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Assessment of Knowledge, Attitude, and Practice (KAP) of Antibiotic Use among Medical Students in University of Khartoum 2022: A Cross-Sectional Study

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Abstract: Background: *In many countries, antibiotic resistance has become a sign of medication misuse. Recognizing the problem and its potentially disastrous consequences is the first step toward halting its progression.* ***Objectives:*** *To assess medical students' knowledge, attitudes, and practices regarding antibiotic use at the University of Khartoum.* ***Subjects and Method:*** *A descriptive cross-sectional study of 354 medical students at the University of Khartoum. A self-administered questionnaire was used to assess antibiotic knowledge, attitude, and practice. The questionnaire was divided into four sections: demographics, knowledge, attitudes, and practice. The qualitative variable was analysed using descriptive analysis, while the quantitative variable was summarized using (mean± Standard deviation) (SD). The Chi-square test was used in terms of the proportions to compare differences in qualitative variables. Likewise, the T-test for unpaired students compares the average differences in quantitative variables between first and final-year students and recorded along with ($p \leq 0.05$) statistically significant.* ***Results:*** *Three hundred fifty-four students were recruited for the analysis. Students performed best in terms of knowledge, followed by attitude and practice. The mean knowledge score was 6.45 (80.6%) [95% CI (6.29, 6.61)] compared to the attitude score of 8.81 (80.1%) [95% CI (8.63, 8.99)] and the practice score of 5.79 (64.3%) [95% CI (5.59, 5.99)]. The findings indicate that final-year students outperformed first-year students in all three sections [($p<0.000$) ($p=0.000$) ($p=0.008$) for knowledge, attitude, and practice, consecutively].* ***Conclusion:*** *This study indicates that the medical curriculum improves the knowledge and attitude of medical students toward antibiotic use, and promotes their attention to the antibiotic resistance that may emerge from the irrational misuse of antibiotics. Regardless, the students' practice was significantly poor and they consumed antibiotics without a doctor's prescription and for non-bacterial illnesses.*

Keywords: *Antibiotic use, Attitude, Knowledge, Practice, Medical Students*

Introduction

Antibiotics are drugs that either kill or suppress the activities of microorganisms. [1] For a long time, antibiotics were referred to as "magic bullets," yet they were not always magical enough to withstand certain major adverse effects. [2]Antibiotic abuse can occur through either prescription noncompliance or self-medication. [1] Misuse will result not only in the creation of resistant bacterial strains but also in severe effects and may impose a financial burden on the public health system. [2] In terms of economic impact, illnesses caused by resistant bacteria need more precise and expensive drugs to cure. [3] It is predicted that 25,000 people die each year in Europe because of resistant bacterial strains, with an economic burden of 1.5 billion euros. [4] Antimicrobial resistance (AMR) is a serious public health issue. [5] In 2011, the World Health Organization (WHO) designated World Health Day as "Combat Antimicrobial Resistance: No Action Today, No Cure Tomorrow." [1] Unnecessary antibiotic usage raises the risk of AMR and lowers the efficiency of antibiotics used to treat bacterial illnesses. [5] Recognizing antimicrobial resistance, its severity, and its relevance is the first step in slowing its spread. Medical students (future prescribers) may help combat antibiotic resistance by boosting patient awareness and understanding, as well as

educating the community about safe antibiotic treatment practices. [6]Despite the importance of medical students in fighting off AMR, the lack of adequate training during their undergraduate and postgraduate years may hamper their ability to undertake these tasks confidently. [6] One of the approaches that are commonly suggested is to undertake instructional and educational campaigns among medical students about antibiotic resistance, its dangerous consequences, and the steps that, can limit its development and spread. However, before planning any training program or educational activity, we have to be aware of the baseline KAP of the target population, which will assist us in devising a suitable approach and an effective curriculum. [6]Concerning the issue of antibiotic use, the brisk manufacture of novel antimicrobial drugs was limited until 2003. [4] The rise of resistant bacterial species has become a global issue. Multiple causes contribute to the emergence of these strains, which are shared by physicians and the public. In 2014, the World Health Organization (WHO) revealed that resistant bacteria had spread around the world, causing diseases, and only 33 of the 133 nations surveyed had an action plan in place to combat antibiotic resistance. The number of people dying from multi-drug resistant bacteria is predicted to be 23,000 in the United States and 25,000 in the European Union per year. In Asia, these figures more than tripled, reaching roughly 96,000 fatalities per year. [7] Antibiotic resistance is a developing issue in Sudan (as it is in other nations). Several studies retype point to resistant bacterial strains in urinary tract infections and diarrheal disorders. [8]Antibiotic resistance is a serious concern in Sudan today and future, and reports of resistance are on the rise. Few types of research have been conducted to assess (KAP) of antibiotic usage among medical students at (Uof K), .The baseline data about this important population has been reduced. Despite the fact that it is important to raise awareness of this population about the proper use of antibiotics. Moreover, the foundation for improving antibiotic handling is of precious value for human health, thereby preventing the negative consequences of the misuse of these valuable drugs. The aim of the study is to assess (Kap) of antibiotics the usage and adverse consequences of misuse of it. The specific objective is to determine the percentages of antibiotic misuse among the study population and to compare the differences in antibiotic use between the first-year students and the final years' medical students at (U of K).

Methodology:

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Study Design: This study utilizes a descriptive cross-sectional facility based study design

Study Area: The study was conducted at the University of Khartoum Faculty Of Medicine. The University of Khartoum is a multi-campus, co-educational, public university located in the Khartoum state, was founded in 1902. The Faculty of medicine is one of these campuses; it features several institutes, academic units, and research centers including Myeloma Research Center, Soba University Hospital, and Saad Abualila Hospital, Dr. Salma Dialysis center, Institute of Endemic Diseases and, U of K publishing house. The university has 16,800 undergraduate students in 23 faculties, schools and, graduate research institutes. The annual admission rate is 3,500 students. There are 6,000 graduate students (graduate diploma, MSc, and, Ph.D.). It has 850 teaching staff (faculty), 20 research fellows, and, 500 teaching assistants. The Faculty of Medicine has around 1800 medical students who graduate after completing six years of the curriculum. The curriculum is composed of three years of basic clinical sciences followed by three years of clinical sciences.

Study Population: All medical students at the University of Khartoum (U of K).

Inclusion criteria: all medical students currently studying at the University of Khartoum at the time of the study.

Exclusion criteria: foreigner students who study at the Faculty of Medicine, University Of Khartoum (Uof K) at the time of study.

Sample Size: For the estimation of sample size, it will be calculated using the equation:

Equation

Sample size n = N/ 1+ N(d2)

n : the sample size, N : population size = 2334,d : margin of error = 0.05

Sample Technique: Stratified random sampling: proportion of each year was calculated in relation to the total sample size.

Data Collection: A structured self-administered questionnaire was used for data collection.

Data Management and Analysis:

The statistical package for social sciences (SPSS) version 25 were used for data analysis. All data were double checked for accuracy. Frequency distribution were examined to check for outliers and normality of the distribution. Mean and standard deviations for continuous variable, numbers, and percentages for categorical variables. Chi sChi-square was used to examine the differences in categorical variables. Unpaired t test was used to determine the difference between the means of knowledge, attitude and score for the first and final years.

Study Variables:

Socio-demographic variables: age, sex and study year, and variables regarding the knowledge, the attitude, and the practice of antibiotic use (KAP).

Ethical Considerations:

Approval was obtained from community department, faculty of medicine, University of Khartoum. The researcher respected the autonomy and confidentiality of respondents. Verbal consent was obtained from the respondents after informing them about the purpose and objectives of this study

Results:

Characteristic of the Study Population:

Three hundred fifty four (354) students participated in the present study. All participant were completed the entire questionnaire. The distribution among student was first year (batch 98) 14.7%, second year (batch 97) 14.4%, second year (batch 96) 13.8%, third year (batch 95) 13.8%, fourth year (batch 94) 14.1%, fifth year (batch 93) 15.3%, sixth year (Batch 92) 13.8 %.(see table 1). The males were 40.7%, while the females were 59.3 %.(Fig: 1).The mean age of the participants was 21.6, with minimum age of 18 and maximum age of 29.

Table 1**:** shows the number and percentages of the students from each study year in the study sample, University of Khartoum 2022.

study level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	sixth year (batch 92)	49	13.8	13.8	13.8
	fifth year (batch 93)	54	15.3	15.3	29.1
	fourth year (batch 94)	50	14.1	14.1	43.2
	third year (batch 95)	49	13.8	13.8	57.1
	second year (batch 96)	49	13.8	13.8	70.9
	second year (batch 97)	51	14.4	14.4	85.3
	first year (batch 98)	52	14.7	14.7	100.0
	Total	354	100.0	100.0	

Knowledge Level of Antibiotic Use:

The knowledge section contains 8 questions, each right answer gets 1, and the wrong answer gets 0. The mean knowledge score was 6.45 (80.6%) (Maximum possible score was 8)[95% CI (6.29, 6.61)]. Knowledge level, we consider having 7 or more in the knowledge section as “good knowledge”, and having a knowledge score of 6 or less as “poor knowledge”. Then we categorized the medical students into two categories, based on completing the third year of medical school, “first years" and “final years”. The "first years" group includes first, second, and third-year medical students. The "final years" group includes fourth, fifth, and sixth-year medical students. Around 97.7% of the study population know there are beneficial bacteria that are good for our health. Whereas, 93.8% of the study participants believed that antibiotics are used for the treatment of bacterial infections. While 12.4%supposed that antibiotics are used for the treatment of viral infections. However, 9% think that

antibiotics have the same effects as anti-inflammatory drugs. A percent of 92.4% participants understood what they heard about antibiotic resistance, and 92.4% think that the more frequently use of antibiotics the more difficult to treat bacterial infections in the future. About 35.3% consider that antibiotics will speed up the recovery of the common cold. While 87.3%, agree on continuing antibiotics even when the symptoms are relieved. The "final years" group mean knowledge score was 7.33 (91.6%), which was higher than the "first years" group. The mean knowledge score was 5.78 (72.3%) (p <0.000). For knowledge questions in the study questionnaire, the final year's group scores higher percentages when compared to the first year's group (Fig: 2 and Table: 2).illustrate the knowledge question in first and final groups .The chi (X2)square test to calculate the p value for each question to determine the statically significant results, University of Khartoum 2022.

Table 2: shows each knowledge question, with comparing the first and final year's percentages for each question, and using the chi square test to calculate the p value for each question to determine the statically significant results, University of Khartoum 2022.

Questions(correct answer)	**First-years students**	Final-years students	**X2**	**P**
1: Are there good bacteria in human body which are good for our health (YES)	195(97.0%)	151(98.7%)	1.175	0.278
2: Can antibiotics be used to cure infections caused by bacteria (YES)	181(90.0%)	151(98.7)	11.134	0.001
3: Can antibiotics be used to cure infections caused by viruses (NO)	127(63.2%)	141(92.2%)	39.650	0.000
4: Do antibiotics have the same effect as anti-inflammatory drugs(NO)	69(34.3%)	122(79.7%)	72.107	0.000
5: Do you heard of resistant bacteria (YES)	174(86.6%)	153(100%)	22.249	0.000
6: The more frequently people use antibiotics, the more difficult it will be to treat bacterial infections in the future (YES)	177(88.1%)	150(98.0%)	12.280	0.000
7: Do you think the use of antibiotics will speed up the recovery of common cold, cough (NO)	74(36.8%)	110(71.9%)	42.828	0.000
8: Once the symptoms are relieved, one should stop using antibiotics (NO)	165(82.1%)	144(94.1%)	11.327	0.001

Table 3**:** shows each attitude question, with comparing the first and final years' percentages for each question, and using the chi square test to calculate the p value for each question to determine the statically significant results in University of Khartoum 2022.

Questions(correct answer)	First-years	Final-years	X2	P
1. Is there abuse of antibiotics at present(YES)	189(94.0%)	149(97.4%)	2.267	0.132
2. Do you think antibiotic overuse in Sudan is a serious problem(YES)	193(96.0%)	152(99.3%)	3.880	0.049
3. Do you think the abuse of antibiotics is the main cause of bacterial resistance (YES)	180(89.6%)	149(97.4%)	8.122	0.004
4. Do you think the antibiotic resistance affect you and your family(YES)	161(80.1%)	140(91.5%)	8.875	0.003
5. Do you prefer to use antibiotics when you have sore throat(NO)	104(51.7%)	90(58.8%)	1.759	0.185
6. Do you prefer to use antibiotics when you have cough(NO)	135(67.2%)	120(78.4%)	5.475	0.019
7. Do you prefer to use antibiotics when you have runny nose(NO)	161(80.1%)	144(94.1%)	14.314	0.000
8. Do you prefer to use antibiotics when you have common cold(NO)	152(75.6%)	140(91.5%)	15.167	0.000
9. Do you prefer to use antibiotics when you have fever(NO)	101(50.2%)	102(66.7%)	9.573	0.002
10. Do you prefer to use antibiotics when you have diarrhoea (NO)	113(56.2%)	97(63.4%)	1.856	0.173
11. Do you think it's necessary to get more information about antibiotic resistance(YES)	198(98.5%)	150(98.0%)	0.114	0.735

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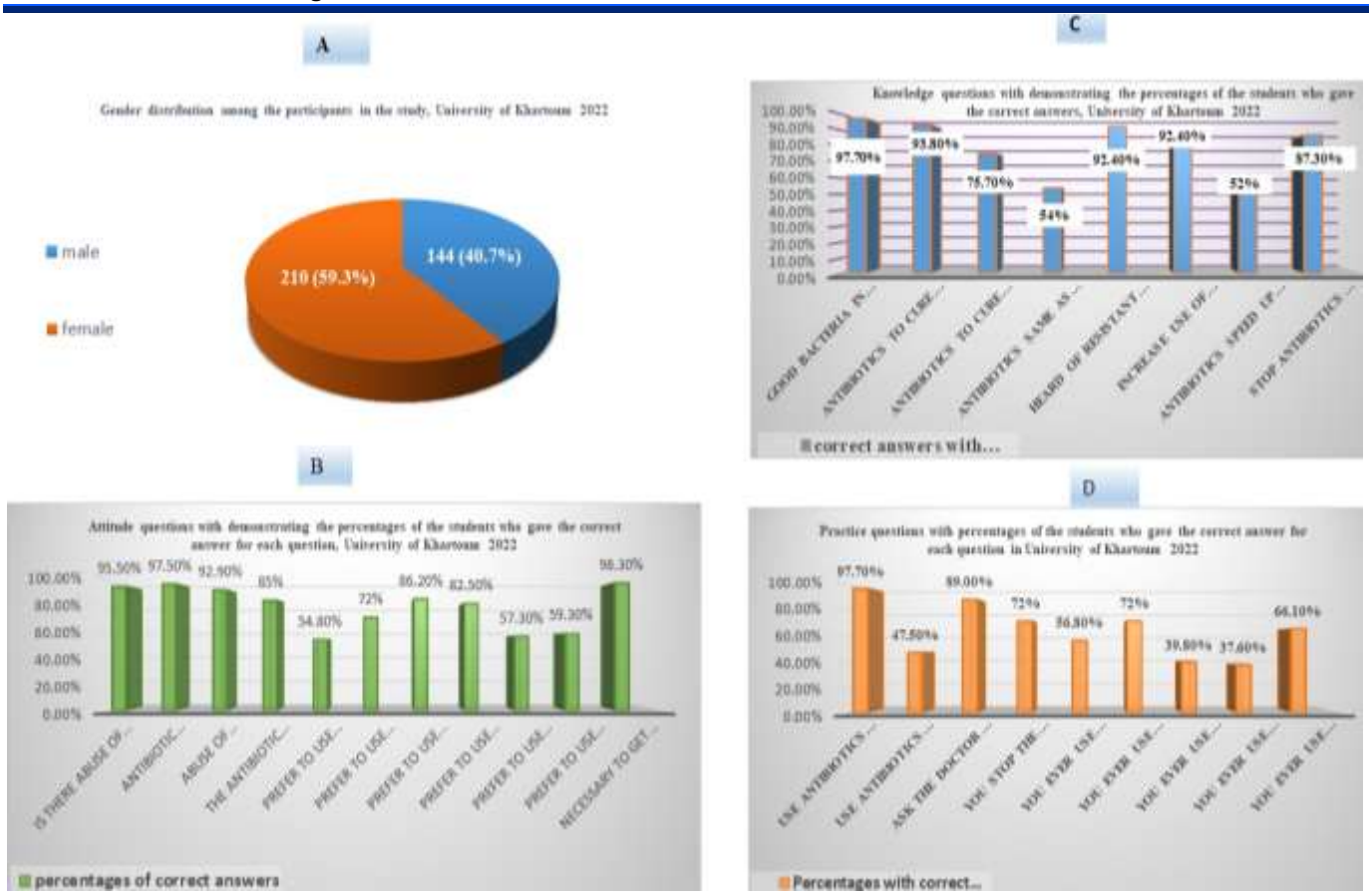

Fig. 1: A: Illustrates gender distribution among the participants in the study, University of Khartoum 2022

Fig. 1: B: demonstrates the knowledge questions, demonstrating the percentages of the students who gave the correct answer for each question, University of Khartoum 2022.

Fig. 1: C: shows attitude questions, indicating the percentages of the students who gave the correct answer for each question, University of Khartoum 2022.

Fig. 1: C: shows practice questions, signifying the percentages of the students who give the correct answer for each question, University of Khartoum 2022.

Attitude Level of Antibiotic Use:

The attitude section contains 11 questions, each right answer gets 1, and the wrong answer gets 0. The maximum possible score is 11. The mean attitude score was 8.81(80.1%) (Maximum possible score of 11) [95% CI (8.63, 8.99)]. For attitude level, we consider having 10 or more in the attitude section as "good attitude", and having an attitude score of nine or less as "poor attitude". About 95.5% agree on the presence of antibiotic abuse at present. However, 97.5% agree that antibiobuse is a serious problem in Sudan. Round 92.9%of students' believed that the abuse of antibiotics is the main cause of bacterial resistance. 85% of students think that antibiotic resistance affects families. The students' attitude toward antibiotic use and their preference to use it for different diseases was as follows: diarrhoea (40.7%), sore throat (45.2%), fever (42.7%), cough (28.0%), common cold (17.5%) and runny nose (13.8%). About 98.3% of the students think that there is a need to get more information about antibiotic resistance. The "final years" group m group attitude score was 9.37(85.2%), while the "first years" group attitude score was 8.39(76.2%) (p=0.000). Regarding the attitude questions, the final years' group scored higher in all questions with exception of the 11th question in which the first years' group scored higher (Fig: 3 and Table: 3).

Practice Level of Antibiotic Use:

The practice section contains nine questions. Each right answer gets one, and each wrong answer gets zero. The maximum possible score is 9. The mean practice score was 5.79 (64.3%) [95% CI (5.59, 5.99)]. For practice level, we consider having a practice

score of 7 or more, as "good practice", and having a practice score of 6 or less as "poor practice".

About 97.7% said that they use antibiotics when prescribed by a doctor. While 52.2% admit, they use antibiotics without a doctor's prescription and instructions. 11% declared that they ask doctors to prescribe antibiotics even if they do not need them. Another 28% confessed that they stop using antibiotics when the symptoms were relieved. The student's practice regarding the use of antibiotics for treating different diseases was highlighted as follows: sore throat (60.2%), cough with fever (62.4%), only fever (43.2%), congested nose with headache (33,.9%), and common cold (28%).

The "final years" group mean practice score was 6.09(67.7%), while the "first years" group mean practice score was 5.55(61.7%) (p=0.008). The first year's group scored higher on three questions (P2, P3, and P7). While the final year's group scored higher in all the remaining

Table 4: shows each practice question, with comparing the first and final year's percentages for each question, and using the chi square test to calculate the p value for each question to determine the statically significant results, University of Khartoum 2022.

Questions(correct answer)	First years students	Final years students	X2	P
1.Do you use antibiotics when prescribed by doctor(YES)	195(97.0%)	151(98.7%)	1.175	0.278
2.Do you use antibiotics without doctor's prescription(NO)	100(49.8%)	68(44.4%)	0.981	0.322
3. Do you ask the doctor to prescribe antibiotics for you even if you don't need them(NO)	179(89.1%)	136(89.9%)	0.002	0.961
4.Do you stop the use of antibiotics as soon as the complaint relieved(NO)	133(66.2%)	122(79.7%)	7.940	0.005
5. Do you ever use the antibiotics for fever(NO)	102(50.7%)	99(64.7%)	6.898	0.009
6. Do you ever use the antibiotics for common cold(NO)	131(65.2%)	124(81%)	10.863	0.001
7. Do you ever use the antibiotics for sore throat(NO)	83(41.3%)	58(37.9%)	0.415	0.519
8. Do you ever use the antibiotics for cough with fever(NO)	67(33.3%)	66(43.1%)	3.560	0.059
9. Do you ever use the antibiotics for congested nose with headache(NO)	126(62.7%)	108(70.6%)	2.421	0.120

Discussion

This is a cross-sectional facility-based study conducted to assess the knowledge, attitude, and practice of antibiotic use among medical students in the University of Khartoum Faculty of medicine in 2022. A sample of 354 participants chosen by stratified random sampling was studied by a self-administered questionnaire. The study showed that the mean age of the study population is (21.6±2.1591 SD years) and the standard deviation is (2.1591) with a minimum age of 18 and maximum age of 29.The mean knowledge score was 6.45(80.6%) [95% CI (6.29, 6.61)] compared to attitude score, which was 8.81(80.1%) [95% CI (8.63, 8.99)] and 5.79(64.3%) [95% CI (5.59, 5.99)]. On average final years, students score higher than the first years students in every section and this agrees with the results from another research conducted in UAE. [2] For the knowledge section, the final year's group's mean knowledge score was 7.33(91.-6%), while the first year's group's mean knowledge score was 5.78(72.3%) [p<0.000]. This result indicates that the medical school curriculum has a positive impact on the overall knowledge of the students about antibiotic use. For the attitude section, the final year's group's mean attitude score was 9.37(85.2%); while the first year's group's mean attitude score was 8.39(76.2%) [p=0.008]. This result indicates a better attitude as the person progresses through medical school. For the practice section, the final year's group mean practice score was 6.09(67.7%), while the first year's group mean practice score was 5.55(61.7%), this means the knowledge and attitude score of final years students translate into better practice and use of antibiotics. The study results confirmed statistically significant differences in the (KAP) assessment of antibiotic use between the final years and the first years. A percent of (93.8%) out of the study population disclosed that antibiotics are used for the treatment of bacterial infections. This result was higher than in previous studies [9, 11, 12], While 12.4% said antibiotics are used for the treatment of viral infections, although the percentage is lower than previous studies [2, 9, 11, 12], this outcome still shows there is a considerable percentage of medical students are not aware that the antibiotics are not used to treat viral illnesses. Only 9% of participant think that antibiotics have the same effects as anti-inflammatory drugs. In contrast, this consequence is lower than a study conducted in Malaysia. [9] This result is ringing an alarm to highlight this dangerous problem. This result reveal that many students have a misconception about antibiotics regarding pain and inflammation. More than 92% of the students agree with the statement, that frequent use of antibiotics will result in the development of bacterial resistance. These findings go on the same line with the studies conducted in UAE and China [2, 5]. Approximately 35.3% of participant think that antibiotics will speed up the recovery of the common cold. This enigmatic percentage was actually much lower than what was found in previous studies. [2, 11, 12] A gargantuan result shows the extent of misconception in medical students, Despite their medical training about 95.5% agree on the presence of antibiotic abuse at present whereas, and 97.5% agree that antibiotic abuse is a serious problem in Sudan. 92.9% said that the abuse of antibiotics is the main cause of bacterial resistance.

These results share similar to a study conducted in Nepal. [11] Interestingly, these result shows there is widespread awareness about the problem of antibiotic abuse on the global and national scale. The students' attitude toward the usage and preference of antibiotic in different diseases was registered. Diarrhoea (40.7%), sore throat (45.2%), fever (42.7%), cough (28.0%), common cold (17.5%) and runny nose (13.8%). although the common cold and runny nose was the least preferred by the students. A considerable number of students who will likely jump to antibiotics when having these non-bacterial illnesses. About 98.3% of the students think that there is a need to get more information about antibiotic resistance, with similar result reported in other studies [2, 5]. This demonstrate the openness of the students toward further education and awareness programs regarding antibiotic use. About 97.7% said that they use antibiotics when prescribed by doctor. These outcomes are found to be higher than in the study conducted in Nepal study. [11], A good safe antibiotic use practice, but on the other hand, 52.5% admit they use antibiotics without doctor's prescription and instructions, which demonstrate that although most of the students use antibiotics when prescribed by doctor, half of them also use the antibiotics without doctor's prescription, and this shows a major problem and suggest that even with medical knowledge, there is still considerable wrong antibiotic use practice. Another evidence for these wrong practices is the presence of almost 11% of students who pressurized the doctors to prescribe antibiotics even if they did not need them. These results might resort to antibiotics for nothing and increase the risk for developing resistant in bacterial strains by doing so. Furthermore, 28% confessed that they stop using antibiotics when the symptoms relieved, regardless whether they completed the dose or not. This raise many questions about the benefit of the medical knowledge if the student will not use for better safer practice. The evaluation and assessment on practice regarding using antibiotics for different diseases. The students answered the questionnaire. And rank the disease as follows, sore throat (60.2%), cough with fever (62.4%), only fever (43.2%), congested nose with headache (33.9%) and common cold (28%). percentages that almost more than quarter of the students used antibiotics for non-bacterial illnesses, promoting more questions about these reckless practices with much need for further evaluation and assessment.

Conclusion and Recommendations:

The present study concluded that, (KAP) assessment levels of the study population regarding the use of antibiotic was ranking good. Higher levels of (KAP) assessment recorded in the final years when compared with the first years of medical education. The majority of participant knew that antibiotic is used for the treatment of the bacterial infections. However, about (35.4%) think that it also used for the treatment of viral infections. One tenth of the population think that antibiotics have the same effects as anti-inflammatory drugs. While more than, the third (118/354) think that antibiotics can speed up the recovery from common cold. The majority agrees on the statement that there is antibiotic abuse globally and nationally. The bulk of the students think that antibiotic should only be given with doctor's prescription. Nevertheless, common cold and runny nose are known as viral illnesses, 17% and 14% prefer to use antibiotics with these diseases respectively. The practice level of the study population was rather poor when you compare it with the knowledge and attitude levels of the final years of education. The majority said they used antibiotics when prescribed by doctors. More than half (177/354) of the population admit they used antibiotic before without doctor's prescription. Only (11%) admitted they pressurized doctors to prescribe antibiotics for them, even if they do not need them. Almost third of the study population confessed they stopped antibiotics when the symptoms relieved. More than quarter of the study population admitted they used antibiotics before for congested nose and common cold, with more than third used antibiotics when they had only fever. The final year's group practice level was higher than the practice level of the first year's group. The study recommended that we should focus on education about the indications of antibiotics and its usage for the treatment of bacterial infections only, excluding viral infections such as common cold. Start the educational programs about antibiotic use as early as possible, especially for the first years' students. We need to put guidelines for the usage of antibiotics, and ensure that there is a clear policy and laws about the dispensing of antibiotics by pharmacies, by which the antibiotics will only be given according to doctor's prescription. Involve the students in community awareness campaign about antibiotics use, by which it will help them to develop sense of social accountability, and this will definitely lead to improvement in their antibiotic use practice. We should add another course about prescribing antibiotics appropriately for the final years' students, through which it will help them to promote appropriate prescribing when they become future physicians, and this will help us in implementing effective policies regarding antibiotic dispensing control

Limitations of the Study:

The findings of the current study cannot be generalized since the type of a cross sectional study, take in one curriculum and conducted at one medical faculty.

Abbreviation: Knowledge, attitude and practice (KAP), University of Khartoum **(**Uof K), and Antimicrobial resistance (AMR).

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