Assessment of Knowledge, Attitude and Practice of Antibiotic Use and Antibiotic Resistance among the Students of Private Universities in Dhaka, Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Author IHC designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KSBR and MTA managed the analyses of the study. Author IHC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background and Objectives: Antibiotic resistance has become a global encumbrance in the field of medicine. Various factors like antibiotic abuse, overuse or irrational usage of antibiotics, over the counter availability of antibiotics etc., have been put forth as accused leading to antibiotic resistance. The present study aims at evaluating the knowledge, attitude and practice of antibiotic usage and antibiotic resistance among undergraduate students in private universities in Dhaka, Bangladesh.

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Methodology: A cross-sectional, questionnaire-based quantitative survey conducted among undergraduate students in private universities in Dhaka, Bangladesh including 1st year to 4th year from different academic background. The questionnaire comprised of: Demographic data; Knowledge including 17 questions; Attitudes including 16 questions and practices consisting of 8 questions. Majority of the questions were dichotomous (Yes/No type) and some questions were asked using five point Likert scale. SPSS version 22.0 software were used in order to analyze data obtained from respondent's. Association among categorical variable were analyzed with Analysis of variance (ANOVA) followed by post hoc Bonferroni test. Responses were presented using descriptive analysis, with chi-square tests to identify factors associated with Knowledge, Attitude and Practice about antibiotic use and antibiotic resistance and the Spearman's rank order correlation coefficient calculated to examine the relationship between responses to the Knowledge, Attitude and Practice questions.

Results: Total number of students from 1st year to 4th year were 244 who had given voluntary consent and participated in this study willingly. The sample comprised more males (56%) than females (44%), the average age of respondents was 21.9 ± 1.5 years and almost 60% of respondents were from allied health science (Pharmacy, Microbiology, Public health, Botany, Zoology, Biotechnology, Biochemistry etc) background. Respondents had relatively good knowledge about aspects of antibiotic use and antibiotic role other than perception on antibiotic resistance. The concept of antibiotic resistance was well familiar but imperfectly understood.

Statistically significant ($p=0.03$) results have been obtained for the correct responses of knowledge questionnaire. Spearman rank order correlation revealed a positive association between each pair of the knowledge, attitude and practice scores for respondents ($p = < 0.05$). The correlation was good between knowledge-attitudes and attitudes-practices and fair between knowledge-practices.

Conclusion: The study provides baseline evidence about the knowledge, attitudes and practices regarding antibiotic use and antibiotic resistance among the undergraduate students in private universities in Dhaka, Bangladesh including 1st year to 4th year from different academic background. The findings of the study will be useful in designing effective and targeted interventions to decrease misconceptions about antibiotic use and antibiotic resistance and to increase awareness about the risks of overuse or inappropriate use of antibiotics.

1. INTRODUCTION

Antibiotics are the most frequently prescribed medications in modern medicine system. The first antibiotic was named penicillin, discovered accidentally from a mold culture by the scientist Alexander Fleming, Professor of Bacteriology at St. Mary's Hospital in London [1]. As world is getting polluted and due to uncontrolled prescription of antibiotics, the bacteria are getting the upper hand over the human race. It's difficult to say whether it is the improper use of antibiotics or the genetic transformation of bacterial DNA that is responsible for decreased effect of antibiotics [2]. Though world is getting more concerned about the use of antibiotics and laws being formulated to control the use of antibiotics, unfortunately third world countries are still far behind in implementing these laws. That's why the bacterial resistance is much higher in third world countries [3]. At the same time the cost of the antibiotics is far beyond the reach of low-income group of people which is leading to the condition of incomplete antibiotic course. All

these ultimately leading to some specific questions like do we know what is antibiotics, how it works, when to take it? A good number of works had been carried out in different parts of the world, but unfortunately very limited work been done in Bangladesh. It's important to understand the knowledge, attitude, and practice among the students of private universities who are ultimately going to be the future leaders.

For over 60 years, since the invention of first generation of antibiotics starting from small wound infections to diseases like typhoid, infectious diseases all are treated with different class of antibiotics successfully. Modern medical research has also taught about the prophylactic use of antibiotics before any major surgical procedures or before travelling to any endemic region of infectious diseases. But the extreme potential of these antibiotics is making us more dependent on them and unknowingly leading to misuse of these drugs. The general population can play a vital role in alleviating the inappropriate and excessive use of antibiotics.

Thus, it is useful to understand the knowledge, attitudes and practice regarding the use of antibiotics, and to possibly identify any unmet educational needs. Developing and implementing effective strategies are needed to reduce the emergence and spread of antibiotic resistance. This strategies aids in assessing the effects of the applied interventions which is dependent on the collection of appropriate data with regard to the magnitude of the problem and its consequence on the general population. According to the latest WHO data, Romania is one of the states worldwide in which antibiotics are consumed in excess. According to a recent Cult Market Research study, in the previous year 1 out of 6 Romanians has taken antibiotics without a prescription, inadequate administration of antibiotics being one of the key factors that contribute to an increase in bacterial resistance [4].

Antibiotics were called "magic bullets" for quite some time; however, due to some serious downsides these magic bullets were not always magical enough to survive. The use and misuse of antibiotics cause selection pressure, that result in the development of resistance traits in bacterial populations [5]. However, the problem was not the antibiotics themselves as they acted as one of the most effective weapons against diseases; in fact, the main problem lied in the drugs' use. Overusing of antibiotics or irrational usage of antibiotics can easily be an outcome not only in the emergence of resistant bacterial strains but also in adverse reactions and that's finally results in an economic threat on the national health system [6]. In order to combat Antimicrobial Resistance, The World Health Organization set the theme of the World Health Day as: 'No Action Today, No Cure Tomorrow' [7]. In September 2013, U.S. Center for Disease Control and Prevention (CDC) reported that the treatment of antibiotic-resistant infections adds $35 billion to health care costs and 8 million hospital days per year in the United States [8]. Several factors are involved and played vital role in case of antibiotic use such as unregulated drug availability, relaxed health policies concerning regulations on antibiotic use, collection of antibiotics without prescription (over-the-counter acquisition), patients' perception and attitudes towards antibiotic use, self-medication, physicians' knowledge and experiences and patient-prescriber interaction. As such, corrective measures and feasible means of intervention are required to control antibiotic use. Accepted strategies for the purpose of using antibiotics properly includes replacement or restriction of formulary, health care provider knowledge level, feedback activities, approval requirement from an infectious disease specialist for the drug prescription and a more rational use of antimicrobial agents throughout the world [9,10].

A survey on 2500 respondents that includes both medical and non-medical students in China indicated that medical students performed better than non-medical students in terms of knowledge and attitude towards antibiotic use [11]. This is analogous to the findings of another study conducted in Chennai among medical and paramedical students [12]. In a study conduct in Malaysia with students of third- and fourth-year pharmacy students, sufficient knowledge but poor attitude of pharmacy students on antibiotics use was reported [13]. Other studies in India [14,15] reported poor knowledge regarding the antibiotic spectra, indications, side effect and their correct use. Moreover, students' knowledge on antibiotic resistance and prescribing pattern of antibiotics was moderate as well as the attitude toward the cause of resistance [16]. Another study [17] published good understanding and awareness regarding antibiotic use and resistance; this was consistent with the study of Khan and Banu [18] which stated that majority of the students were informed about antimicrobial resistance and its consequences. A cross-sectional among university undergraduates study was conducted to measure their knowledge, attitude and practice towards antibiotic use and reported that they posed poor knowledge of the right sources of antibiotic; furthermore, majority of them were found to use the same antibiotics as previously prescribed by their doctors in order to treat their perceived infections while 51.2% kept leftover antibiotics for future use [19]. In Italy, a study conducted in Torino University where the respondents were health care profession students also elicited the remaining gap between knowledge and practice [20].

2. METHODS AND MATERIALS

2.1 Study Design

A cross sectional study considering and practice quantitative approach on knowledge, attitude of antibiotic use and antibiotic resistance among the students of private universities in Dhaka, Bangladesh.

2.2 Study Population and Sample Size

The study conducted on undergraduate students of different subjects in different private

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universities in Dhaka city. The sample size was calculated using the following formula: n = Z^2pq/d^2 [21], here n is the sample size, Z is the statistic that corresponds to the level of confidence, P is a measure of expected prevalence, q=(1-p), When p is in decimal value and d is precision (analogous to effect size). With response rate of 50% and a confidence interval 95% then the sample size was calculated as 384 subjects from which 244 respondents completed the full questionnaire. The inclusion criteria were all the students of selective private universities of Dhaka and exclusion criteria were all the medical students, any student who was not psychologically fit to understand the questions, any student who had previously participated in this kind of research regarding antibiotic use and antibiotic resistance and any student who was not willing to participate.

2.3 Development of Research Instrument

This study was conducted in a simple questionnaire format. This study was both self and interviewer administrative questionnaire. Data from the respondents was collected using a structured and well modified manner. This questionnaire was filled by the respondent himself or interviewer in favor of the respondent.

2.4 Data Analysis and Interpretation

For data input, SPSS (Statistical Package for the Social Sciences) and Microsoft Excel software were used carefully. And for data analysis, SPSS version 22 was used as principal software. The demographic table and chart were displayed for data presentation, the comparative analysis presented by a proper bar chart, pie chart or scatter plot. All tables of visual graphics representation depended on statistical applications. Responses were presented using descriptive analysis, with chi-square tests to identify factors associated with Knowledge, Attitude and Practice about antibiotic use and antibiotic resistance and the Spearman's rank order correlation coefficient was calculated to examine the relationship between responses to the Knowledge, Attitude and Practice questions.

During Data collection, the respondents were explained about the aim and purposes of the study. Informed permission was taken from the respondent prior to data collection. Respondent's dignity and respects was maintained and

interviews were taken with strict privacy as well as no potential harm to anybody or environment was done during this study.

3. RESULTS

Total number of students from 1st year to 4th year were 244 who had given voluntary consent and respondents in this study willingly.

Table # 1 represents that, comparatively more number of males (56%) had participated than females (44%). Overall mean age was 21.9±1.5. Particularly, the maximum age of respondents were 25years and minimum 18 years

Table # 2 shows that, Demographic information of study respondents can be obtained. In this study, majority of respondents were Muslim's 203 (83%) and some of the respondents were non-muslim 41 (17%) by religion. The mean religion was 1.44±0.498. Seven renowned private university students were participated in this study where most of the study respondents were from Bangladesh university 83 (34%). In this study, 61 (25%) respondents were from Daffodil International University, 27 (11.1%) respondents are from Stamford University Bangladesh, 22 (9%) respondents are from University of Asia-pacific, 21 (8.6%) respondents were from East West university and lower amount of respondents (15, 6.1%) were from Ahsanullah university of science and technology & BRAC University. The mean value of respondent's affiliation in university was 3.65±1.75. In our study highest number of respondents were 2nd year students 85 (34.8%) & lowest number of respondents were in 1st year students 25 (10.2%). The mean value of this variable was 1.55±0.5. Regarding academic attainment, most of the respondents were studied in allied health science department 143 (53.8%) and lowest in science department 4 (1.6%). The mean academic attainment status was 1.80±1.087.

Out of 244 respondents, 131 (54%) obtained information from academic curriculum, 59 (24%) from Social network like Facebook, what's app, messenger etc, 17 (7%) from media, including newspapers, magazines, and TV advertisements etc and 6 (3%) from google. Only 18 (7%) students declared that they obtained information from human doctor whereas 13 (5%) obtained from pharmacist.
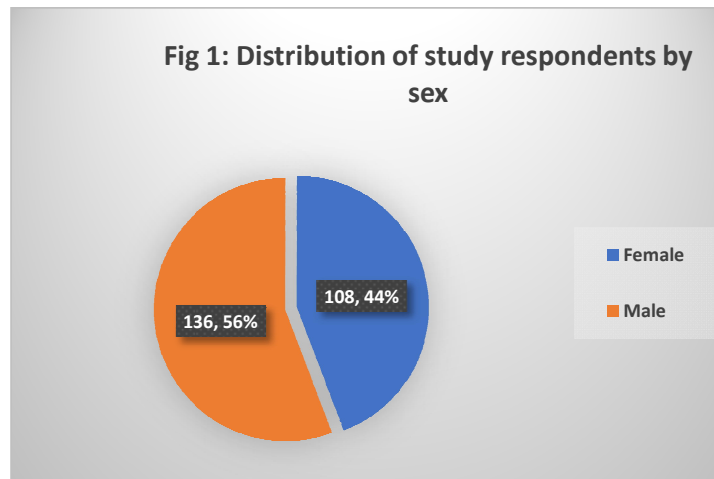
Fig. 1. Distribution of study respondents by sex

Table 1. Distribution of study respondents by sex

Sex	Number of respondents	% Number of respondents
Male	136	56%
Female	108	44%

Table 2. Demographic information of study respondents

SI	Variables	Total	Male	Female	Mean	Std. Deviation
	Socio-demographic variables of respondents					
1	***Religion of the respondents***					
	Muslim	203 (83%)	109 (80%)	94 (87%)	1.44	0.498
	Non-muslim	41 (17%)	27 (20%)	14 (13%)		
2	***University of the respondent***					
	Daffodil International University	61 (25%)	32 (23.5%)	29 (26.9%)	3.65	1.79
	Bangladesh University	83 (34%)	51 (37.5%)	32 (29.6%)		
	Brac University	15 (6.1%)	7 (5.1%)	8 (7.4%)		
	East West University	21 (8.6%)	12 (8.8%)	9 (8.3%)		
	Ahsanullah university of science and technology	15 (6.1%)	6 (4.4%)	9 (8.3%)		
	Stamford University Bangladesh	27 (11.1%)	15 (11%)	12 (11.1%)		
	University of Asia Pacific	22 (9%)	13 (9.6%)	9 (8.3%)		
3	***Academic status of the respondent***					
	1st Year	25(10.2%)	19(76%)	6(24%)	1.55	0.5
	2nd Year	85(34.8%)	50(58.8%)	35(41.2%)		
	3rd Year	77(31.5%)	38 (49.3%)	39(50.6%)		
	4th year	57(23.3%)	29(50.9%)	28 (49.1%)		
4	**Academic attainment *of the respondent***					
	Allied Health science (Pharmacy, Microbiology, Public health, Botany, Zoology, Biotechnology, Biochemistry etc)	143 (58.6%)	73 (51.0%)	70 (48.9%)	1.80	1.087
	Engineering	46 (18.8%)	28(60.9%)	18(39.1%)		

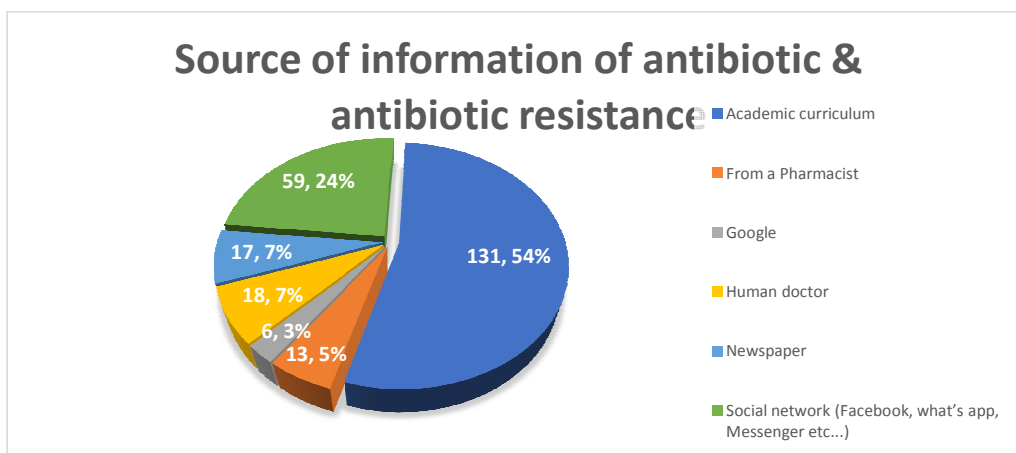| SI	Variables	Total	Male	Female	Mean	Std. Deviation
	Commerce (BBA)	33 (13.5%)	20 (60.6%)	13 (39.3%)		
	Humaities (English, Bangla, Economics, History, Geography, Development studies, etc)	18 (7.3%)	11 (61.1%)	7 (38.9%)		
	Science (Math, Physics, Chemistry, Statistics, etc)	4 (1.6%)	4 (100%)	0 (0%)		

Fig. 2. Source of information of antibiotic & antibiotic resistance

Table #4 represents that, the mean score of knowledge 10.7±2.084 whereas highest score was 14 and lowest score was 4 out of 16. Besides, the mean score of attitude 13.95±3.971 whereas highest score was 21 and lowest score was 5 out of 22. Moreover, the mean score of practice 6.76±1.905 whereas highest score was 10 and lowest score was 2 out of 10.

As illustrated in Table 5, knowledge, attitudes and practices level was assessed with sex of the respondents, academic level of the respondents and academic attainment of the respondents.

In relation to sex of the respondents, we found here that X^2 (10) =20.37, P=.026 for knowledge level, X^2 (16) =22.63, P=.124 for attitude level and X^2 (8) =21.774, P=.005 for practice level.

This entailed that there was statistically significant association between (a) sex and knowledge level; (b) sex and practice level & strength of association between the variables was very strong but statistically no significant association between sex and attitude level & strength of association between the variables was very weak.

In relation to academic level of the respondents, we found here that X^2(30) = 60.19, P=.001 for knowledge level, X^2 (48) =52.60, P=.300 for attitude level and X^2 (24) =38.351, P=.032 for practice level. This entailed that there was statistically significant association between (a) academic level and knowledge level; (b) academic level and practice level & strength of association between the variables was very strong but statistically no significant association between academic level and attitude level & strength of association between the variables is very weak.

In relation to academic attainment of the respondents, we found here that X^2 (40) =13.74, P=.000 for knowledge level, X^2 (64) =113.63, P=.000 for attitude level and X^2 (32) =52.167, P=.014 for practice level. This entailed that there was statistically significant association between (a) academic level and knowledge level; (b) academic attainment & attitude level; (c) academic level and practice level; & strength of association between the variables was very strong.

Table #6 shows, Spearman rank order correlation revealed a positive association between each pair of the knowledge, attitude and practice scores for respondents. The correlation was good between knowledge-attitudes and attitudes-practices and fair between knowledge-practices.

Table 3. Frequency and percentage of practice scores among study respondents

Academic level	No of respondents (Total=244)	Knowledge score		Attitude score		Practice score	
		Frequency and percentage Total=163 (67%)	P-value	Frequency and percentage Total=192 (67%)	P-value	Frequency and percentage Total=192 (67%)	P-value
1st year	25	14.4 (57.6%)	F=3.038	14.7 (58.8%)	F=1.491	14.7 (58.8%)	F=1.491
2nd year	85	59.1 (69.5%)	P=.03	54.3 (63.9%)	P=.218	54.3 (63.9%)	P=.218
3rd year	77	52.3 (68%)		47 (61%)		47 (61%)	
4th year	57	37.6 (66%)		40 (70.1%)		40 (70.1%)	

Values are expressed as frequencies and percentages. n=Total number of respondents, Frequency and percentage of participants who gave correct response based on semester of study.

Knowledge, attitude and practice compared with 1st, 2nd, 3rd and 4th years by using one-way ANOVA followed by post-hoc analysis with Bonferroni test. P value less than 0.05 was considered as statistically significant

Table 4. Knowledge, attitude and practice scoring of respondents

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
Knowledge of the student	244	10	4	14	10.70	2.084
Attitude of the student	244	16	5	21	13.95	3.971
Practice of the student	244	8	2	10	6.76	1.905

Table 5. Responses to questions related to knowledge, attitudes and practices in relation to antibiotics use and antibiotic resistance

Variables	Knowledge level	Symmetric measures	Attitude level	Symmetric level	Practice level	Symmetric level
	X^2 (p- value)	Phi & Cramer's V; (Approximate significance)	X^2 (p- value)	Phi & Cramer's V; (Approximate significance)	X^2 (p- value)	Phi & Cramer's V; (Approximate significance)
Sex of the respondents	X^2 (10) =20.37, P=.026	.289 & .289; (.026)	X^2 (16) =22.63, P=.124	.305,.305; (.124)	X^2 (8) =21.774, P=.005	.299, .299; (.005)
Academic level of the respondents	X^2(30) = 60.19, P=.001	.497 & .287; (.001)	X^2 (48) =52.60, P=.300	.464, .268; (.300)	X^2 (24) =38.351, P=.032	.396, .229; (.032)
Academic attainment of respondents	X^2 (40) =13.74 P=.000	.754 & .377; (.000)	X^2 (64) =113.63, P=.000	.682, .341; (.000)	X^2 (32) =52.167, P=.014	.462, .231; (.014)

Table 6. Correlations between knowledge, attitudes, and practices

Variables	Correlation Coefficient	P VALUE
Knowledge-Attitude	.304	<0.05
Knowledge-Practice	.167	<0.05
Attitude-Practice	.295	<0.05

4. DISCUSSION

Population plays an essential role in the abusive or irrational use of antibiotics, as well as in the spread of perceptions on bacterial resistance. The findings of the study reveal a certain degree of superficiality in the knowledge regarding antibiotics usage and antibiotic resistance.

Antibiotics are used for the provision and treatment of various disease particularly bacterial infections [22, 23]. However, during the last decades due to the overuse and misuse of antibiotics, the world witnessed a great manifestation in the spread of microbial resistance that affects the health, economic burden, higher mortality rates, prolonged hospital stay and finally increased nosocomial infections [24,25].

This study was particularly trying to identify the knowledge, attitudes and practices of the undergraduate students in private universities in Dhaka, Bangladesh regarding antibiotic use and antibiotic resistance to identify any factors associated with these main outcomes of interest.

Overall, the respondents in our study had relatively good knowledge about antibiotic use & resistance. Though the respondents had excellent perception on antibiotics and its role, they didn't know or not sure that administration of antibiotic can't cure infections caused by virus, a fairly similar percentage was found in studies conducted in Britain (42%) [26] and Lebanon (39%) [27]. For this reason, only one-third respondents informed that the use of antibiotics will not speed up recovery of cold, cough and other diseases caused by common flu virus. In this study, the students were fairly knowledgeable about pharmacological aspects of drug with an exception of the term antibiotic role as prophylactic. Significantly higher percentage of respondents believed that antibiotics need to be used according to prescription/professional advice. More than 80% knew about definition of antibiotic resistance whereas in a study in Italy, only9.8% knew the definition of antibiotic resistance [28].

With regard to attitudes towards antibiotic use, majority of the respondents believed that 'Antibiotic resistance is a burden in Bangladesh and it affects our family health'. Their attitude regarding Overuse/misuse of antibiotics results in antibiotic resistance is highly significant compared with other study conducted in Saudi-Arabia (39.3%) [29]. More than 90% respondents answered that 'vaccination can help to heal disease' and about 75% knew that 'vaccination helps in reducing the uses of antibiotics'. This suggests a high expectation in regard to use vaccine that sparks our immune response and helping our body fights off and remember the germ so it can attack it if the germ ever invades again [30]. About 75% respondents answered that 'antibiotics should be used only prescribed by doctors', a comparable result to that found in a study conducted in South Indian teaching hospital (67%) [31]. In the current study most respondents (96.3%) intended to establish a course on "Rational use of antibiotics" at the university level.

With regard to practices towards antibiotic use, nearly half of respondents (48.3%) stated that "They don't stop the use of antibiotics as soon as they experience better' a lower percentage than was found in studies conducted in South Indian teaching hospital (53.4%) [31]. But in comparison with same studies conducted in South Indian teaching hospital [31, a higher percentage of practice was found regarding that 'They don't ask to the doctor to dispense antibiotics for common cold'. In this study, respondents about more than 80% practiced that 'They carefully inspect expiry date prior using'. Nearly half of respondents (43.1%) still believed that "when they get affected by a fever, antibiotics help them to get better more quickly", a comparable result to that found in a study conducted in Indonesia [32].

Although respondents were aware that antibiotic resistance was a problem, one-fourth (25.4%) were still not sure whether "Inappropriate use or half course of antibiotics leads to antibiotics resistance". This finding is consistent with a Palestinian study that found one-third of respondents clearly knew about the meaning of antibiotic resistance, however nearly one-third of

them incorrectly agreed that antibiotics' effectiveness would not be affected if antibiotics are taken less or more than the prescribed dose [33].

The findings of the study also indicated that the new generations have high expectations with regard to being prescribed antibiotics, which increases the likelihood of non-prescription use of antibiotics as well as increasing compliance to the rational utilization of antibiotic use. To alarm our generations mass education campaigns are needed to be conducted to emphasize the potential risks of resistance by using nonprescription antibiotics and the inappropriateness of using antibiotic therapy for minor ailments.

Another findings of the study revealed that, knowledge level of study respondents was found statistically significant in relation to sex, academic level and academic attainment (Table-5). But attitude of the respondents only significantly associated with academic attainment and there was negative association of attitude level with sex and academic level of the respondents(Table-5). Finally, there was statistically significant association of practice level of the respondents found with sex, academic level and academic attainment of the respondents(Table-5).

The study also ascertained a relationship between respondents having poor knowledge, less appropriate attitudes and poor practices regarding the proper use of antibiotics. Respondents, such as those with not from health science background, who had less knowledge and less appropriate attitudes and practices to antibiotic use and who could be targeted in education campaigns.

A positive finding was better participation of female students in this study and posed better knowledge, attitude and practice in regard to antibiotic use and antibiotic resistance. In most developing countries, including Bangladesh, females hold the responsibility of taking care of their children and other family members, thus their better knowledge, attitude and practices should contribute to some extent to the control of antimicrobial resistance.

5. CONCLUSIONS

It can be concluded that, though there was adequate theoretical knowledge among

undergraduate students however they lack in their attitude and behavior regarding antibiotic usage and resistance. Therefore, it is essential to improve their attitude and behavior regarding antibiotic usage and resistance. To enhance the overall knowledge and attitude about antibiotics, students need special courses of education over rational prescription of antibiotics that highlight more on behavior of undergraduate students towards antibiotic usage and resistance instead of improving knowledge alone.

This study is an important step towards a better understanding of the knowledge, attitudes and practices regarding antibiotic usage and antibiotic resistance among the undergraduate students in Bangladesh. Throughout the country, its findings can be generalizable more extensively, especially where people are less knowledgeable about antibiotic use and consequently use antibiotic inappropriately. Our findings are important to the campaign to reduce the overuse or inappropriate use of antibiotics, and its findings can be used to permeate the design of effective and targeted interventions to lessen misconceptions about antibiotic use and to increase awareness regarding the risks of inappropriate use.

The misuse of antibiotics could be due to less knowledge of prescribers, the demand of the patients, less pervasion of awareness among patients through physicians and negative attitude and practice pattern [34-36]. The utilization of antibiotic control methods are important factors that involves interactions between health caregivers, community pharmacists and populations [37,38].

5.1 Study Implications

The study associated with the knowledge, attitude and practice level of undergraduate students and guided them for appropriate use of antibiotics that is known as antibiotic stewardship. So that Effectiveness of current antibiotics can be preserved as well as protect people from antibiotic resistant infections and avoid side effects from using antibiotics inappropriately.

6. RECOMMENDATIONS

- Students and community people should focus on rational use of antibiotics by increasing awareness, proper follow-up of prescription and proper dosage regimen of

antibiotics guided by health physicians, doctors and pharmacists. Government, Health ministry and DGDA should provide guidelines to raise awareness among community people.

- As antibiotic resistance becomes a global burden, Laws and policies regarding purchasing of antibiotics should be implemented by the government.
- The findings of the study can also be used as a baseline for the purpose of monitoring future interventions.
- Future studies should focus on the development and implementation of such education measures to improve antibiotic use among undergraduate students in Bangladesh.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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