A KAP Study on Antibiotic Usage and Antibiotic Resistance among College Students

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ABSTRACT
Introduction: Antibiotics were considered one of the greatest inventions of 20th century. Before this, infectious diseases contributed to high mortality and morbidity throughout the world. In addition to treating infectious diseases, antibiotics made many modern procedures possible, including cancer treatment, organ transplants and open-heart surgery. The expeditious emergence of antibiotic resistance is currently causing a worldwide public health crisis. This is resulting in substantial economic and clinical burden on both individual and population health.
Objectives
• To assess the Knowledge of Antibiotics usage and resistance among college students.
• To assess the Attitude of college students towards the use and misuse of Antibiotics.
• To assess the Practices of Antibiotics usage among college students.
Materials and Methods: A prospective observational study was carried out over a period of six months among Healthcare students from Medical, Pharmacy, Dental and Nursing courses of SJM Institutes in Chitradurga.
Results: A total of 231 healthcare students from Medical, Pharmacy, Dental and Nursing Colleges were enrolled for the study, out of which 43 were from medical, 77 from pharmacy, 57 from dental and 54 from nursing students. The age wise distribution of participants showed that the mean age of the study population was 22.9 ± 2.57 and gender wise distribution revealed that majority of the study participants were females (80.5%). The findings of the study showed that the mean score of knowledge (7.35) and attitude (7.28) of Medical students towards antibiotics use and resistance were higher than other students included in the study, with the least mean score observation among the nursing students for both (5.30) and (5.67) respectively. Meanwhile, the mean score of practices of Pharmacy students (3.95) were higher than others, with the least among the Dental students (3.28).
Conclusion: The study concludes that the Medical students had the best knowledge and attitude when compared to other students, however they lack in their practices towards the antibiotics usage and resistance. But, in spite of only satisfactory levels of knowledge and attitude, the practices of Pharmacy students were best among the others. As far as knowledge and attitude is concerned, there is a significant need for improvements in Pharmacy, Dental and Nursing students and also to change practices among Medical, Dental and Nursing students.
Keywords: Antibiotics usage, Resistance, Healthcare students, Knowledge, Attitude, Practices.

I. INTRODUCTION

Antibiotics, also known as antibacterial, are medications that destroy or slow down the growth of bacteria and are used to treat diseases caused by bacteria. Antibiotics cannot treat viral infections such as cold, flu, and most coughs [1]. Antibiotics were considered one of the greatest inventions of 20th century. Before this, infectious diseases contributed to high mortality and morbidity throughout the world [2]. In addition to treating infectious diseases, antibiotics made many modern procedures possible, including cancer treatment, organ transplants and open-heart surgery [3].

Antibiotic use might be influenced by several factors such as unregulated drug availability, relaxed health policies concerning regulations on antibiotic use, procurement of antibiotics without prescription (OTC), patient's knowledge and attitude towards antibiotic use, self-medication, physician's knowledge and experiences and patient-prescriber interaction.

Therefore, controlling antibiotic use requires feasible means of intervention [4]. Rational use of drug means that a patient receives medication appropriate to his/her clinical needs, in doses that meet his/her own individual requirements for an adequate period of time, at the lowest cost to his/her and his/her community [5].

The irrational use of antibiotics has resulted in antibiotic resistance which is a serious threat to the entire world today. The major cause of misuse of antibiotics is inadequate knowledge about antibiotics among prescribers [6]. Antibiotic misuse also leads to treatment failure, increased hospitalization time, and economical burden [7]. Among other factors self-medication with antibiotics has also been identified as one form of irrational use [8].

Misuse of antibiotics poses a serious risk to infectious disease control and public health in general, hence it is necessary to improve public awareness, enforce strict antibiotic policies and bring a change in the behavior of consumers. Major resistance control strategies therefore recommend education of the public to promote appropriate antibiotic use [9]. Medical students are future medical practitioners. Hence they must be directed towards rational antibiotics prescribing behavior. It has been recommended that adequate training on antimicrobial prescribing and resistance should be provided to the undergraduate medical students to help minimize antibiotic resistance [10].

The World Health Organization (WHO) predicts that there will be 10 million deaths due to antimicrobial resistance (AMR) in 2050. The expeditious emergence of antibiotic resistance is currently causing a worldwide public health crisis. This is resulting in substantial economic and clinical burden on both individual and population health. The current position regarding antibiotic resistance is often blamed on their overuse and misuse [11]. Antibiotics resistance results when the microorganisms develop a mechanism to protect itself from antibiotics for its survival, which makes the antibiotic to be useless when used against that microorganism. Hence there will be need for use of newer, higher efficacy and more expensive antibiotics [12].

The problem of resistance is compounded in developing countries due to multiple reasons which include self-medication without prescription, OTC sale of antibiotics, inadequate regulations of antibiotics, high cost of medical consultants and dissatisfaction with medical practitioners [13]. In addition, inappropriate antibiotic dosages have also contributed to the emergence of antibiotic-resistant bacterial strains. The multi-drug resistant (MDR) bacterial spp., having resistance to multiple antibiotics, can cause life-threatening infections. Developments of superbugs are the result of such kinds of antibiotic associated evils [14].

A holistic approach to tackle the menace of antibiotic resistance will involve steps taken at all levels of society (public, policy makers, health and agriculture professionals) to reduce the impact and limit the spread of resistance. The general public can play a key role by taking actions to prevent infections to avoid the need for antibiotics and using antibiotics only when prescribed by certified health professional. Other remedial actions will include; always taking the full prescription, never using left-over antibiotics and never sharing antibiotics with others [15].

With these backgrounds, the present study was conducted to assess the current level of knowledge, attitude and practices (KAP) of antibiotics use and resistance among college students.

II. MATERIALS AND METHODS
Study Design:
This was a questionnaire based prospective observational study.
Study Site:
This study was conducted among students of selected SJM Institutes (Medical, Pharmacy, Dental, Nursing) in Chitradurga, Karnataka.
Study Period: Study was conducted for a period of six months.
Study Subject:
Healthcare students from selected SJM Institutes (Medical, Pharmacy, Dental, Nursing) Chitradurga, Karnataka who met the following criteria:
Inclusion Criteria:
• Random healthcare students from Medical Pharmacy, Dental, Nursing courses of SJM Institutes.
• Both male and female students.
Exclusion Criteria:
• Students who were drop out from the study.
Ethical Approval:
The study was approved by the Institutional Ethical Committee of SJM College of Pharmacy, Chitradurga.
Ref. No: SJMCP/684/2021-2022.
Sources of Data:
• Data was collected using questionnaire based on online survey.

Study Procedure:

- A six month prospective observational study was carried out in Medical, Pharmacy, Dental and Nursing Colleges of SJM Institutes in Chitradurga.
- The study was started after obtaining the consent from Institutional Ethical Committee (IEC). After obtaining informed consent, the questionnaire was distributed through google forms among the students who were all studying in Medical, Pharmacy, Dental and Nursing Colleges of SJM Institutes in Chitradurga.
- A self-administered questionnaire on knowledge, attitude and practices of antibiotics use, misuse and resistance has been provided which consisted of:
a) Socio-demographic details.
b) Basic knowledge on antibiotics use and resistance.
c) Attitude on antibiotics use and misuse.
d) Practices with regards to antibiotics use.
- Data was collected by the investigators and confidentiality was maintained during the data collection process.

Statistical Evaluation of Data:

Descriptive statistical analysis has been carried out in the present study. Data are presented as mean± standard deviation (SD) and as frequency distribution. The statistical analysis was performed using the IBM SPSS Data Analysis Version 22.0 for windows and Graph Pad Prism 9 (La Jolla, CA, USA) has been used to generate graphs and Microsoft Excel for tables.

III.   RESULTS

A total number of 231 responses were recorded, where the questionnaire was designed to assess the Knowledge, Attitude and Practices of Antibiotics use, misuse and resistance among college students of selected SJM Institutes. The objectives of the study were to assess the Knowledge, Attitude and Practices of college students towards the antibiotics use, misuse and resistance. Therefore, the following are the study results based on the objectives of the study.

3.1 Age wise Distribution
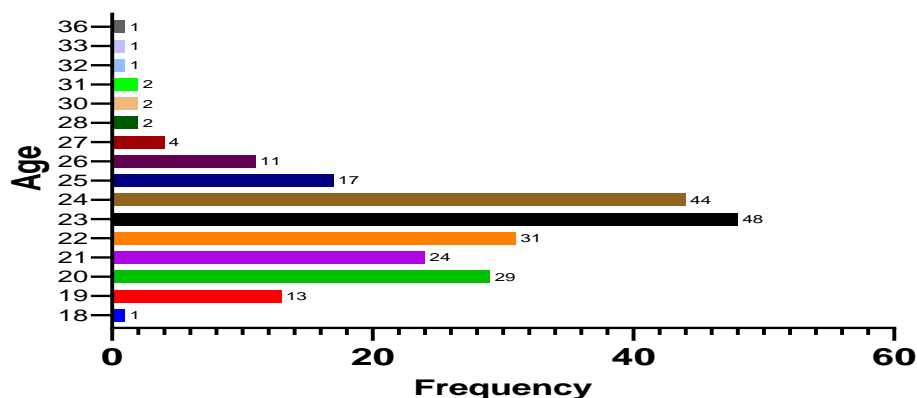The mean age of the study population was 22.9 ± 2.57. The results are graphically represented in Figure no.1

Figure no.1 Details of Age Distribution

3.2 Gender wise Distribution
Out of total number of participants 45 (19.5%) were males and 186 (80.5%) were females. The results are shown graphically in Figure no.2.
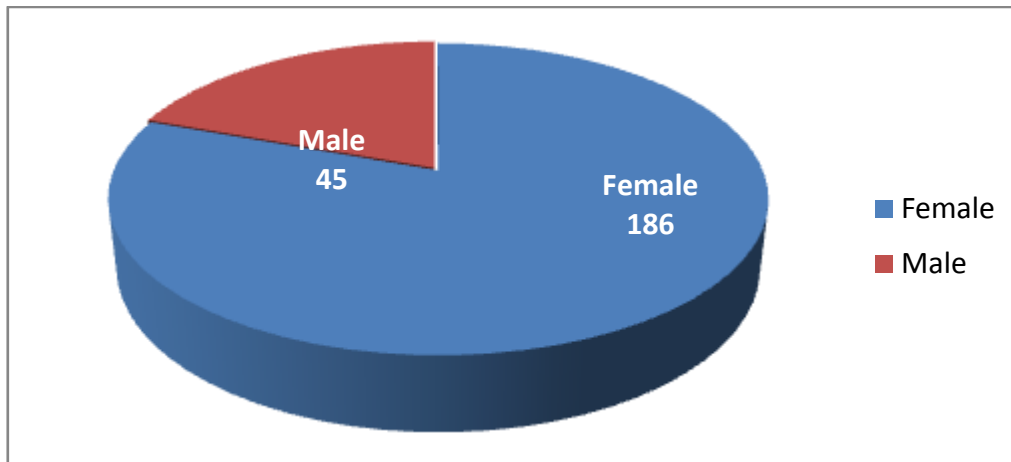
Figure no.2. Details of Gender Distribution

3.3 Course wise Distribution

Out of 231 participants, 77 (33.3%) were Pharmacy students, 57 (24.7%) were Dental (BDS) students, 54 (23.4%) were Nursing students and 43 (18.6%) were Medical (MBBS) students. The results are graphically represented in Figure no.3.
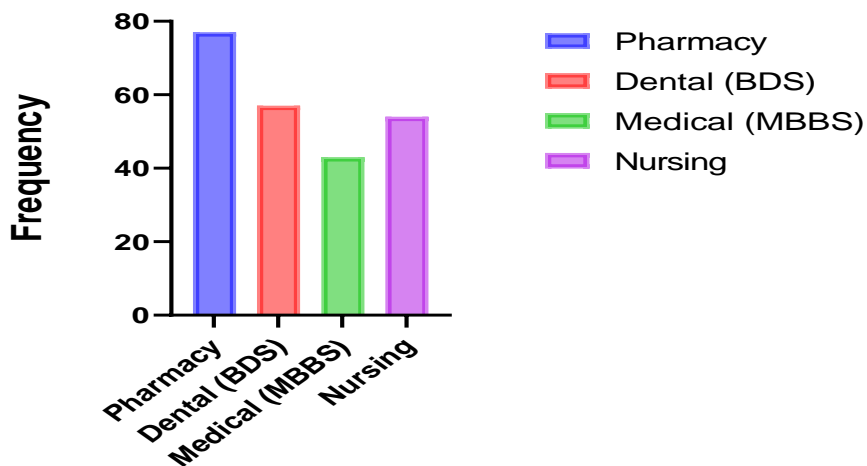

Figure no.3. Details of Course Distribution

3.4 Questionnaire Assessment
3.4.1 Knowledge Based Questions

To assess the knowledge of the participants regarding antibiotic usage and antibiotic resistance a self designed questionnaire containing 10 questions were given. Totally 2310 responses were recorded for 10 questions, out of which only 1465 (63.4%) responses were correct and rest 845 (36.5%) responses were incorrect. The results are depicted in Table no.1.

Table no.1. Responses for Knowledge Based Questions

Sl no	Questions	No. of correct responses	No. of incorrect responses
Q1	What are the different sources from which antibiotics can be obtained?	146	85
Q2	What do antibiotics treat among the following conditions?	164	67
Q3	What are the life threatening side effects of antibiotics?	124	107
Q4	Do antibiotics distinguish between	104	127

	beneficial and harmful bacteria?		
Q5	Is it considered safe to all antibiotics during pregnancy?	189	42
Q6	What are the common causes of antibiotic resistance?	101	130
Q7	What are the multidrug resistant bacteria informally called?	153	78
Q8	Do a resistant bacteria spread from animals to humans?	138	93
Q9	What are the spreading routes for resistant bacteria?	182	49
Q10	Which of the following would most likely contribute to the development of super infections?	164	67
Total		**1465**	**845**

3.4.1.1 Knowledge Assessment
Distribution of mean scores of Knowledge assessment (Total score is 10)

The mean scores were analysed using suitable statistical parameters like mean, standard deviation and Chi-square test to check the significance of result comparing with p value (0.000). In this study the result shows that the mean values for Pharmacy students were 6.53, for Nursing students 5.30, for Dental students 6.42 and for 7.35 for Medical students. Standard deviation values were 1.984, 2.328, 1.463, and 1.631 for Pharmacy, Nursing, Dental and Medical students respectively and the p value was 0.000 (extremely significant) for all the study participants as tabulated in Table no.2.

Table no.2. Distribution of mean scores of knowledge assessment

Course	Mean scores	Standard Deviation
Pharmacy	6.53	1.984
Nursing	5.30	2.328
Dental	6.42	1.463
Medical	7.35	1.631

Relationship between the course of study and level of knowledge on antibiotics use and resistance.

The results were significant with a Chi-square of 68.468 and a P value of 0.000. This meant that there was a significant difference in knowledge about antibiotics use and resistance and course of study. The Medical students were more knowledgeable about antibiotics use and resistance when compared to other students included in the study. The results are shown in Table no.3.

Table no.3. Chi-Square test

Test	Value	Df	P value, Sig
Pearson chi-square	68.468	27	0.000

3.4.2 Attitude Based Questions
To assess attitude of the participants regarding antibiotic usage and antibiotic resistance a self designed questionnaire containing 10 questions were given and the responses were recorded. The results are shown in Table no.4.

Table no.4. Responses for Attitude Based Questions

Sl no	Questions	Responses		
		Agree	Disagree	Uncertain
Q1	Do you agree that antibiotics should be prescribed for all types of infections?	49	154	28
Q2	Do you think that more expensive antibiotics are more effective?	28	168	35
Q3	Do you think that we should be more concerned regarding antibiotic consumption?	201	12	18
Q4	Do you think that physician always prescribe antibiotics unnecessarily?	99	93	39
Q5	Do you think self medication promote antibiotic resistance?	152	61	18
Q6	Is it necessary to get more education about antibiotics?	213	11	7
Q7	Is there a need to establish a course on the rational use of antibiotics?	193	15	23
Q8	Do you think broad spectrum antibiotics are better than narrow spectrum antibiotics?	93	72	66
Q9	Do you think antibiotics usage disturbs the gut flora and cause diarrhoea?	152	31	48
Q10	Do you think that overuse of antibiotic in food production is also contributing to increase drug resistance?	117	27	87

3.4.2.1 Attitude Assessment
Distribution of mean scores of Attitude Assessment (Total score is 10)
The scores of the test were analysed using suitable statistical parameters like mean, standard deviation and Chi-square test to check the significance of result comparing with p value

(0.000). In this study the result shows that the mean values for Pharmacy students were 6.53, for Nursing students 5.67, for Dental students 6.89 and 7.28 for Medical students. Standard deviation values were 1.767, 1.923, 1.819, and 1.723 for Pharmacy, Nursing, Dental and Medical students respectively as tabulated in Table no.5.

Table no.5. Distribution of mean scores of Attitude Assessment

Course	Mean scores	Standard Deviation
Pharmacy	6.53	1.767
Nursing	5.67	1.923
Dental	6.89	1.819
Medical	7.28	1.723

Relationship between the course of study and their Attitude towards antibiotics use and misuse.
The results were significant with a Chi-square test of 45.122 and a P value of 0.038. This meant that there was a significant difference in

attitude on antibiotics use and misuse with course of study. Medical students had a better attitude towards antibiotics use when compared to other students included in the study. The results are shown in Table no.6.

Table no.6. Chi-Square test

Test	Value	df	P value, Sig
Pearson chi-square	45.122	30	0.038

3.4.3 Practice Based Questions

To assess participants practice regarding antibiotic usage and antibiotic resistance a self designed questionnaire containing 5 questions were given and the responses were recorded. The results are shown in Table no.7, 8 &9.

Q1: How do you generally take antibiotics?

Out of 231 responses majority of the participants 202 (87.4%) answered that they would take antibiotics by Physician's prescription. The results are shown in Table no.7.

Table no.7. Response given by the participants to question: How do you generally take antibiotics?

Response	Number of participants	Percentage (%)
According to previous prescription	2	0.9
Physician's prescription	202	87.4
Self-medication	13	5.6
Suggested by friends	5	2.2
Suggested by pharmacist	9	3.9
Total	231	100.0

Q2. Do you fail to complete the course of antibiotic? If yes, What are the causes of incomplete medication?

Out of 231 responses majority of the participants 137 (59.3%) answered No. The results are shown in Table no.8.

Table no.8. Response given by the participants to question: Do you fail to complete the course of antibiotic? If yes, what are the causes of incomplete medication?

Response	Number of participants	Percentage (%)
Forget to take medicine properly	19	8.2
No, I complete my course of antibiotics	137	59.3
Stop taking antibiotics when I face allergic reactions	26	11.3
Stop taking when I feel better	43	18.6
Usually do not complete the course of antibiotic	6	2.6
Total	231	100.0

Table no.9. Response given by participants to knowledge based questions

Sl no	Questions	Responses		
		Yes	No	May be
Q1	Do you give your antibiotics to friends/family when they get sick?	82	149	-

| Q2 | Do you save the remaining antibiotic for further use? | 63 | 127 | 41 |
| Q3 | Do you check the expiry date of antibiotic before using it? | 219 | 4 | 8 |

3.4.3.1 Practice Assessment
Distribution of mean scores of Practices Assessment (Total score is 5)
     The scores of the test were analysed using suitable statistical parameters like mean, standard deviation and Chi-square test to check the significance of result comparing with p value (0.000). In this study the result shows that the mean values for Pharmacy students was 3.95, for Nursing students 3.35, for Dental students 3.28 and for 3.77 for Medical students. Standard deviation values were 1.245, 1.348, 1.236, and 1.020 for Pharmacy, Nursing, Dental and Medical students respectively and the p value was 0.000 (extremely significant) for all the study participants as tabulated in Table no.10.

Table no.10. Distribution of mean scores of Practices Assessment

Course	Mean scores	Standard Deviation
Pharmacy	3.95	1.245
Nursing	3.35	1.348
Dental	3.28	1.236
Medical	3.77	1.020

Relationship between the course of study and their practices on antibiotics use.
     The results were significant with a Chi-square of 40.845 and a P value of 0.000. This meant that there was a significant difference in practices about antibiotics use with course of study. The Pharmacy students had better practices towards antibiotics use when compared to other students included in the study. The results are shown in Table no.11.

Table no. 11. Chi-Square test

Test	Value	df	P value, Sig
Pearson chi-square	40.845	15	0.000

IV. DISCUSSION

     The Emergence of Bacterial strains resistant to antimicrobial agents presents a growing concern worldwide. Among other factors, the irrational use of antibiotics has contributed to the progressive loss of bacterial sensitivity to antibiotics and spreading of resistant strains of bacteria, with substantial clinical and economic impact.

     The clinical effectiveness of antibiotics depends partially on their correct use, depending on patients, physicians and retailers. Physician's decisions may be influenced by several factors such as the lack of correct information on indications for antibiotic use and pressure from patients and families. Patient factors relating to incorrect antibiotic use include self-medication, sharing medication with other people, not taking a full course of treatment and keeping part of the course for another occasion [16].

     The present study was a questionnaire based prospective observational study which aimed to assess the knowledge, attitude and practices of antibiotics use, misuse and resistance among the students of Pharmacy, Dental, Medical and Nursing Colleges of SJM Institutes. A total of 231 healthcare students from these courses were enrolled out of which 77 were from pharmacy, 57 from dental, 43 from medical and 54 from nursing students.

     In this study, when asked about the knowledge of antibiotics usage, majority (81.8%) of participants responded that antibiotics are not safe to use during pregnancy and breast feeding, while only 10.4% of participants had a wrong idea regarding its safe usage and about 7.8% participants had no knowledge. In a similar study conducted by Al-Shibani N et al the levels of knowledge regarding the safe usage of antibiotics during pregnancy and breast feeding were relatively lower when compared to the current

study which was about 61.6% and 55.8% respectively.

Nearly 59.7% participants in this study knew that resistant bacteria spread from animals to humans, but a small proportion (15.2%) had poor knowledge of it and 25.1% were not even aware. In an observation made in a study conducted among students of International University of Africa by Awad MM et al wherein the level of knowledge in only 37.4% participants were found to be satisfactory which was much lower than the current study.

Self-medication holds key to the development of antibiotic resistance. In a study conducted by Shaik T et al the participants had a mixed attitude towards the rational use of antibiotics. On one hand they thought that self-medication promotes antibiotic resistance and on the other hand they also thought that it can be prescribed for all types of infections irrespective of etiology. This was contrasting to the current study, in which the participants had a better attitude i.e about 65.8% participants accepted that self-medication promotes antibiotic resistance and also a majority of 66.7% participants disagreed that antibiotics should be prescribed for all types of infections.

In the present study, on assessing the participant's practice relating to saving the remaining antibiotics for further use, 55% disagreed and 27.3% agreed. These results were comparable to a study done by Asharani N et al where 73.3% participants disagreed to the above statement.

It is very encouraging to note that nearly 94.8% participants checked expiry date of antibiotics before using it. Similar perception was also observed among participants of the study conducted by Mahajan M et al where it was surprisingly noted that all (100%) participants checked expiry date of antibiotics before using it.

Overall the result of the study showed that, Medical students had the best knowledge and attitude towards antibiotics usage and resistance when compared to other students but, inspite of the satisfactory levels of knowledge and attitude, the practices of Pharmacy students were best among the others. The study also revealed a significant gap in the level of knowledge, attitude and practices on antibiotics usage and resistance between Dental and Nursing students which should be taken into note and improved.

V.   CONCLUSION

The study concluded that:

- The Medical students had better level of knowledge (mean score = 7.35) about antibiotics use and resistance compared to other students included in the study, while the least level of knowledge were observed among Nursing students (5.30).
- The Medical students had better attitude (7.28) towards antibiotics use compared to other students included in the study, while the least level of attitude were observed among Nursing students (5.67).
- The Pharmacy students had better practices (3.95) towards antibiotics use compared to other students included in the study, while the least level of practices were observed among Dental students (3.28).

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REFERENCES

[1]. Sunusi LS, Awad MM, Hassan NM, Isa CA. Assessment of Knowledge and Attitude toward Antibiotic use and Resistance among students of International University of Africa, Medical complex, Sudan. Global Drugs and Therapeutics 2019;4:1-6.

[2]. Agarwal S, Yewale VN, Dharmapalan D. Antibiotics Use and Misuse in Children: A knowledge, attitude and practice survey of Parents in India. Journal of Clinical and Diagnostic Research 2015;9(11):21-24.

[3]. Hutchings M, Truman AW, Wilkinson B. Antibiotics: past, present and future. Current opinion in Microbiology 2019;51:72-80.

[4]. Jairoun A, Hassan N, Ali A, Jairoun O, Shahwan M. Knowledge, attitude and practice of antibiotic use among university students: a cross sectional study in UAE. BMC Public Health 2019;19:1-8.

[5]. Rajalingam B, Alex AS, Godwin A, Cherian C, Cyriac C. Assessment of rational use of antibiotics in a private tertiary care teaching Hospital. Indian Journal of Pharmacy Practice 2016;9(1):14-18.

[6]. Asharani N, Dhanalakshmi TA, Shyamanth M. Knowledge, attitude, and practices toward antibiotic usage and antibiotic resistance among Medical students and interns: A cross-sectional study. Journal of Medical Sciences and Health 2020;6(1):12-17.

[7]. Bhardwaj K, Shenoy SM, Baliga S, Unnikrishnan B, Baliga BS. Knowledge, attitude, and practices related to antibiotic use and resistance among the general public of coastal South Karnataka, India- A cross-sectional survey. Clinical Epidemiology and Global Health 2021;11:1-7.

[8]. Mir SA. A cross-sectional study on knowledge, attitude, and behavior related to antibiotic use among undergraduate medical students in tertiary care medical college, Kashmir. International Journal of Basic & Clinical Pharmacology2015;4(6):1156-1162.

[9]. Limaye D. Knowledge, attitude and practices of antibiotic usage among students from Mumbai University. International Journal of Research in Medical Sciences 2018;6(6):1908-1912.

[10]. Zulu A, Matafwali SK, Banda M, Mudenda S. Assessment of knowledge, attitude and practices on antibiotic resistance among undergraduate medical students in the school of medicine at the university of Zambia. International Journal of Basic & Clinical Pharmacology 2020;9(2):263-270.

[11]. Haque M. Antibiotic use: A cross-sectional study evaluating the understanding, usage and perspectives of Medical students and Pathfinders of a public defence university in Malaysia. Antibiotics 2019;8:1-21.

[12]. Kanneppady SS, Oo AM, Lwin OM, Abed AA, Kanneppady SK. Knowledge, Attitude, and Awareness of Antibiotic Resistance among Medical Students. Archives of Medicine and Health Sciences 2019;7(1):57-60.

[13]. Dutt HK, Sarkhil MZ, Hasseb A, Singh G. A comparative knowledge, attitude, and practice study of antimicrobial use, self-medication and antimicrobial resistance among final year students of MBBS, BDS, and BSc Nursing at a tertiary care hospital at Kannur. National Journal of Physiology, Pharmacy and Pharmacology 2018;8(9):1305-1311.

[14]. Mittal AK, Bhardwaj R, Mishra P, Rajput SK. Antimicrobials Misuse/ Overuse: Adverse Effect, Mechanism, Challenges and Strategies in Combat Resistance. The Open Biotechnology Journal 2020;14:107-112.

[15]. Chukwu EE.A national survey of public awareness of antimicrobial resistance in Nigeria. Antimicrobial Resistance and Infection Control 2020;9:1-1.

[16]. Mahajan M, Dudhgaonkar S, Deshmukh S. A questionnaire based survey on the knowledge, attitude and practices about antimicrobial resistance and usage among the second year MBBS students of a teaching tertiary care hospital in Central India. International Journal of Pharmacological Research 2014;4(4):175-179.