67%(8)	50%(4)	50%(4)	0%(0)	100%(8)
Ciprofloxacin	0%(0)	100%(24)	33.33%(4)	66.67%(8)	0%(0)	100%(8)	50%(4)	50%(4)

Table 4 displays the susceptibility pattern of the gram-negative isolates. Among Escherichia coli, the percentage of susceptibility is relatively high, with only three antimicrobial agents showing high percentages of resistance: Chloramphenicol (66.67%), Septrin (66.67%), and Augmentin (83.33%). For Neisseria spp, only one antimicrobial agent showed high resistance: Amoxicillin (66.67%). Similarly, only one antimicrobial agent, Augmentin (100%), showed high resistance for Klebsiella spp. Finally, for Salmonella spp, Chloramphenicol (100%) and Augmentin (100%) showed high resistance percentages.

DISCUSSION

Antibiotic resistance is a growing concern, and the misuse of antibiotics is a significant contributor to the problem. It is essential to educate people early on about the appropriate use of antibiotics to combat the spread of resistance. This study aimed to assess female students' knowledge of antibiotic resistance in the same hostel. To our knowledge, this is the first study conducted on this specific group in this setting. Understanding their awareness and knowledge levels can help in addressing the issue of antibiotic resistance among women because this gender is associated with differences in drug prescribing in the community (Schröder *et al*., 2016). According to a study, the largest gender difference in medication use was for antibiotics [16].

A meta-analysis showed that women are more likely than men to be prescribed certain antibiotics, with women receiving about 25% more prescriptions than men. Women aged 16 to 54 showed the highest gender difference in antibiotic prescription. Additionally, women had twice as many medical visits for respiratory tract infections (RTIs) as men and the female gender was associated with more inappropriate prescribing [17].

Also, the stigma around sexuality directly impacts women's access to healthcare, especially in societies that stigmatise sexually transmitted infections (STIs). This can make women too embarrassed or fearful to report STI-related symptoms and seek treatment. Inaccessible diagnostic testing and a focus on symptom management in sub-Saharan Africa also expose women to inappropriate antibiotic treatments, increasing their risk of developing antimicrobial resistance (AMR) [18]. These reasons prompted the focus on female undergraduate students.

80 female students from different departments participated in this study, and most respondents (93.8%) were aware of the term "Antibiotic Resistance," This study's results revealed that this percentage is relatively higher than a previous study conducted by Ulaya *et al*., in 2022 [19], where only 71.8% of the respondents had heard about antibiotics. However, even though a significant percentage of respondents had heard about antibiotic resistance, only 40.7% were confident in their knowledge. Although many know the term antibiotic resistance, few truly understand it.

Most respondents (88.9%) have used antibiotics in the past 12 months, similar to a study by Farghaly *et al*., 2021 [20], where about 85.5% of participants had taken antibiotics during the last year, which shows that the students frequently take antibiotics. About 71.6% of respondents have received formal education on antibiotic use and resistance, with 79.0 % affirming their source of knowledge from lectures (Table 1), showing that lectures have been an effective way to enlighten antibiotic resistance.

The study found a relationship between the student's year of study and their knowledge of antibiotic resistance, with students in higher levels of study having more knowledge than those in lower levels (chi-square = $p < 0.10$). This suggests a need for educators to develop a general course covering important health issues that could benefit all students.

The result shows that 74.1% (figure 4) of the respondents obtain antibiotics from a pharmacy, and

out of these, only 30.9% always complete the full course of antibiotics that a healthcare professional prescribes (figure 5). Although lectures are an eye opener to antibiotic resistance, healthcare professionals such as pharmacists and clinicians are obligated to enlighten their patients on the dangers of antibiotic resistance, which could arise from patients not completing the full course of antibiotics prescribed by them. Only 6.2% (figure 6) of people regularly discuss antibiotic use with their healthcare professionals in this study. This number is significantly lower than the 20% reported in a study by Mason *et al*., in 2018 [21], which showed that respondents received counselling from community pharmacists on antibiotic resistance. It is concerning that many patients may be aware of antibiotic resistance but lack adequate knowledge about it.

91.4% of the students think that antibiotics are overused, and 88.8% believe that antibiotic resistance can cause difficulty in eliminating infections from the body. Despite this knowledge, only a small % of respondents, 4.9%, have ever participated in an antibiotic awareness campaign. This highlights the need for more such campaigns since lectures can only reach a limited audience of people whose course of study exposes them to it. However, antibiotic resistance is not exclusive to those people. Every individual can experience it, which makes it necessary to increase awareness about antibiotic misuse and resistance. Therefore, such a campaign will be more effective in creating awareness for antibiotic resistance and better management.

This study's most predominant bacteria isolate was Streptococcus spp, followed by Escherichia coli (Table 4.1). This is in contrast to a study conducted by Hossain *et al*., in 2021 [22], in Noakhali, Bangladesh, where Escherichia coli was the most predominant, followed by Staphylococcus saprophyticus. It also differs from a study on female university students in Saudi Arabia, where Escherichia coli was the most predominant organism, followed closely by Staphylococcus aureus [23]. In South-West Nigeria, Escherichia coli was the predominant bacterial pathogen isolated. Ofloxacin and gentamicin showed the highest activity in the susceptibility pattern [24].

The most effective antibiotic against *Streptococcus spp* was Ciprofloxacin. For *Escherichia coli*, Ciprofloxacin and Amoxicillin were the most effective (Table 4.3); this is similar to a study carried out by Ali *et al*., 2020 [24], where Ciprofloxacin was also the most effective antibiotic for *Escherichia coli*. Ampiclox showed a high resistance pattern among the gram-positive isolates compared to other antimicrobial agents (Table 4.2). For gram-negative isolates, Augmentin showed a high resistance pattern in comparison to other antimicrobial agents used (Table 4.3), which is different from the result obtained by Al-Ofairi *et al*., 2024 [25], in Sana'a City, Yemen, where the gram-negative isolates were resistant to Imipenem, Ernofloxacin and Norfloxacin.

Most of the participants in this study are future healthcare professionals. Their knowledge and attitude toward antibiotic resistance can help address this global crisis or hinder the health sector. There is sufficient understanding of antibiotic resistance but a nonchalant attitude toward its use. Working on this attitude should be the focal point in universities. This study can aid policymakers within the educational system in explaining the need to be keen on antibiotic resistance awareness in the university curriculum.

The respondents' knowledge of antibiotic resistance and usage is due to their medically inclined course of study, which has exposed them more than individuals whose course is not medically or biologically related. The exposure includes being surrounded by peers in the same field and closely interacting with lecturers with vast knowledge on such a subject.

CONCLUSION

Although this study was limited to only female students, it has given a realistic perception of this particular part of the population, providing credible insight into their understanding of antibiotic resistance. Given that the respondents are future healthcare professionals and, as females, are also potential primary supporters of the family.

The study identified a correlation between the student's year of study and their knowledge of antibiotic resistance, indicating that students in higher study levels possessed greater knowledge than those in lower levels. This implies that there may be a gap in the understanding of antibiotic resistance among students in the earlier years of study.

Additionally, educational systems need to include awareness campaigns on antibiotic resistance in community service courses because the current curriculum lacks coverage of important health issues, including antibiotic resistance.

RECOMMENDATIONS

Although courses about antibiotic resistance are already in the curriculum, more emphasis and attention should be given to them. Healthcare professionals and patients should communicate actively. If policymakers in the educational system

include awareness campaigns as community service courses, it will benefit not only students but also the general public.

One limitation of our study is the small sample size we used for data collection. Despite employing a well-defined sampling technique, the limited number of participants may have affected the generalizability of our findings. Additionally, our study was conducted in a specific geographic location, so the results may not be applicable to other regions or populations.

REFERENCE

1. Michaelidou, M., Karageorgos, S. A., & Tsioutis, C. (2020). Antibiotic use and antibioticresistance: Public awareness survey in the Republic of Cyprus. *Antibiotics, 9*(11), 759.
2. World Health Organization. (2022). *Antimicrobial resistance*. World Health Organization.
3. Tuyishimire, J., Okoya, F., Adebayo, A. Y., Humura, F., & Lucero-Prisno III, D. E. (2019). Assessment of self-medication practices with antibiotics among undergraduate university students in Rwanda. *Pan African Medical Journal*, 33.
4. Fuhrmeister, E. R., Larson, J. R., Kleinschmit, A. J., Kirby, J. E., Pickering, A. J., & Bascom-Slack, C. A. (2021). Combating antimicrobial resistance through student-driven research and environmental surveillance. *Frontiers in Microbiology*, *12*, 577821
5. Tsopra, R., Courtine, M., Sedki, K., Eap, D., Cabal, M., Cohen, S., ... & Lamy, J. B. (2020). AntibioGame®: A serious game for teaching medical students about antibiotic use. *International journal of medical informatics*, *136*, 104074.
6. Zulu, A., Matafwali, S. K., Banda, M., & Mudenda, S. (2020). Assessment of knowledge, attitude and practices on antibiotic resistance among undergraduate medical students in the school of Medicine at the University of Zambia. *Int J Basic Clin Pharmacol*, *9*(2), 263-70.
7. Machowska, A., & Stålsby Lundborg, C. (2019). Drivers of irrational use of antibiotics in Europe. *International journal of environmental research and public health*, *16*(1), 27.
8. Marzan, M., Islam, D. Z., Lugova, H., Krishnapillai, A., Haque, M., & Islam, S. (2021). Knowledge, attitudes, and practices of antimicrobial uses and resistance among public university students in Bangladesh. *Infection and drug resistance*, 519-533.
9. Sánchez, X., Landázuri, A., Londo, P., Manzano, A., Moreno Roca, A., & Jimbo, R. (2020). Knowledge, Attitudes and Practices in Antibiotic Use in Family Medicine Students. *Journal of Primary Care & Community Health*, *11*, 2150132720984758.
10. Shahpawee, N. S., Chaw, L. L., Muharram, S. H., Goh, H. P., Hussain, Z., & Ming, L. C. (2020). University students' antibiotic use and knowledge of antimicrobial resistance: what are the common myths?. *Antibiotics*, *9*(6), 349.
11. Chukwu, E. E., Oladele, D. A., Awoderu, O. B., Afocha, E. E., Lawal, R. G., Abdus-Salam, I., and Dhingra, S., Rahman, N. A. A., Peile, E., Rahman, M., Sartelli, M., Hassali, M. A., & Haque, M. (2020). Microbial resistance movements: an overview of global public health threats posed by antimicrobial resistance, and how best to counter. *Frontiers in Public Health*, 8, 535668.
12. Boynton, P. M., & Greenhalgh, T. (2004). Hands-on guide to questionnaire research: Selecting, designing, and developing your questionnaire. *BMJ: British Medical Journal*, *328*(7451), 1312-1315. https://doi.org/10.1136/bmj.328.7451.1312
13. Taro Yamane Formular In Calculating Sample Size For Research | by Projectclue 12 | Medium
14. Anie, C. O., Oghenejobo, M., & Asibe, E. (2022). Identification and evaluation of bacteriapresent in the toilet bowls of students' hostel in Delta State University, Abraka. *World Journal of* Pharmacy *and Pharmaceutical Sciences*, *11*(10), 2278-4357.
15. Andrews, J. M. (2009). BSAC standardised disc susceptibility testing method (version 8). *Journal of antimicrobial chemotherapy, 64*(3), 454-489.Schröder, W., Sommer, H., Gladstone, B. P., Foschi, F., Hellman, J., Evengard, B., & Tacconelli, E. (2016). Gender differences in antibiotic prescribing in the community: A systematic review and meta-analysis. *Journal of Antimicrobial Chemotherapy*, *71*(7), 1800-1806. https://doi.org/10.1093/jac/dkw054
16. Loikas, D., Wettermark, B., von Euler, M., Bergman, U., & Schenck-Gustafsson, K. (2013). Differences in drug utilisation between men and women: a cross-sectional analysis of all dispensed drugs in Sweden. *BMJ open*, *3*(5), e002378.
17. Schröder, W., Sommer, H., Gladstone, B. P., Foschi, F., Hellman, J., Evengard, B., & Tacconelli, E. (2016). Gender differences in antibiotic prescribing in the community: a systematic review and meta-analysis. *The Journal of Antimicrobial Chemotherapy/Journal of Antimicrobial Chemotherapy*, *71*(7), 1800–1806. https://doi.org/10.1093/jac/dkw054
18. Centers for Disease Control and Prevention. (2011). 10 Ways STDs Impact Women Differently from Men. In *CDC FACT SHEET*. https://www.cdc.gov/std/health-disparities/stds-women-042011.pdf
19. Ulaya, G., Nguyen, T. C. T., Vu, B. N. T., Dang, D. A., Nguyen, H. A. T., Tran, H. H. ... & Lewycka, S. (2022). Awareness of Antibiotics and Antibiotic

Resistance in a Rural District of Ha Nam Province, Vietnam: A Cross-Sectional Survey. *Antibiotics,* 11(12), 1751.

20. Farghaly, M., Badran, A., & Keraa, K. (2021). Assessing knowledge, practices, use and raisingawareness of antibiotics and antibiotic resistance among dental patients before and after educational sessions: Raising awareness of antibiotics resistance. *Brazilian Dental Science,* 24(4).
21. Mason, T., Trochez, C., Thomas, R., Babar, M., Hesso, I., & Kayyali, R. (2018). Knowledge and awareness of the general public and perception of pharmacists about antibiotic resistance. *BMC public health,* 18, 1-10.
22. Hossain, I., Bhowmik, S., Uddin, M. S., Devnath, P., Akter, A., Eti, L. N., ... & Islam, M. T. (2021). Prevalence of urinary tract infections, associated risk factors, and antibiotic resistance pattern of uropathogens in young women at Noakhali, Bangladesh.
23. Ajani, T. A., Elikwu, C. J., Nwadike, V. U., Tayo, B., Shonekan, O. A., Okangba, C. C., ... & Coker, O. A. (2020). Urinary tract infections and antimicrobial susceptibility pattern among female students in a tertiary institution in southwest Nigeria-A cross sectional study. *Journal of Clinical Sciences*, *17*(4), 131-135.
24. Ali Al Youssef, S., Ghareeb Mohamed, A., Ahmed Abdelrahman, R., Mohamed Abo Baker, R., Ibrahim Abass, N., & Khalafalla Ahmed Masaad, H. (2020). Asymptomatic Urinary Tract Infection among Female University Students. *Egyptian Journal of Health Care*, *11*(4), 341-353.
25. Al-Ofairi, B. A., Edrees, W. H., Al-Hadheq, A. A., Al-Jendy, A. S., Alrahabi, L. M., Al-Ruwaisis, A. M., & Obad, K. N. (2024). Gram-Negative Bacteria in Some Clinical Specimens and their Antibiotics Resistance Profiles, Sana'a, Yemen. *Electronic Journal of University of Aden for Basic and Applied Sciences,* 5(1), 86-94.