

## Effect of Educational Guidelines regarding Preventive Measures of Antibiotic Resistance on Nursing Students' Knowledge and Attitude

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### Abstract

**Background:** Antibiotic resistance is an emerging worldwide concern with serious repercussions in terms of morbi-mortality. **Aim of study:** Was to evaluate the effect of educational guidelines regarding preventive measures of antibiotic resistance on nursing students' knowledge and attitude. **Research design:** Quasi- experimental research design (pre-test and post-test) was utilized to achieve the study's aim. **Setting:** The study was conducted at Faculty of Nursing, Benha University, Benha, Egypt. **Sample:** Simple random sample of 1<sup>st</sup> year nursing students at Benha Faculty of Nursing were taken, from both sexes, during the second term of the academic year 2020/2021, the total sample included 263 students. **Tools of data collection:** Two tools were used; I: Structured interviewing questionnaire that included socio demographic and knowledge parts and II: Students' attitude scale regarding antibiotic use. **Results:** There was a highly significant statistical difference in total knowledge level throughout different study periods (pre, immediately post and after one month) of implementing educational guidelines. Also, there was a highly significant statistical difference in total attitude level regarding antibiotic use throughout different study periods. Finally, there was a highly significant statistical positive correlation between students' total knowledge and total attitude after implementing educational guidelines; during immediately post and after one month periods where the higher the level of knowledge, the more positive is the attitude. **Conclusion:** Nursing students' knowledge and attitude regarding antibiotic use and resistance were improved significantly after implementation of educational guidelines. **Recommendations:** Ongoing educational programs regarding antibiotic use & resistance and integrating brief content about that topic in first year educational curricula are needed to improve nursing students' knowledge and attitude.

**Key words:** Antibiotic resistance, attitude, Educational guidelines, Knowledge, Nursing students & Preventive measures.

### Introduction

Antibiotics are a type of antimicrobial drugs designed to treat bacterial infections within the body. The first antibiotic, salvarsan, was deployed in 1910. In just over 100 years antibiotics have drastically changed modern medicine and extended the average human lifespan by 23 years. Where, besides treating infectious diseases, they made many modern medical procedures possible including cancer treatment, organ transplants and open-heart surgery.

Antibiotics can be verified according to their spectrum, mechanism of action, affected bacterial structure/function, and according to drug form (Hutchings et al., 2019).

Since the mid-1950s, a gradual decline in antibiotic discovery, development and the evolution of drug resistance in many human pathogens had led to the current antimicrobial resistance crisis with some infections now effectively untreatable. This refers to reduced or even disappeared efficacy of antibiotics against bacterial infection. Where, the main

mechanisms of antibiotic resistance not only include both genetic and mechanistic basis of antibiotic resistance, but also involve bacterial biofilm formation (Sunusi et al., 2020).

Poor knowledge of the healthcare professionals regarding quality use of antibiotics, lack of antibiotic stewardship programs for healthcare professionals including nurses, self-medication by the general public due to insufficient knowledge and financial crisis especially in the developing countries are the main contributing factors towards the development of antimicrobial resistance. Also, the patients' expectation for antibiotics is another factor influencing physicians' antibiotic prescribing behaviors (Anwar et al., 2021).

Preventive measures should be taken to prevent the global antibiotic resistance crisis from growing bigger. Infection prevention and control program can be highly effective in controlling antibiotic resistance crisis in a middle-income country despite the lack of a national surveillance system and limited resources. Expansion of infection prevention and control initiatives, potentially paired with a robust antimicrobial stewardship program, should be considered in resource limited settings as a feasible cost-effective opportunity to achieve meaningful reductions in antibiotic resistance and healthcare-associated infection incidence (Ershova et al., 2018).

Among all healthcare professionals, nurses are an integral component of the healthcare system. Nurses have direct interaction with the patients during the drug administration process and play an important role in ensuring quality use of medicines (Anwar et al., 2021).

### **Significance of the study**

Antibiotic resistance is a growing threat to modern medicine and global health security. Every year, 700,000 people die from resistant

infections, mainly bacterial infections, worldwide. Current estimates indicate that the continued rise in antibiotic resistance will result in 10 million deaths every year and 2% to 3.5% reduction in productivity by the year 2050. The threat of antibiotic resistance is growing at an alarming rate and the situation is perhaps aggravated in developing countries, such as Egypt, due to gross antibiotic abuse, lack of awareness about antibiotic use & resistance, low-standard health care services, incompetent medical staff and low economy (Singh et al., 2021).

Antibiotic resistance can be attributed to lack of knowledge on the issue of antibiotic resistance and inappropriate attitude towards their usage like self-medication. Numerous studies have reported improper antibiotic use among students with self-medication and adequate lack of knowledge of antibiotic agents (Sunusi et al., 2019). Therefore, assessing the level of knowledge and attitude among nursing students and giving needed educational guidelines regarding preventive measures of antibiotic resistance are important (Jayaweerasingham et al., 2019).

### **Aim of the study**

The aim of the current study was to evaluate the effect of educational guidelines regarding preventive measures of antibiotic resistance on nursing students' knowledge and attitude.

### **Research hypotheses**

To achieve the aim of this study the following research hypotheses were formulated:

**H1:** Nursing students' level of knowledge regarding preventive measures of antibiotic resistance would be significantly improved after implementing educational guidelines than before.

**H2:** Nursing students' level of attitude regarding antibiotic use would be significantly improved after implementing

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educational guidelines than before.

**H3:** There would be a significant correlation between students' knowledge and their attitude towards antibiotic use.

### **Subjects and Methods**

#### **Research design**

Quasi-experimental research design (pre-test and post-test) was utilized to achieve the study's aim.

#### **Setting**

The study was conducted at Faculty of Nursing, Benha University, Benha, Egypt.

#### **Sample**

**Sample type:** Simple random sample of first year nursing students.

**Sample size:** The sample size was calculated based on the actual number of 1st year nursing students at Benha Faculty of nursing during the second term of the academic year 2020/2021. Utilizing the following formula (Yamane, 1967):

$$n = \frac{N}{1+N(e)^2}$$

Where:

n= sample size

N= total population (771 students)

e= margin error (0.05)

So, a total of 263 students were included in the current study.

**Sampling technique:** After defining subjects and deciding sample size, a list of subjects, sampling frame, was made. Every subject was assigned a number then a random number generator (Research Randomizer) was used to generate random numbers from subjects to be included in the sample.

**Inclusion Criteria:** Students were selected from both sexes and according to their willingness to participate in the study.

#### **Tools of data collection**

Data were collected using the following two tools:

#### **Tool (I): Structured interviewing questionnaire:**

It was designed by the investigator through reviewing of recent related scientific literatures and it included two parts as follows:

#### **Part (1): Students' socio-demographic characteristics:**

It was concerned with assessment of students' socio demographic characteristics related to their age, gender, residence, economic status, having previous information about antibiotics and preventive measures for resistance caused by abusing them.

#### **Part (2): Students' knowledge sheet regarding preventive measures of antibiotic resistance:**

It was adapted from (Gupta et al., 2019; Rábano-Blanco et al., 2019; Shah et al., 2019 and Voidăzan et al., 2019) & concerned with assessment of students' knowledge regarding: Definition, types, indications, contraindications & side-effects of antibiotics; definition, mechanisms, leading factors & consequences of antibiotic resistance and preventive measures of antibiotic resistance.

The questionnaire contained (29) questions, all of them were multiple-choice questions. The students were asked to reply to these questions by selecting only one correct answer for each question pre and post educational guidelines implementation.

#### **Scoring system:**

Scoring system for knowledge of students involved in study was calculated as follows: The students' answers were compared with model key answers and score (1) was given for correct answer and score (0) for incorrect answer. The total score for knowledge questions was (29). The knowledge score was converted into percent and categorized as follows:

•>75% was considered as a good level of

knowledge (more than 22 degrees).

•60% - 75% was considered as an average level of knowledge (18-22 degrees).

•< 60% was considered as a poor level of knowledge (Less than 18 degrees).

**Tool (II): Students' attitude scale regarding antibiotic use:**

It was adapted from (Alqarni & Abdulbari, 2018; Jayaweerasingham et al., 2019 and Sakr et al., 2020) to assess students' attitude regarding antibiotics use. A 5-point Likert scale (“Strongly agree”, “Agree”, “Neutral”, “Disagree” and “Strongly Disagree”) was used. To simplify the analysis, “strongly agree” and “Agree” responses were classified under the category of “Agree”, while “Disagree” and “Strongly Disagree” responses were classified under the category of “Disagree”.

The scale contained (17) items. The students were asked to reply to these items by selecting only one proper response for each item pre and post educational guidelines implementation.

**Scoring system**

Scoring system for attitude of the students involved in study was calculated as follows: score (3) for proper response, score (2) for neutral response, and score (1) for improper response. The total score for attitude was (51). The attitude score was converted into percent and categorized as follows:

• $\geq$  60% was considered as a positive level of attitude (equal to or more than 31 degrees).

•< 60% was considered as a negative level of attitude (Less than 31 degrees).

**\*Educational guidelines regarding preventive measures of antibiotic resistance:**

It was designed by the investigator through reviewing of recent related scientific literatures. Guidelines were planned to cover knowledge and attitude regarding preventive measures of antibiotic resistance. The guidelines' content included the following

items: Definition, types, indications, contraindications & side-effects of antibiotics; definition, mechanisms, leading factors & consequences of antibiotic resistance and preventive measures of antibiotic resistance including antibiotic stewardship and infection control measures.

**Validity of tools**

The face and content validity were ascertained for relevance, comprehensiveness, simplicity, clarity and ambiguity through a jury of five experts from Medical Surgical Nursing department, Faculty of Nursing, Benha University; one professor and four assistant professors. Also prepared developed educational guidelines which covered all items related to (preventive measures of antibiotic resistance) based on newest current literature was revised by the same experts and all recommended modifications were done.

**Reliability of tools**

Reliability was tested statistically to assure that the tools were reliable before data collection.

**Testing the reliability of the tools through Alpha Cronbach reliability analysis:**

**Table 2: Testing the reliability of the tools:**

Tools	Alpha	P-value
Structured interviewing questionnaire	0.75	<0.05
Students' attitude scale regarding antibiotic use	0.85	<0.01

**Ethical considerations**

This study was conducted after primary approval obtained from Ethics Committee, Faculty of Nursing, Benha University. Then, official permission was obtained from dean of Benha Faculty of Nursing in order to conduct the study. Then, the investigator explained the aim and nature of the study to study subjects. They were also informed that their

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participation is optional, and that they have the right to withdraw at any time without any consequences. The investigator assured maintaining anonymity and confidentiality of data and that all gathered information used only for their benefit and for the purpose of the study. Then, written consent was obtained from each participant enrolled into the study.

### **Pilot study**

Pilot study was performed on 10% (26 students) of the total sample size to test the clarity and applicability of tools and the educational guidelines, to estimate time needed for their filling in as well as to identify any possible obstacles that may hinder data collection. According to the results of pilot study some modifications were done as needed. Students involved in the pilot study were excluded from the main study. The pilot study was done two weeks before starting the main study.

### **Field work:**

Data collection of the current study was carried out from 17 April 2021 to 24 June 2021 during the second term of the academic year 2020/2021. The investigator attended Benha faculty of nursing three days per week (Saturday, Monday and Wednesday) after nursing sections according to faculty schedule of 1st year students and interviewed about 90 students each time (The investigator divided students into three groups for each time). The study was conducted through four phases:

#### **1-Assessment phase:**

It was carried out for all studied students by the investigator to collect baseline data about students' socio-demographic characteristics, knowledge and attitude level regarding antibiotic use and preventive measures of antibiotic resistance using questionnaire sheet (**Tool I**) and Likert scale sheet (**Tool II**). Interview took about 30 minutes.

#### **2-Planning phase:**

This phase included the following:

- 1-Determining the educational sessions' strategy.
- 2-Selecting the teaching place (classroom in faculty of nursing, Benha University).
- 3-Determining the educational sessions' finances (supplied by the investigator for all printed material and media).
- 4-The appointment for starting educational sessions was scheduled with students according to their faculty schedule.

#### **3-Implementation phase:**

- 1-The educational guidelines implementation was conducted in 4 sessions.
- 2-At the end of implementing educational guidelines, the investigator received notes from the students, asked them about their opinion on the educational guidelines & their benefits from the subject and then distributed the questionnaire (**Tool I part II**) and Likert scale (**Tool II**) to do another test immediately after implementation of educational guidelines.

#### **4-Evaluation phase:**

The evaluation was done immediately post and one month post implementation of educational guidelines, using the same tools of the pretest (**tool I part 2 & tool II**), to detect the changes in the studied students' knowledge and attitude levels regarding antibiotic use & preventive measures of antibiotic resistance and to evaluate the effectiveness of the educational guidelines.

#### **Statistical analysis**

The collected data were organized, categorized, tabulated and analyzed using the number & percentage distribution as well as mean & standard deviation. Statistical analysis was computed by statistical package for social sciences (SPSS 20.0). Chi-square test (X<sup>2</sup>) was used for comparisons between qualitative variables to find out relations. Paired t test (t) was used to differentiate

between quantitative data of one group before and after guidelines. Pearson method ( $r$ ) was used to test correlation between numerical variables. Statistical significance was considered at  $p\text{-value} \leq 0.001$ .

### **Results**

**Table (1)** shows that, 69.2% of studied students their age was 18 years with a mean age of  $18.5 \pm 0.5$  years. Related to gender, 60.8% of them were females, and 63.9% of studied students were residing in rural areas. Also, 51.7% of them had a moderate level of economic status. In addition, 17.1% only of them had previous information about antibiotics and preventive measures of resistance, and 66.7% of them had their main source of information from a family member works in a health-related field.

**Table (2)** shows that, there was a highly significant statistical difference ( $p \leq 0.001$ ) in total knowledge level throughout different study periods (pre, immediately post and after one month) of implementing educational guidelines. Where there was a significant difference ( $p \leq 0.001$ ) between pre and immediate post periods in term of a poor level of total knowledge among 61.2% of studied students before guidelines, to be good among 68.4 % immediately post guidelines. Also, there was a significant difference ( $p \leq 0.001$ ) between pre and one month periods after implementation of educational guidelines where 63.9 % of studied students had good level of total knowledge, which supports the first research hypothesis (H1) which stated that nursing students' level of knowledge regarding preventive measures of antibiotic resistance will be significantly improved after implementing educational guidelines than before.

**Figure (1)** illustrates that, 61.2% of studied students had a poor level of total knowledge before implementation of educational guidelines, while 68.4% of them

had a good level of total knowledge immediately post guidelines and also among 63.9% after one month of educational guidelines implementation.

**Figure (2)** illustrates that, 74.9 % of studied students had a negative level of total attitude before implementation of educational guidelines, to be positive among 87.5% and 82.1% respectively during immediate post and after one month of guidelines implementation, which supports the second research hypothesis (H2) which stated that nursing students' level of attitude regarding antibiotic use will be significantly improved after implementing educational guidelines than before.

**Table (3)** shows that, there was a highly significant statistical positive correlation between students' total knowledge and total attitude after implementing educational guidelines; during immediately post and after one month periods with  $P\text{-value} = (<.001^{**})$  where the higher the level of knowledge, the more positive is the attitude, which supports the third research hypothesis (H3) which stated that there will be a significant correlation between students' knowledge and their attitude towards antibiotic use.

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**Table (1): Distribution of studied students according to their socio-demographic characteristics (n=263).**

<b>Socio-demographic characteristics</b>	<b>(No.)</b>	<b>%</b>
<b>Age (years)</b>		
- 18	182	<b>69.2</b>
- 19	81	30.8
<b>Mean ±SD</b>	<b>18.5±0.5</b>	
<b>Gender</b>		
- Male	103	39.2
- Female	160	<b>60.8</b>
<b>Residence</b>		
- Urban area	95	36.1
- Rural area	168	<b>63.9</b>
<b>Economic status (from your point of view)</b>		
- High	86	32.7
- Moderate	136	<b>51.7</b>
- Low	41	15.6
<b>Having previous information about antibiotics and preventive measures for resistance</b>		
- Yes	45	<b>17.1</b>
- No	218	82.9
<b>Source of this information</b>	(n=45)	
- a family member works in a health-related field	30	<b>66.7</b>
- a close friend works in a health-related field	10	22.2
- attending a course/symposium on antibiotics	5	11.1
- academic curriculum	0	0.0

**Table (2): Difference in total knowledge level among studied students pre and post implementing educational guidelines (n=263).**

Total students' knowledge	Pre educational guidelines						Immediately post educational guidelines						After one month of educational guidelines						X <sup>2</sup> test (P value) (1)	X <sup>2</sup> test (P value) (2)	F test, (P value) (3)
	Poor (< 60%)		Average (60% - 75%)		Good (> 75%)		Poor (< 60%)		Average (60% - 75%)		Good (> 75%)		Poor (< 60%)		Average (60% - 75%)		Good (> 75%)				
	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)			
Antibiotics	180	68.4	58	22.1	25	9.5	25	9.5	68	25.9	170	64.6	30	11.4	70	26.6	163	62	<b>25.36</b> ( <b>&lt;.001</b> <b>**</b> )	<b>23.82</b> ( <b>&lt;.001</b> <b>**</b> )	<b>58.61</b> ( <b>&lt;.001</b> <b>**</b> )
Uses of antibiotics	161	61.2	64	24.3	38	14.4	27	10.3	60	22.8	176	66.9	30	11.4	65	24.7	168	63.9	<b>28.27</b> ( <b>&lt;.001</b> <b>**</b> )	<b>26.34</b> ( <b>&lt;.001</b> <b>*</b> )	<b>62.58</b> ( <b>&lt;.001</b> <b>*</b> )
Antibiotic resistance	138	52.5	75	28.5	50	19	20	7.6	61	23.2	182	69.2	23	8.7	65	24.7	175	66.5	<b>26.30</b> ( <b>&lt;.001</b> <b>**</b> )	<b>24.67</b> ( <b>&lt;.001</b> <b>**</b> )	<b>60.02</b> ( <b>&lt;.001</b> <b>*</b> )
Preventive measures for antibiotic resistance	163	62	65	24.7	35	13.3	25	9.5	60	22.8	178	67.7	25	9.5	68	25.9	170	64.6	<b>29.77</b> ( <b>.001</b> <b>*</b> )	<b>25.63</b> ( <b>&lt;.001</b> <b>*</b> )	<b>63.87</b> ( <b>&lt;.001</b> <b>*</b> )
<b>Total knowledge</b>	<b>161</b>	<b>61.2</b>	<b>66</b>	<b>25.1</b>	<b>36</b>	<b>13.7</b>	<b>21</b>	<b>8</b>	<b>62</b>	<b>23.6</b>	<b>180</b>	<b>68.4</b>	<b>28</b>	<b>10.6</b>	<b>67</b>	<b>25.5</b>	<b>168</b>	<b>63.9</b>	<b>56.69</b> ( <b>&lt;.001</b> <b>**</b> )	<b>50.27</b> ( <b>&lt;.001</b> <b>*</b> )	<b>88.48</b> ( <b>&lt;.001</b> <b>*</b> )

(X<sup>2</sup>) Chi-square. (f) Friedman test. (p) p-value. (\*\*) Highly statistically significant at p ≤ 0.001.

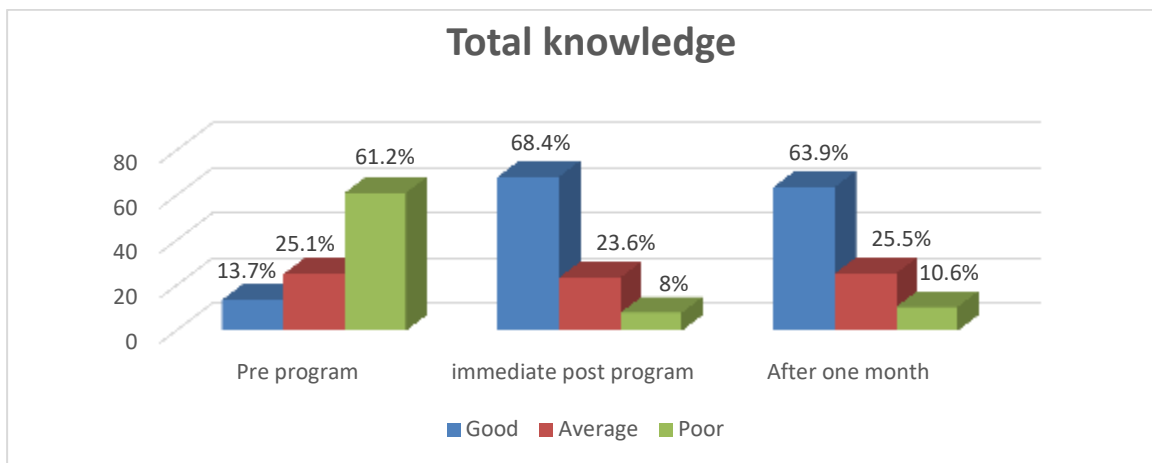
(1) Difference between **pre and immediately post** educational guidelines implementation.

(2) Difference between **pre and after one-month** of educational guidelines implementation.

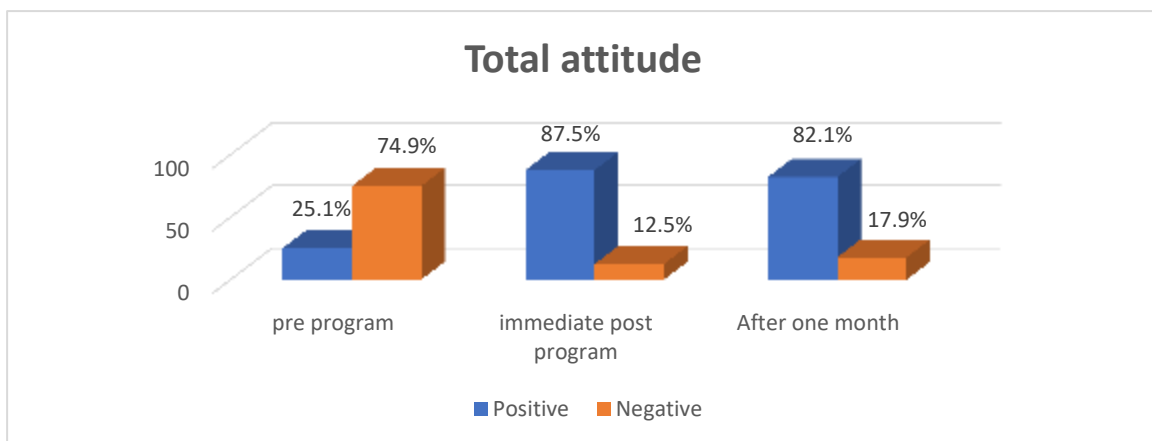
(3) Difference between the **three study periods**.



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**Figure (1): Difference in total knowledge level among studied students pre and post implementing educational guidelines (n=263).**



**Figure (2): Difference in total attitude level among studied students regarding antibiotic use pre and post implementing educational guidelines (n=263)**

**Table (3): Correlation between total knowledge and total attitude of studied students regarding antibiotic use pre and post educational guidelines implementation.**

r.p	Total attitude			
	immediately post implementation of educational guidelines		after one month of implementation of educational guidelines	
Total knowledge	r	p-value	r	p-value
		.515	<.001**	.502

(r) Pearson test.

(p) p-value.

(\*\*) Highly statistically significant at  $p \leq 0.001$

## **Discussion**

Antibiotics have played an essential role in progressing modern medical and surgical care, minimizing the global burden of communicable diseases, and extending human life expectancy. These medicines have transformed modern medical practice, but the persistent evolutionary changes of microorganisms along with wide misuse of antibiotics resulted in antibiotic resistance which became a major global public health threat (**Haque et al., 2019**). Many researchers have identified the gap in knowledge and attitude among medical students with regard to antibiotic resistance prevention. To address this gap and to strengthen preventive measures of antibiotic resistance, effective educational intervention is needed (**Sudha et al., 2021**).

So, the present study was conducted with the aim of evaluating the effect of educational guidelines regarding preventive measures of antibiotic resistance on nursing students' knowledge and attitude.

Thus discussion of the study findings will be presented in the following sequence:

**Regarding to students' socio-demographic characteristics;** the results of the current study reported that more than two thirds of studied students their age was 18 years with a mean age of  $18.5 \pm 0.5$  years. This result was in the same line with **Dönmez, Güngör and Göv (2018)** whose study was about "Knowledge, Attitude and Practice of Self-Medication with Antibiotics among Nursing Students" and reported that more than half of studied students their age were (17-20) years old. This result was not in the same line with **AL-Salih et al. (2019)** whose study was about "Knowledge and Attitudes regarding Antibiotic Use and Resistance among Nursing and Dentistry Students in Babylon University/ Iraq" and

reported that most of studied students their age were (20-25) years old.

**As for gender,** the results of the current study revealed that three fifths of studied students were females. This result was agreed with the study done by **Rábano-Blanco et al. (2019)** whose study was about "Nursing Students' Knowledge and Awareness of Antibiotic Use, Resistance and Stewardship: A Descriptive Cross-Sectional Study" and reported that most of studied students were females. While contradicted with **Akbar et al. (2021)** whose study was about "Knowledge about antibiotics and antibiotic resistance among health-related students in a Saudi University" and reported that more than half of studied students were males.

**Concerning residence;** the results of the current study reported that approximately two thirds of studied students were residing in rural areas. This result was disagreed with **Dönmez, Güngör and Göv (2018)** who reported that most of studied students were residing in urban areas.

**Regarding to economic status;** the results of the current study reported that nearly half of studied students had a moderate level of economic status. This result was in the same line with **Dönmez, Güngör and Göv (2018)** who reported that more than half of studied students had a moderate level of economic status.

**As regards to having previous information about antibiotics and preventive measures for resistance caused by abusing them;** the results of the current study revealed that less than one fifth only of studied students had previous information about antibiotics and preventive measures for resistance, and two thirds of them had their main source of information from a family member works in a health-related field.

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This result was in the same line with the study conducted by **Rábano-Blanco et al. (2019)** who reported that most of studied students did not receive antibiotics training prior entering nursing but with family members/close friends working in health-related fields. While this result was not in the same line with **AL-Salih et al. (2019)** who reported that around the majority of study participants were highly knowledgeable regarding antibiotics use, side effects and resistance during assessment phase.

**Regarding students' total knowledge level;** the results of the current study showed that there was a highly significant statistical difference ( $p \leq 0.001$ ) in total knowledge level throughout different study periods (pre, immediately post and after one month) of implementing educational guidelines. Where there was a poor level of total knowledge among nearly three fifths of studied students before guidelines, to be good among about two thirds of them immediately post and after one month of implementing educational guidelines.

**This finding supported the first research hypothesis (H1)** which stated that nursing students' level of knowledge regarding preventive measures of antibiotic resistance will be significantly improved after implementing educational guidelines than before. This result was agreed with that of **Tamboli et al. (2016)** whose study was about "Impact of educational session on knowledge and attitude towards antimicrobial prescribing and awareness about antimicrobial resistance among undergraduate medical, dental and nursing students: a comparative study" and reported that there was a highly statistically significant improvement in the post-session knowledge about antimicrobial use and resistance in studied nursing students.

**Concerning students' total attitude level;** the current study results reported that there was a highly significant statistical difference ( $p \leq 0.001$ ) in total attitude level regarding antibiotic use throughout different study periods (pre, immediately post and after one month) of implementing educational guidelines. Where there was a negative level of total attitude among about three quarters of studied students before guidelines, to be positively improved among around the majority of them immediately post and after one month of implementing educational guidelines.

**This result supported the second research hypothesis (H2)** which stated that nursing students' level of attitude regarding antibiotic use will be significantly improved after implementing educational guidelines than before. This result was in the same line with the study done by **Tamboli et al. (2016)** who reported that there was a highly statistically significant improvement in the post-session attitudes about antimicrobial use and resistance in studied nursing students. While it was contradicted with the study done by **Sunusi et al. (2019)** who reported that three fifths of studied students had average attitude level regarding antibiotic usage during assessment phase.

**As regards to correlation between total knowledge and total attitude of studied students;** the results of the current study showed that there was a highly significant statistical positive correlation between students' total knowledge and total attitude after implementing educational guidelines, where the higher the level of knowledge, the more positive is the attitude. **This finding supported the third research hypothesis (H3)** which stated that there will be a significant correlation between students'

knowledge and their attitude towards antibiotic use.

This result was agreed with the study done by **Tamboli et al. (2016)** who reported that there was a positive correlation between knowledge and attitudes about antimicrobial use and resistance in studied nursing students after implementing educational guidelines. While it comes on contrary with **AL-Salih et al. (2019)** who reported that study participants were with a high knowledge level but with negative attitudes regarding antibiotics use, side effects and resistance.

### **Conclusion**

The educational guidelines regarding preventive measures of antibiotic resistance was effective in improving nursing faculty's students' level of knowledge and attitude regarding antibiotic use & resistance in term of a highly significant statistical difference ( $p \leq 0.001$ ) in total knowledge and attitude level throughout different study periods (pre, immediately post and after one month) of implementing educational guidelines. Also, there was a highly significant statistical positive correlation between students' total knowledge and total attitude after implementing educational guidelines (during immediately post and after one month periods) with  $P\text{-value} = (<.001^{**})$  where the higher the level of knowledge, the more positive is the attitude.

### **Recommendations**

1. Ongoing educational programs regarding antibiotic use & resistance as well as integrating brief content about that topic in nursing faculties' first year educational curricula are needed.
2. Further researches need to be done on larger samples, from different Egyptian nursing faculties.

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## تأثير الإرشادات التعليمية المتعلقة بالإجراءات الوقائية لمقاومة المضادات الحيوية علي معرفة وسلوك طلاب التمريض

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تشكل مقاومة المضادات الحيوية تهديداً متزايداً للطب الحديث والأمن الصحي العالمي. ففي كل عام، يموت ٧٠٠,٠٠٠ شخص من الميكروبات المقاومة للأدوية، وخاصة حالات الالتهابات البكتيرية، في جميع أنحاء العالم. يمكن أن تعود مقاومة المضادات الحيوية إلى نقص المعرفة بمسألة مقاومة المضادات الحيوية والإتجاه الخاطيء في إستخدامها مثل العلاج الذاتي. لذلك هدفت هذه الدراسة إلى تقييم آثار الإرشادات التعليمية المتعلقة بالإجراءات الوقائية لمقاومة المضادات الحيوية على معرفة وسلوك طلاب التمريض. وقد أجريت الدراسة في كلية التمريض جامعة بنها على ٢٦٣ طالب وطالبة من الفرقة الأولى للعام الجامعي ٢٠٢٠ / ٢٠٢١. حيث كشفت النتائج أن الطلاب كان لديهم مستوي ضعيف من المعلومات وإتجاهات سلبية بالنسبة لإستخدام المضادات الحيوية وطرق الوقاية من مقاومة المضادات الحيوية، بينما تحسنت معلومات وإتجاهات الطلاب بشكل كبير بعد الإرشادات التعليمية. وأوصت الدراسة بضرورة البرامج التعليمية المستمرة عن إستخدام المضادات الحيوية وطرق الوقاية من مقاومة المضادات الحيوية وكذلك إدراج محتوى مختصر عن هذا الموضوع في المقرر التعليمي لطلاب الفرق الأولى بكليات التمريض.