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### Antibiotics Knowledge and Resistance Awareness in Non-Medical Colleges: A Case Study at Tikrit University

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#### Abstract

**Background:** Antibiotic use among the Arab population has changed over time, often leading to misuse and contributing to the rise of antimicrobial resistance.

**Objective:** This study sought to tackle this concern by assessing the knowledge and attitudes of a sample of university students at Tikrit university regarding antibiotic use and resistance development, with the goal of creating strategies to mitigate the risk of antibiotic resistance.

**Methods:** Paper-based cross-sectional survey was conducted over two months covering students from different non-medical colleges at Tikrit University. Data were collected, organized, tabulated and represented as percent.

**Results:** The present study showed that a large percent of participants had bad knowledge about whether antibiotics is effective against bacteria or virus as well as there is misconception about whether antibiotics considered a medication that can be prescribed without medical prescription with 80% of respondent believe that antibiotics are over the counter drugs. Approximately 60% of participants showed awareness about the definition of antibiotics resistance and other general knowledge about the main factors contributing to this resistance. Moreover, our data regarding practices towards antibiotics showed that approximately 60% of participants completed the course of antibiotics while less than 40% of them cease taking the antibiotics once they start feeling better before completing their treatment course.

**Conclusion:** Our results revealed that while most participants exhibited adequate knowledge and practices regarding antibiotic use, their attitudes toward it were lacking. Implementing health education initiatives and promotional campaigns is crucial to curb antibiotic misuse by enhancing public awareness.

## المعرفة بالمضادات الحيوية والوعي بمقاومتها في الكليات غير الطبية: دراسة حالة في جامعة تكريت

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## الخلاصة

شهد استخدام المضادات الحيوية بين السكان العرب تغييرًا ملحوظًا مع مرور الوقت، مما أدى في كثير من الأحيان إلى إساءة استخدامها وساهم في تزايد مقاومة مضادات الميكروبات. سعت هذه الدراسة إلى معالجة هذا القلق من خلال تقييم معارف ومواقف عينة من طلاب جامعة تكريت فيما يتعلق باستخدام المضادات الحيوية وتطور مقاومتها، بهدف وضع استراتيجيات للحد من خطر مقاومة المضادات الحيوية. أُجري مسح مقطعي ورقي على مدى شهرين، شمل طلابًا من مختلف الكليات غير الطبية في جامعة تكريت. جُمعت البيانات ورُتبت وحُولت إلى جداول، ثم مُثِّلت كنسب مئوية. أظهرت هذه الدراسة أن نسبة كبيرة من المشاركين لديهم معرفة ضعيفة بفاعلية المضادات الحيوية ضد البكتيريا أو الفيروسات، بالإضافة إلى وجود تصور خاطئ حول ما إذا كانت المضادات الحيوية تُعتبر دواءً يمكن وصفه دون وصفة طبية، حيث يعتقد 80% من المشاركين أن المضادات الحيوية تُصرف بدون وصفة طبية. أظهر حوالي 60% من المشاركين وعيًا بتعريف مقاومة المضادات الحيوية، ومعرفة عامة أخرى بالعوامل الرئيسية التي تُسهم في هذه المقاومة. علاوة على ذلك، أظهرت بياناتنا المتعلقة بالممارسات تجاه المضادات الحيوية أن حوالي 60% من المشاركين أكملوا دورة العلاج، بينما توقف أقل من 40% منهم عن تناولها بمجرد شعورهم بالتحسن قبل إكمال دورة العلاج. بالإضافة إلى ذلك، استخدم 43.5% من المشاركين الكمية المتبقية من المضادات الحيوية، خاصةً في حالات المرض المتكرر، بنسبة (48%). كشفت نتائجنا أنه على الرغم من أن معظم المشاركين أظهروا معرفة وممارسات كافية بشأن استخدام المضادات الحيوية، إلا أن مواقفهم تجاهها كانت ناقصة. يُعد تنفيذ مبادرات التنقيف الصحي والحملات الترويجية أمرًا بالغ الأهمية للحد من إساءة استخدام المضادات الحيوية من خلال تعزيز الوعي العام. وبالتالي، هناك حاجة إلى مزيد من البحث لتقييم أثر جهود التوعية على استخدام المضادات الحيوية للمساعدة في تقليل معدلات مقاومة المضادات الحيوية.

## Introduction

Antibiotic use is a critical concern in the healthcare sector as advancement in developing effective antibiotics for various illnesses appear to be undermined by the growing challenge of antibiotic resistance <sup>(1)</sup>. Antibiotics resistance is an increasing concern in global healthcare, primarily resulting from the misuse of antibiotics, which leads to bacteria becoming resistance to the drugs designed to eliminate them. The annual mortality rate associated with this global public health issue is approximately up to two million people around the world <sup>(2)</sup>. The careful and proper administration of antibiotic course is the main factor to ensure that antibiotic drug remain effective against infection with avoiding the development of resistance against that drug in the future <sup>(3)</sup>. Antibiotic resistance is lethal since infections become unresponsive to the remedies intended for killing them, therefore alternative treatment means were

required which would be unobtainable in most cases. Consequently, patients who develop antibiotics resistance being unable to find effective treatments in the coming years, as the effectiveness of these medications diminishes due to the development of resistance <sup>(4)</sup>. Previous researches were conducted among universities students indicated that they had a strong awareness of antibiotics use. However, their attitudes toward antibiotic use and resistance were shaped by absence of understanding about how resistance develops and its long-term consequences. These researches reveal a consistent pattern of antibiotic use based on limited knowledge of their mechanism and the potential risks of misuse, which ultimately contribute to resistance <sup>(4,5)</sup>. The antibiotics usage is still insecurely regulated and people often be able to obtain antibiotics that were not given by a doctor and are used as part of self-medication <sup>(6)</sup>. More than 50% of *Escherichia coli* and *Klebsiella pneumoniae* strains were being

resistant against third-generation cephalosporin and fluoroquinolone in 19 Arab countries according to World Health Organization (WHO) report in these countries <sup>(7)</sup>. This is possibly for the reason that individuals in the Arab counties can effortlessly obtain antibiotics from a relative or a friend's treatment, cease their antibiotics course once they feel improved or even obtain them from healthcare sectors by immoral means <sup>(8)</sup>. Even though these actions have confirmed to be harmful in the long term, individuals still misuse antibiotics, indicating how people might have surface-level knowledge about antibiotics functionality <sup>(9)</sup>. Individuals may have developed a negative perception of antibiotics use, leading them to believe they can use them appropriately without fully understanding their implications <sup>(10)</sup>. It is crucial to determine the level of understanding, awareness and practices towards antibiotics as well as estimate the level of awareness regarding antibiotic's resistance within individuals in countries with modest to moderate-income. High rates of self-medication with antibiotics were occur within these populations leading to the repeated use of antibiotics without a doctor's prescription <sup>(11,12,13)</sup>. This happens when individuals have easy access to antibiotics without sufficient knowledge about their proper use and administration. Consequently, they may choose to self-medicate with antibiotics based on personal judgment rather than medical advice. While such practices might provide short-term relief, they can lead to long-term consequences, including antibiotics resistance, which harms individual health and poses a significant threat to the effectiveness of healthcare systems <sup>(14)</sup>. To tackle this issue, it is essential to explore people's knowledge and attitudes regarding antibiotics. This research focused on assessing their understanding and perspectives on antibiotics use and resistance among Iraqi students. The study focuses on Iraqi under-graduated students at Tikrit

university, which brings a fresh outlook on the understanding and attitudes surrounding antibiotics within this population, owing to the growing cases of antibiotics misuse and development of antibiotics resistance at this geographical area. This study focuses on non-medical student that have modest knowledge about antibiotics. The study was conducted to estimate knowledge, attitude, and practice towards antibiotics use and developing the antibiotic resistance upon misuse among the undergraduate students of non-medical colleges at Tikrit University.

## **Subjects and Methods**

### ***Study Design, Period and Participants***

The survey was administered in a paper-based format over a two-month period from April 15<sup>th</sup> 2024 to June 15<sup>th</sup> 2024, including undergraduate students of non-medical colleges within Tikrit university.

### ***Questionnaire Designed***

The questionnaire was designed based on a through literature review and included 14 multiple-choice, closed-ended questions. It was prepared in Arabic and divided into four sections. The first section focused on gathering participant information, such as gender and age. The second part had designed to assess background knowledge about antibiotics, the third part had designed to assess awareness about antibiotics resistance and the fourth part designed to show the participants' practice towards antibiotics use <sup>(15,16,17)</sup>.

### ***Statistical Analysis***

The data were collected, reviewed, organized, tabulated and frequencies and percentages were calculated using Microsoft Excel 2021.

**Ethical Approval**

The work was approved ethically by the Scientific Research Ethics Committee of Tikrit University Pharmacy College. (Ref. no. SREC14). All participants were informed about the purpose of the study, and written informed consent was obtained prior to the completion of the paper-based questionnaire. Participation was voluntary, and confidentiality of the responses was ensured.

**Results****General Information**

Three hundred of undergraduate students were participated in this study from non-medical colleges at university of Tikrit. The colleges that participated in filling out the information are the non-medical colleges. The percent of males participating in the study was 55% with while female percent was 45%. The ages of the participating individuals were 4% less than twenty years old and 57% of individuals between 20-22 years old and 39% of individuals over 22 years old. The mean age is 22.05 years. The general information data were expressed in Table 1.

**General knowledge about Antibiotics**

The percentage of individuals who knew that antibiotics are effective to cure bacterial infections was 40% while the percent of individuals who believe that antibiotics can cure viral infections was 14%. 35% of individuals believe that antibiotics are effective against both viral and bacterial infections and 11% of students did not have an answer about antibiotics functionality as shown in Figure 1. The most noticeable data in our study 80% of participants believe that antibiotics are drugs prescribed without a doctor prescription. In other hand, 93% of participants knew that some patient may have allergy to specific antibiotic. Majority of study's participants knew that antibiotics administration may associated with adverse

effects. Regarding the effect of antibiotics on the beneficial normal flora, only 60% have information related to this subject while 23% don't have any information on the effect of these drugs on normal flora as shown in Tab.2

**Knowledge of Participants about Antibiotics Resistance**

When participants were asked about the concept and definition of antibiotic resistance, 63% of them knew the resistance term and 9% deny that concept while 28% did not have any knowledge about antibiotics resistance. The present study showed that approximately more than 60% of students aware that incompleteness of antibiotics treatment and improper use of antibiotics are the main factors leading to increased risk of developing antibiotics resistance. In addition, the data about the ability of spreading the resistant bacteria from person to other showed that 60% of individuals confirm this information and 21% of them deny it and 19% of them do not have any information related to this question. To estimate the awareness about the dangerous of developing antibacterial resistance, the participants asked if they believe that issue is a currently worldwide issue and require urgent address; 64% of them were believe it's a global issue as shown in Table3.

**Practice of Participants Towards Antibiotics**

The majority of study's participants are using prescribed antibiotics 237(79%) while 17% of them usually purchase the antibiotics from pharmacy without a prescription and a little percent getting antibiotics from relatives or friends as shown in figure 2. When the participants were asked about behavior toward completing or not completing the recommended course of antibiotics, 40% of participants replied that cease the course when they feel better while 57% of them completed the recommended course of antibiotics. On the other hand, when the participants were asked about using leftover antibiotics, about 44% of

participants replied with yes while 56% of them answered with no. Using the remaining antibiotics from previous treatment course, especially in repeated illness by percentage 48% of participants used the leftover antibiotics while 27% of them used the leftover for respiratory sickness (rhinorrhea /sore throat/fever). For sick family members was by percentage of 25% as shown in Table 4.

## Discussion

Inappropriate use of antibiotics in society has grown over time contributing to an increasing number of antimicrobial resistance cases despite limited mitigation efforts engaged to address this health problem globally. Examining public opinion especially the undergraduate students on antibiotic use and antibiotic resistance is an essential step in developing a plan to tackle this issue <sup>(14)</sup>. Therefore, the present study is conducted with the aim of determining student's knowledge and attitudes towards the use of antibiotics and their resistance to develop a path to solve this problem. In current study, the percent of individuals who gave the correct answer and knew antibiotics are effective for treating bacterial infections was only 40% while the percent of other incorrect choices were 60%. This finding presented those contributors had modest information about antibiotics functionality, while most of them still incorrectly believing that antibiotics can be used to treat viral infections. our study showed the same result as study by Nasir A. et al. <sup>(1)</sup>. In addition, Saudi studies revealed that the majority of participants do not believe antibiotics are effective in treating viral infections <sup>(15,16)</sup>. The reason for this misconception is that a significant portion of the population may struggle to distinguish between viral and bacterial infections, leading them to believe that antibiotics can be used to treat both <sup>(17)</sup>. Another factor for this misconception is people's self-medication

using antibiotics for diseases such as colds and flu. This pattern has escalated to epidemic levels in modern society <sup>(18)</sup>. This unreasonable usage of antibiotics has been a major contributing factor to emergence of antimicrobial resistance within communities <sup>(19,20)</sup>. The most noticeable result is that 80% of participants believe that antibiotics are OTC drugs; considered to be obtained without a prescription. These people must be informed and educated on the correct method about how to get and use antibiotics correctly. This finding was agreed with Patil study in 2019 <sup>(21)</sup>. The interpretation of that result that majority of respondents may get the antibiotics without prescription as this is now a common trend in our society since most people are not visiting the doctor clinic for their treatment and purchasing the antibiotics without medical prescription. Individual social factors such as salary, health care access, traveling fee are some causative reasons that make individual decide to purchase medication without prescription. As in India study <sup>(22)</sup>. Overall, most participants demonstrated good knowledge about the antibiotic's adverse effects and presence of allergic reaction to specific antibiotics. These finding were agreed with Alnasser study in Saudi Arabia <sup>(17)</sup>. Around 60% of participants agree that the beneficial body's normal flora may destroyed by antibiotics. This finding agrees with Al-Nasser study <sup>(17)</sup> while additional Saudi study revealed that over 25% of participants disagreed or were uncertain about whether antibiotics could disrupt the body's bacterial flora <sup>(15)</sup>. Several studies have found that there is unreasonable use of antibiotics in Arab populations and increased incidence of bacterial resistance to antibiotics indicating there is lack of awareness and inadequate cooperation between sick people and healthcare givers <sup>(23)</sup>. In the present study around 60% of the participating students had correct information and they were aware about antibiotics can develop resistance. This

finding is agreed with Alnasser study which showed that 75% of respondents knew that not completing a full course of antibiotics may develop antibiotics resistance <sup>(17)</sup>. Another Saudi study revealed that more than 50% of the participants knew that bacterial resistance is developed when person incomplete the course of their antibiotic's treatment <sup>(24)</sup>. In general, there are limited understanding about antibiotic resistance and the health problems associated with this issue. A feasible reason for this is that, although some people may be aware with the idea, it is clear that the effect of antibiotics resistance is generally misunderstood and is also believed to be curable <sup>(25)</sup>. Furthermore, there is a wrong belief that antibiotics resistance is only present in people who administer antibiotics regularly. However, there are many cases of individuals that develop resistance to antibiotics after consuming less than five instances of antibiotics <sup>(26)</sup>. These findings supported by the sights stated in Hunter research, Meerza et al. and Knudsen and Kishik <sup>(27,28,29)</sup>. Consequently, people may lack a sense of urgency to correct their misuse of antibiotics because they do not expect any negative consequences to affect them. This highlights the pressing issue of an unfinished course of antibiotics. This study finds that some students discontinue the usage of antibiotics once they begin to feel better and recover from their ailment. Incomplete antibiotic courses are a major contributing factor to the development of antibiotics resistance. Approximately 60% of participants was stopped taken antibiotics by the end of the treatment course, and this is what is required, but unfortunately, 40% of them confides that they discontinue the treatment course as soon as begin to feel better. This finding is in alignment with previous studies that showed approximately the same percent of individuals who stopped administering antibiotics as soon as they are feel improved and the symptoms of ailment are relieved <sup>(1,30,31)</sup>. It is necessary also to

investigate the source of getting antibiotics by students. The present study presented that 79% of students consumed antibiotics with a doctor prescription. This is a positive reality and this finding was in disagreement with study by Marzan et al <sup>(32)</sup>. Our result agreed with Nasir study at which 60.83% purchase antibiotic with prescription <sup>(1)</sup> while other study conducted in Ethiopia only 19.6% buy antibiotics with prescription <sup>(33)</sup>. The current study revealed that 44% of participants may use antibiotics leftover. They were using antibiotics leftover for repeated sickness at rate of 48% and for respiratory disorders (rhinorrhea and sore throat) at a rate of 27% and 25% of them may give the antibiotics leftover to their family members or friends. These people must be educated that they should not use the leftover antibiotics or shared them in order to control and prevent the outbreak of antibiotics resistance. These finding were agreed with study done by Marzan et al in 2021 <sup>(32)</sup>, while Saudi study showed that 80% of contributors did not use leftover antibiotics in the event of repeated illness <sup>(17)</sup>. Our findings support the results of Davis et al. (2020) <sup>(34)</sup>, Broom et al. (2021) <sup>(35)</sup> and Hawkins et al. (2022) <sup>(36)</sup>, which emphasize the importance of monitoring patients prescribed antibiotic medications to ensure they adhere to and complete their treatment.

## Conclusion

Our results revealed that while most participants exhibited adequate knowledge and practices regarding antibiotic use, their attitudes toward it were lacking. Implementing health education initiatives and promotional campaigns is crucial to curb antibiotic misuse by enhancing public awareness. Consequently, additional research is needed to assess the impact of awareness efforts on antibiotic usage to help reduce antibiotic resistance rates.

**Table1:** General Participant's Information, total respondent (n=300).

| Parameter |                         | n (%)<br>n = 300 |
|-----------|-------------------------|------------------|
| Gender    | Male                    | 165 (55%)        |
|           | Female                  | 135 (45%)        |
| Age       | < 20 years old          | 12 (4%)          |
|           | Between 20-22 years old | 171 (57%)        |
|           | > 22 years old          | 117 (39%)        |

**Table 2:** Student's Knowledge and Awareness about Antibiotics, (n=300)

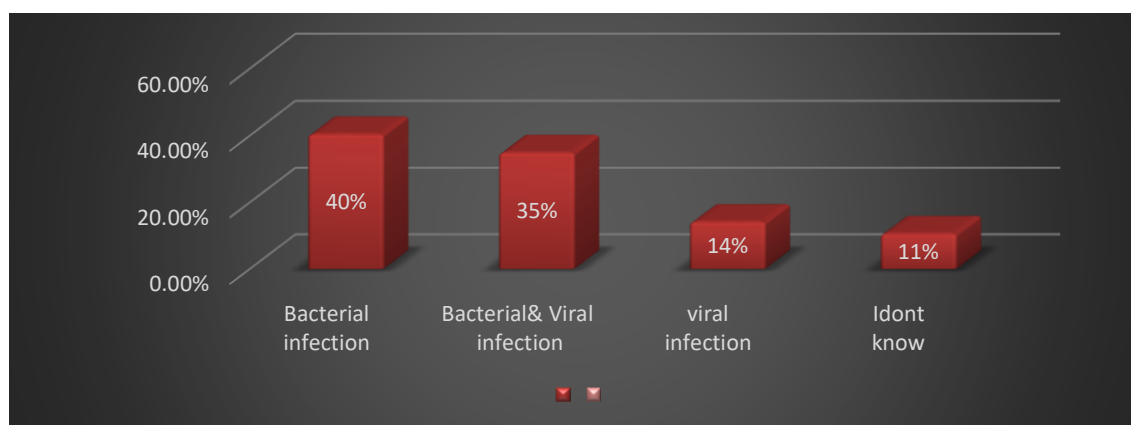
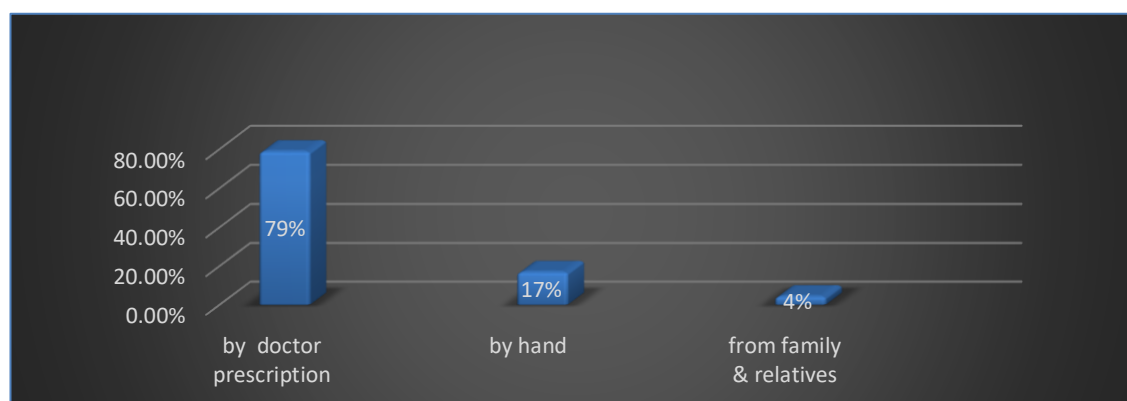
| Question Statements                                                                                                 | Yes       | No       | I don't know |
|---------------------------------------------------------------------------------------------------------------------|-----------|----------|--------------|
| Antibiotics are OTC drugs (prescribed without a prescription).                                                      | 240 (80%) | 42 (14%) | 18 (6%)      |
| Some patients may have allergy to specific antibiotic                                                               | 279 (93%) | 6 (2%)   | 15 (5%)      |
| Antibiotics may destroy the beneficial bacteria that naturally reside on the skin or in the gastrointestinal tract. | 183 (61%) | 48 (16%) | 69 (23%)     |
| Antibiotics have many adverse effects                                                                               | 237 (79%) | 27 (9%)  | 36 (12%)     |

**Table 3:** Student's Knowledge and Awareness about Antibiotics Resistance (n=300).

| Question statements                                                                                                                                                 | Yes      | No      | I don't know |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|--------------|
| Antibiotic resistance refers to the ability of bacteria to withstand the effects of antibiotics, making it challenging to treat infections caused by these bacteria | 189(63%) | 27(9%)  | 84(28%)      |
| Using antibiotics when it is not necessary or without a doctor prescription leads to antibiotics resistance                                                         | 207(69%) | 36(12%) | 57(19%)      |
| Failing to complete the full course of antibiotics can contribute to antibiotics resistance                                                                         | 192(64%) | 51(17%) | 57(19%)      |
| Antibiotic's resistance bacteria can spread from person to person                                                                                                   | 180(60%) | 63(21%) | 57(19%)      |
| Antibiotic resistance is currently a worldwide issue?                                                                                                               | 192(64%) | 45(15%) | 63(21%)      |

**Tables 4:** Practices Toward Antibiotics Among the Total participants (n=300).

| Question Statements                                      | n (%)     |
|----------------------------------------------------------|-----------|
| <b>How do you get the antibiotics?</b>                   |           |
| • By doctor prescription                                 | 237 (79%) |
| • By Pharmacist                                          | 51 (17%)  |
| • By family members or friends                           | 12 (4%)   |
| <b>When do you usually stop taking antibiotics?</b>      |           |
| • When the drug course ended                             | 171 (57%) |
| • When feel better                                       | 120 (40%) |
| • I don't remember                                       | 9 (3%)    |
| <b>Do you used leftover antibiotics?</b>                 |           |
| • Yes                                                    | 132 (44%) |
| • No                                                     | 168 (56%) |
| <b>In which cases usually used leftover antibiotics?</b> |           |
| • For repeated illness                                   | 144 (48%) |
| • For respiratory sickness                               | 81 (27%)  |
| • For family members when someone need it                | 75 (25%)  |

**Figure 1:** Percent of Participants (n=300) that answered with yes, no or I don't know regarding the question: The antibiotics could be used to treat Bacterial infection, Viral infections, both bacterial and viral infections & I don't know.**Figure 2:** The Percent of Participants (n=300) that answered with by doctor prescription, from pharmacy or from family members & friends regarding the question: How do you get the antibiotics?

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