KNOWLEDGE AND ATTITUDE TOWARDS ANTIBIOTICS USE AND BACTERIAL RESISTANCE AMONG FINAL YEAR MEDICAL STUDENTS

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ABSTRACT

Background: Antibiotic resistance has become a worldwide public health concern and is in part related to physicians' and pharmacist's lack of knowledge. It is essential to focus our attention on healthcare profession students. **Objective:** This study was conducted to assess the knowledge and attitude towards antibiotics use and bacterial resistance among final year medical students of different universities. **Methods:** This is an observational cross-sectional university student's based study. A 393 of final year students of medicine, pharmacy, and nursing faculties were enrolled. The study was completed in National University (private university) and Neelain University (governmental university) in Khartoum State, Sudan. Data were collected using a predesign pretested questionnaire. The questionnaires were divided into two parts; knowledge and attitude towards antibiotic use and resistance. Data were analyzed by employing One-way ANOVA and Independent T-Test using (IBM SPSS Inc., Chicago, IL) and STATA version 11. **Results:** Findings of this study found that 49% of the total study population had poor knowledge towards antibiotic use and bacterial resistance. Also, almost half (51%) of the total study population had good knowledge towards antibiotic use and bacterial resistance. Additionally, 42% of the total population had poor attitude towards antibiotic use and bacterial resistance. Binary logistic regression for prediction knowledge has been used, and it was found that the private university was poor in knowledge 2.214 times more than the governmental university; Students who have no family members working in the medical field have 6.719 times more poor knowledge than students who have family members working in the medical field; private university contributed more to being poor in attitude 1.839 compared to the governmental university; students from nursing and medicine faculties were found to be poor in attitude 1.834 times more compared to pharmacy

faculties. students with poor knowledge contributed to being poor in attitude 2.342 times. **Conclusions:** Nearly half of the total students had poor knowledge and attitude towards antibiotic use and bacterial resistance. Sufficient knowledge is associated with better attitude and vice versa. Governmental university students associated with better knowledge and attitude toward antibiotic use; private universities should be investigated to detect the barriers. Nursing and medicine students are associated with poorer knowledge and attitude. Curricula should be modified, especially for medicine and nursing. Activities such as seminars and workshops regarding antibiotics are needed to emphasize students.

INTRODUCTION

Antibiotics are the most active chemotherapeutics among drugs; they exert their therapeutic effect by antagonising the growth of bacteria. The majority of antibiotics are considered safe, but any antibiotic can cause side effects and in some cases life-threatening side effects, such as leukopenia, thrombocytopenia, anaemia, skin rash, photosensitivity reaction, and anaphylactic reaction.[1]

A significant problem with antimicrobials is the emergence of human pathogens resistance. Antibiotics resistance is a current problem worldwide, particularly in developing drug classes in developing countries.[2] The irrational and overuse of antibiotics may not only result in the emergence of resistant bacterial strains, but also adverse reactions and economic burden on the national health system.[3] An increase of 20 billion USD in direct healthcare cost in the United States was reported due to antibiotic resistance.[4] However, in developing countries, many studies have been conducted in the past, but it is challenging to quantify the burden imposed by antibiotic resistance on developing societies with precision.[2]

In Sudan, most drugs can be obtained from pharmacies and drug stores without the requirement of a prescription. As a result, minor ailments are often treated with antimicrobials.[2] However, the wrong concept in a community like using antibiotics to treat viral infections and the common cold, and the prevalence of self-medication is alarmingly high, the chance of developing resistant microbes is much higher, and therefore, what is happening in Sudan should also be of great concern to the world.

Several factors may enhance irrational antibiotics usage, which could be doctors' diagnostic uncertainty, patients' expectations, lack of patient and health care professionals education,

pharmaceutical marketing, antibiotic availability without a prescription as well as economic and political reasons.[4]

Inadequate training of healthcare professionals in their undergraduate education in an area of antibiotic use and resistance was highlighted by many researchers.[4] Competence in the understanding of resistance patterns is a valuable guide to devise antibiotic guidelines and directing the antibiotic practices towards the right path. Given this, many studies have emphasised on revising the curriculum of junior healthcare professionals to promote the judicious use of antibiotics. Therefore, before embarking on any interventions to patients or the public, it is necessary to ascertain the understanding of future healthcare practitioners.[5] This study was conducted to assess the knowledge and attitude towards antibiotics use and bacterial resistance among final year medical students of different universities.

METHODOLOGY

Study design

This is an observational cross-sectional university student's based study.

Study area

This study was conducted in different faculties (medicine, nursing, and pharmacy) in National University (a private university) and Neelain University (governmental university) in Khartoum State, Sudan.

Study Duration

The study was conducted in Khartoum State during the periods of 15th May to 15th June 2018.

Study Populations

The study population was selected from final year students of different medical colleges (medicine, nursing and pharmacy faculties) in the tow different universities (private and governmental) in Khartoum State, Sudan.

Sampling

The subjects in this study were selected randomly from 393 university students.

Table 1: Sample Distribution.

College	Total (National University)	Total (Neelain University)
Pharmacy	129	110
Medicine	180	190
Nursing	44	130
Total	353	430

N/1+N (e) 2

TN = Total number of study population

e = Designed margins of error (CIM 95%)

N1 = Neelain University (207 Sample size of governmental students)

N2 = National University (188 Sample size of private students)

430/1+(430 (.0025)) = 207 N1 = 207

351/1+(351 (.0025)) = 188 N2 = 188

TN = N1 + N2 = 395

The missing data was due to two incomplete questionnaires (393 out of 395 students enrolled).

Table 2: Selected Sample Size Calculation.

College	Private University	Governmental University)	Total
Pharmacy	69	53	122
Medicine	96	91	187
Nursing	23	63	86
Total	188	207	395

Inclusion Criteria

Final year students (medicine, nursing, and pharmacy students) at Neelain University and National University.

Data collection Process

Data were collected using a predesigned pretested questionnaire. Questionnaires were filled by the researcher via a direct interview with the study subjects. Although the questionnaire used for assessing Knowledge, in order to have a better assessment of overall knowledge, each correct answer carried one mark while the wrong answer carried 0 marks, also for the question had five options 0.2 marks were assigned for each correct answer, this gave a total score range of 0 – 10. For attitude, a Likert scale was used involving; strongly agree, somewhat agree, undecided, somewhat disagree and strongly disagree scored from 1 to 5

respectively, this gave a total score from 5-25 marks. The score in knowledge and attitude domains were not normally distributed were expressed as median then was categorized as poor (less than the median) and good (median and above).

Data analysis

Data was collected using a predesigned pretested questionnaire to be filled by respondents include study variables. Then data was organised and analysed using Statistical Package for Social Sciences software, version 21.0 (IBM SPSS Inc., Chicago, IL) and STATA version 11 were used. Initially, all information gathered via questionnaires then coded into variables. Descriptive statistics involving frequencies, percentages, and graphical distribution (Pie chart), Mean, Median and standard deviation and inferential statistics involving Independent T-test, One-way ANOVA (Analysis of variance) Test, Spearman's rho correlations and binary logistic regression were used to present results. A *p*-value of less than 0.05 was considered statistically significant.

2.1.8 Ethical Considerations

Ethics approval for this study was conducted under permission from National University Human Research Ethics Committee department of clinical and industrial pharmacy on May 2018 and collection of data was be started after obtaining approval from National University and Neelain University, and informed consent was taken verbally from all study participants.

RESULTS

The proportion of females, 69.7% was higher than that of males 30.3%. The findings of this study found that 98% were aged between[20-39] years and 2% were aged between[40-59] years. 57% of students had a family member working in the medical field while 43% had no family members working in the medical field. 86.3% of students were living in an urban area, and 13.7% were living in a rural area. 77.9% of students were living with family while 22.1% were living as outsiders (independently) as shown in table (3).

Table 3: Demographic Data of Students.

| Variables		Number	Per cent
Gender	Male	119	30.3 %
	Female	274	69.7%
Age groups	20-39 years	385	98%
	40-59 years	8	2%
Family member working in the medical field	Yes	224	57%
	No	169	43%
Family residence	Urban	339	86.3%
	Rural	54	13.7%
Living status	Family	306	77.9%
	Outsider	87	22.1%

Knowledge Scores of Students

Table (4) shows that the lowest mark was one and the highest was 10. The average mark was between 4 and 8 (mean +– SD).

Table 4: Knowledge Scores of Students Towards Antibiotic Use.

Descriptive Statistics	Number	Minimum	Maximum	Median	Mean	Std. Deviation
Knowledge score	393	1	10	6.2	6.3	2

49% of the students had poor knowledge regarding the antibiotic use and bacterial resistant, and 51% of the students had good knowledge regarding the antibiotic use and bacterial resistant. As shown in figure (1).
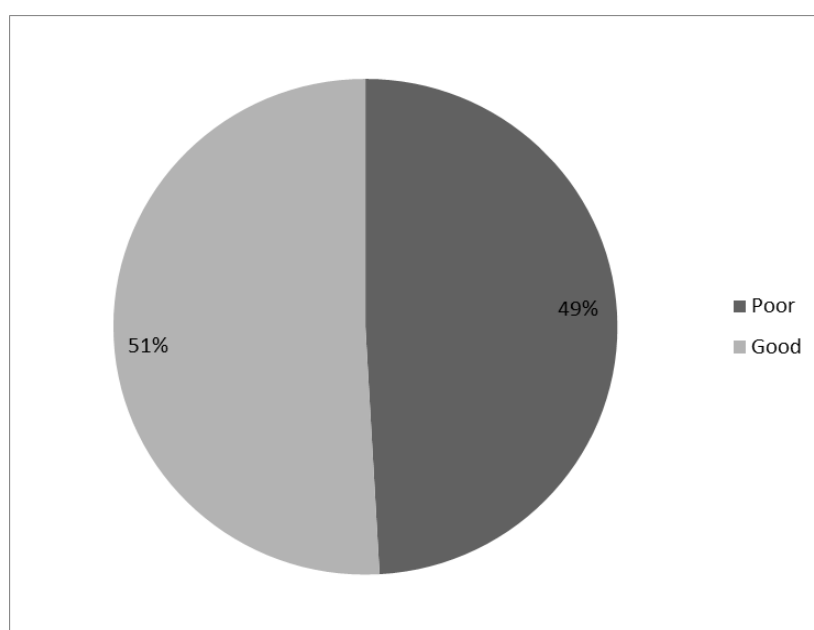
Figure 1: Classification of Students According To The Knowledge Score.

Attitude Scores of Students

Table (5) shows that the lowest mark was five and the highest was 24. The average mark was between 11 to 19 (mean +– SD).

Table 5: Attitude Scores of Students Towards Antibiotic Use.

Descriptive Statistics	Number	Minimum	Maximum	Median	Mean	Std. Deviation
Attitude Score	393	5	24	15	15	4

42% of the students had a poor attitude towards the antibiotic use, and bacterial resistant and 58% of the students had good attitude towards the antibiotic use and bacterial resistant. As shown in figure (2).
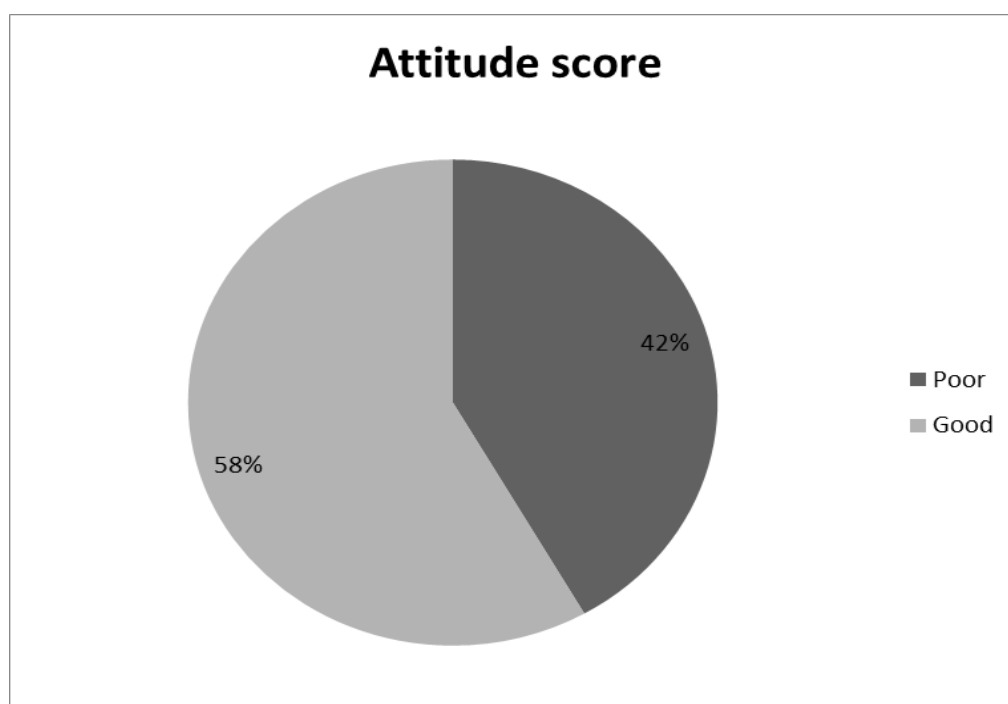

Figure (2): Classification of Students According to The Attitude Score.

Association between knowledge and demographic data:

Table (6) shows that there is a significant association between knowledge and university *(p = 0.00001)*, governmental university students having better knowledge score compared to private. This funding reflects that students with good knowledge are associated with better attitude compared to that of poor attitude *(p = 0.0000001)*.

Table 6: Association Between Knowledge and Demographic Data.

Independent T-Test						
Variables		**Number**	**Knowledge score**			**P-value**
			Mean	**Std. Deviation**	**Std. Error Mean**	
University	Governmental	207	6.71	1.994	0.139	0.00001***
	Private	186	5.89	1.952	0.143	
Gender	Male	119	6.23	1.923	0.176	0.541
	Female	274	6.37	2.054	0.124	
Age groups	(20-39) years	385	6.33	1.995	0.102	0.742
	(40-59) years	8	5.98	2.944	1.041	
Family member working in the medical field	Yes	224	6.35	2.083	0.139	0.789
	No	169	6.29	1.924	0.148	
Family residence	Urban	339	6.35	2.039	0.111	0.567
	Rural	54	6.19	1.858	0.253	
Living status	Family	306	6.32	2.055	0.117	0.966
	Outsider	87	6.33	1.872	0.201	
Attitude score	Poor	164	5.51	1.942	0.152	0.0000001***
	Good	229	6.91	1.86	0.123	

P-value <0.05 that are considered as statistically significant.

*** *P*-value <0.0005 that is considered as statistically extremely significant.

Association Between Attitude and Demographic Data

Table (7) shows there is a significant association between attitude and university *(p = 0.001)*, governmental university students having a better attitude score compared to that non-governmental. There is a negative association between attitude and age groups *(p = 0.024)*, that the younger age group[20-39] had a better attitude compared to the older group(40-59). There is a positive association between attitude and knowledge *(p = 0.000001)*; this finding reflects that students with good attitude are associated with better knowledge compared to students with poor knowledge.

Table 7: Association Between Attitude and Demographic Data.

Independent T-Test						
Variables		**Number**	**Attitude score**			**P value**
			Mean	**Std. Deviation**	**Std. Error Mean**	
University	Governmental	207	16.1	4.264	0.296	0.001*
	Non-governmental	186	14.61	4.257	0.312	
Gender	Male	119	15.38	4.318	0.396	0.955
	Female	274	15.41	4.328	0.261	
Age groups	(20-39) years	385	15.47	4.273	0.218	0.024*
	(40-59) years	8	12	5.451	1.927	
Family member working in the medical field	Yes	224	15.55	4.471	0.299	0.417
	No	169	15.2	4.115	0.317	
Family residence	Urban	339	15.53	4.352	0.236	0.115
	Rural	54	14.54	4.046	0.551	
Living status	Family	306	15.59	4.24	0.242	0.115
	Outsider	87	14.72	4.549	0.488	
Knowledge score	Poor	193	13.95	3.923	0.282	0.000001***
	Good	200	16.79	4.235	0.299	

*.*P* value <0.05 that's considered as statistically significant.

** *P*-value <0.005 that's considered as statistically highly significant.

*** *P*-value <0.0005 that is considered as statistically extremely significant.

Comparison of knowledge between faculties

Table (8) shows that knowledge among pharmacy students was found to be better than that of other colleges.

Table 8: Comparison in Knowledge Between Pharmacy, Medicine and Nursing Students.

One Way Anova Test					
Variables		**Number**	**Knowledge score**		
			Mean	**Std. Deviation**	**Std. Error**
Faculties	Pharmacy	124	7.57	1.674	0.15
	Medicine	185	5.78	1.969	0.145
	Nursing	84	5.69	1.733	0.189
P value = 0.000001***					

*. *P*-value <0.05 that is considered statistically significant.

Comparison in Attitude Between Faculties

The attitude among pharmacy students was found to be better than that of other colleges, as shown in Table (9).

Table 9: Comparison in Attitude Between Pharmacy, Medicine and Nursing Students.

One Way ANOVA Test					
Variables		**Number**	**Attitude score**		
			Mean	**Std. Deviation**	**Std. Error**
Faculties	Pharmacy	124	16.85	4.336	0.389
	Medicine	185	15.06	4.119	0.303
	Nursing	84	13.99	4.155	0.453
P value = 0.000004***					

*.*P* value <0.05 that is considered statistically significant.

Level of knowledge among students according to demographic data

Binary logistic regression for prediction knowledge has been used, and it was found that the private university was poor in knowledge 2.214 (1.38-3.553) times more than the governmental university with a *P* value 0.001<0.05.

Students who have no family members working in the medical field have 6.719 (3.932-11.48) times more poor knowledge than students who have family members working in the medical field, with *a p-*value of 0.000001<0.05.

Students with poor attitude are 2.349 (1.479-3.731) times poorer in knowledge with a *P*-value of 0.0003<0.05.

Level of Attitude Among Students According to Demographic Data

Binary logistic regression for prediction knowledge has been used, and it was found that the private university contributed more to being poor in attitude 1.839 (1.182-2.862) compared to the governmental university with a *P*-value 0.007<0.05.

Students from nursing and medicine faculties were found to be poor in attitude 1.834(1.089-3.087) times more with a *P*-value of 0.023<0.05 compared to pharmacy faculties.

Students with poor knowledge contributed to being poor in attitude 2.342 (1.473-3.724) times with a *P*-value 0.0003<0.05.

DISCUSSION

This study was an observational cross-sectional university student's based study. A 393 of final year students of medicine, pharmacy, and nursing faculties were enrolled. Data were collected using predesign pretested questionnaires. The questionnaires were divided into two parts; knowledge and attitude towards antibiotic use and resistance**.**

The study showed that half of the participants had poor knowledge and attitude towards antibiotic use and bacterial resistance. These findings were consistent with a study conducted in China that showed excessive use of antibiotics, especially among the more senior medical students, signifying a deficiency of antibiotics usage instruction in their curriculum.[21] This may be due to some students who neglected their courses, or their curriculums have a deficiency in antibiotics usage instructions.

The study showed consistency with the study conducted in Trinidad and Tobago (2015) that established a good knowledge of pharmacy students regarding antibiotic usage. However, students' attitude toward antibiotic use was poor.[12] The study mentioned above, which was conducted only on pharmacy students, shows that the students have good knowledge. The result was different from our study that was conducted on pharmacy, medicine and nursing students, and that is the reason why half of the students had poor knowledge. On the other hand, the results for attitude were poor in both studies. Unfortunately, this is lamentable and fearful; therefore focus on education and awareness of medical students must be a priority.

Additionally, another study conducted in Kosovo (2016) unfolded good and moderate knowledge of pharmacy students regarding the antibiotics.[13] The knowledge of pharmacy students in this study ranged between good and moderate, without any records of poor knowledge. This indicates that medicine and nursing curricula need to be modified.

However, a study was conducted in Ethiopia (2016) revealed that final year undergraduate paramedical students (Optometry, Pharmacy, Nursing, Midwifery, and Health officer) had poor knowledge regarding antimicrobial resistance, their knowledge and attitude significantly varied across their field of study.[9] It was observed that the result was poor despite the study being conducted on the final year students. The reason behind this result displayed for pharmacy students and students of other disciplines in the study is the differences in knowledge and attitude according to their specialisation. Moreover, a study that was conducted in Jordan showed that medical students and non-medical students have inadequate knowledge, gaps in terms of knowledge and attitude regarding antibiotics use among students. Also, a study in western China has shown an almost similar result: undergraduates (medical students and non-medical students) have inadequate and poor knowledge of aspects of antibiotics.[11] In previous studies, the result showed poor knowledge and attitude because the studies were conducted on medical students in addition to non-medical and for different levels of students, not final year students.

Also, the study found that there is a significant association between knowledge, attitude, and university. Governmental students are more knowledgeable than non-governmental students. These findings may be due to a better quality of education in the governmental university.

Another critical finding states that there is a positive association between knowledge and attitude and vice versa. This refers that an increase in knowledge leads to an increase in attitude. A possible explanation for this is that the increase in knowledge leads to increase of information and behaviours of students which in turn leads to reflection on attitude. These findings, however, differ from that in the Trinidad and Tobago study, which exhibited good knowledge of pharmacy students regarding antibiotic usage. However, students' attitude toward antibiotic use was poor.[12] It was observed that the knowledge was good, but the attitude was poor.

The study found there is a negative association between attitude and age; this means as age increases, the attitude decreases towards the use of antibiotic. This is a result of the cultural and social beliefs that remain unchanged and the lack of information updates.

Also, the study found that students with no family members working in the medical field have poor knowledge when compared to students who have family members working in the medical field. In this study it was observed that when there are students have a family member working in the medical field, they get advice, awareness from them this will increase their knowledge the opposite for other students who do not have any family members in the medical field.

Furthermore, this study reveals that nursing and medicine faculties have shown more attributions to the poor attitude in comparison with faculty of pharmacy. This concludes that the curriculum delivered in the pharmacy faculty contains more information about drug compared to the curriculum in the other faculties. The study showed comparability with the study conducted In Malaysia (2012), which establishes a comparison to final year medical students and pharmacy students who showed better understanding and adequate knowledge.[5] However, there was another result showed in a study conducted in Croatia (2018), that there is no difference in the average knowledge score among final year medical, and pharmacy students. This study reveals that medical and pharmacy students have a relatively good understanding of antibiotic resistance.[15]

Limitations

- The study was conducted among medical students in two universities, needed number of universities for a more accurate result and at the time of research, most universities were closed.

- The study period was short.

CONCLUSION

Nearly half of the total students had poor knowledge and attitude towards antibiotic use and bacterial resistance. Sufficient knowledge is associated with a better attitude and vice versa. Governmental university students associated with better knowledge and attitude toward antibiotic use; private universities should be investigated to detect the barriers. Nursing and medicine students are associated with poorer knowledge and attitude. Family members working in the medical field affect positively on the knowledge and attitude toward antibiotics use of their relatives form the students. Curricula should be modified, especially for medicine and nursing. Activities such as seminars and workshops regarding antibiotics are needed to emphasise students.

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