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# Antibiotic misuse awareness by public community in Al-BAYDA

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**Abstract:**
Antibiotic resistance is a global health threat, often driven by public misuse and misconceptions. This cross-sectional study in Al-Bayda, Libya, assessed community knowledge, attitudes, and behaviors toward antibiotic use and antimicrobial resistance (AMR). Using a bilingual questionnaire adapted from the European Commission's AMR survey, 293 valid responses were analyzed (response rate: 73.25%). Results showed that 98.6% had used antibiotics in the past year, and 34.47% obtained them without prescription. Misconceptions were widespread: 62.45% believed antibiotics kill viruses, and 81.22% thought they treat colds and flu. However, 87.37% recognized that misuse causes resistance. Doctors were the main information source (39.24%), while media played a minor role. Knowledge varied significantly by gender, age, and education, with females and those aged 25–34 showing better awareness. No strong link was found between knowledge and misuse, suggesting behavioral influences beyond awareness. These findings highlight the need for tailored public health interventions in Libya, integrating education, policy enforcement, and community involvement to promote responsible antibiotic use.

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**Keywords:** Antibiotic, Antibiotic Resistance, Attitude, Knowledge.

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# وعي المجتمع المحلي في مدينة البيضاء حول سوء استخدام المضادات الحيوية

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**الملخص:**

لا تزال مقاومة المضادات الحيوية تمثل تهديدًا صحيًا عالميًا متزايدًا، يغذّيها في الغالب سوء الفهم بين الأفراد وسوء الاستخدام. هدفت هذه الدراسة المقطعية، التي أُجريت في مدينة البيضاء – ليبيا، إلى تقييم معرفة المجتمع ومواقفه وسلوكياته تجاه استخدام المضادات الحيوية ومقاومة الميكروبات (AMR). استُخدم استبيان ثنائي اللغة مستوحى من مسح المفوضية الأوروبية حول مقاومة المضادات الحيوية، واستُقبلت 293 استجابة صالحة من أصل 400 مشارك (بنسبة استجابة 73.25%). أظهرت النتائج معدلًا مرتفعًا في استخدام المضادات الحيوية؛ إذ أبلغ 98.6٪ من المشاركين عن استخدامها خلال العام الماضي، فيما حصل 34.47٪ منهم عليها دون وصفة طبية. كما كانت المفاهيم الخاطئة واسعة الانتشار، حيث اعتقد 62.45٪ أن المضادات الحيوية تقتل الفيروسات، و81.22٪ أنها فعالة ضد نزلات البرد والإنفلونزا، بينما أدرك 87.37٪ أن الاستخدام غير الضروري يسهم في تطور المقاومة. كان الأطباء المصدر الرئيس للمعلومات (39.24٪)، في حين كان دور وسائل الإعلام محدودًا رغم انتشار الإنترنت. أظهر التحليل فروقات معنوية في المعرفة تبعًا للجنس والعمر والمستوى التعليمي، حيث أظهرت الإناث ومن تتراوح أعمارهم بين 25 و34 عامًا وعيًا أعلى. ومع ذلك، لم يُلاحظ ارتباط مباشر بين المعرفة والسلوك الفعلي، مما يشير إلى تأثير عوامل اجتماعية وثقافية أعمق. تؤكد هذه النتائج الحاجة إلى استراتيجيات صحية عامة دقيقة في ليبيا، تدمج التوعية وتطبيق السياسات بصرامة وتعزيز المشاركة المجتمعية، من خلال تمكين دور الصيادلة والاستفادة من الإعلام التقليدي والرقمي، لتحقيق استخدام أكثر مسؤولية للمضادات الحيوية.

**الكلمات الدالة:** المضادات الحيوية، مقاومة المضادات الحيوية، سلوك، المعرفة.

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**Introduction:**

Antimicrobial resistance has in recent decades become a significant global public health threat. Studies performed throughout Europe have indicated that resistant bacteria truly pose a looming threat, associated with the widespread use of antibiotics (Goossens *et al*., 2005). The higher the consumption of antibiotic substances, the more likely bacteria become resistant. Often, this tendency is due to improper use of antibiotics, unhelpful communication, and inadequate education by healthcare professionals (Franco *et al*., 2009).

For example, the average rate of antibiotic consumption in Malaysia is 9.65 defined daily doses per 1,000 inhabitants per day (Shamsuddin *et al*., 2016). According to the Malaysian National Medicine Use Survey (NMUS) 2007, antibiotics rank 11th in overall drug use, accounting for the highest percentage of healthcare expenditure in 2006 and 2007. Penicillin was found to be the commonly used class of antibiotics.

Antibiotics in Britain in the past decades has perhaps given rise to large gaps in public understanding of their use and capacity for efficacy. Those from lower-income neighborhoods were often not aware of much of such knowledge that was seen in affluent areas (Mason *et al*., 2018). Following this, over a third of participants mistook antibiotics for the treatment of most coughs and colds, and almost half were unfortunate to be unaware that antibiotics could interfere with the body's naturally occurring beneficial bacteria (McNulty *et al*., 2007).

Italy met a similar campaign where less than 10% of the population had shown a reasonable understanding of antibiotic resistance; age strongly influenced misconceptions, along with the general misbelief that antibiotics work against the common cold (Napolitano *et al*., 2013). Conversely, the Hong Kong population is relatively well informed and responsible in antibiotic use. Nevertheless, the Arabs persist as a challenge, where about two thirds of Jordanians believed that antibiotics could fight colds and coughs (Shehadeh *et al*., 2012), with nearly half of the Kuwaiti participants expressing insufficient knowledge about the function of antibiotics and resistance (Awad and Aboud, 2015).

Acting on the threat posed by antimicrobial resistance, the WHO initiated a global strategy in 2001, asking countries to stimulate public awareness about the rational use of antibiotics (World Health Organization, 2001). The International Pharmaceutical Federation

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(FIP) in its 2008 policy statement on the control of antimicrobial resistance supported this concern (Lim and Teh, 2012). Efforts at the regional level, including those of the WHO South East Asia Regional Office, underlined the necessity to put these recommendations into practice (World Health Organization, 2011). In Libya, research on public knowledge and attitudes toward health practices has been limited. Mukhtar et al. (2025).

According to the 2021 data, the city of Al-Bayda in northeastern Libya had a population of about 254,518. Despite global attention to antibiotic resistance, there persists a dearth of published data and research, focusing on the public awareness, knowledge, and behavior toward antibiotic use in Libya. Therefore, we conducted our study in Al-Bayda to assess the public knowledge, attitude, and awareness of antibiotic use and antimicrobial resistance. Data were collected through a structured paper questionnaire, which was administered among subjects in key public areas such as markets, universities, and other community settings.

**Methods:**

**Study design:** This cross-sectional study was conducted in Al-Bayda, Libya, to evaluate public awareness and behaviors related to antibiotic use and microbial resistance. Data were collected using a structured paper-based questionnaire distributed directly to individuals in key public locations such as markets and universities.

**Sample Size and Sampling Technique:** The sample size was determined using specialized statistical software for cross-sectional studies, taking into account the estimated population of Al-Bayda, which is approximately 254,518 residents according to the most recent estimates available for 2021.

A convenience sampling method was used to select participants, allowing all eligible individuals to participate voluntarily without incentives, to minimize potential response bias.

**Study Participants and Data Collection Procedures:** The study included individuals aged 20 years and above. Data collection occurred between June 17, 2023, and May 6, 2025. A total of 400 participants completed the questionnaire. Researchers ensured that participants were residents of Libya by asking key questions about nationality, residency, and general knowledge of the region.

**Study Instrument:**

The questionnaire consisted of several sections, including:

• The first section covered demographic data (gender, age,

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educational level, marital status, employment status).

• The second section included information about previous antibiotic use.

• The third section assessed participants' knowledge and attitudes towards antibiotic effectiveness, side effects, and bacterial resistance.

The questionnaire was designed to ensure participant anonymity, and completion of all essential variables was mandatory to avoid missing data. The instrument was developed based on a review of the relevant literature and reviewed by experts in pharmacology and public health.

**Data Quality Control**

A pilot study involving 30 participants was conducted to ensure the clarity and comprehensibility of the questions. Data collectors received two days of training to standardize the administration process and interaction with participants. Completed questionnaires were reviewed to exclude any duplicate or incomplete responses to ensure the highest data quality.

**Statistical Analysis**

Statistical analysis was performed using Minitab software (version 21). Descriptive statistics (frequencies and percentages) were used to present the demographic characteristics of the participants.

• An independent samples t-test was used to compare awareness scores between male and female participants.

• One way ANOVA was conducted to assess differences in awareness across age groups and educational levels.

• Chi square tests were used to analyses associations between categorical variables, such as gender and responses to knowledge-based questions.

- Regression analysis was employed to identify predictors of awareness levels, including age, gender, education, employment status, and source of information.

**Ethical Considerations**

Ethical considerations were carefully addressed throughout the study. Prior to data collection, all participants were provided with detailed information about the purpose, procedures, and potential

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risks or benefits of the study. Written informed consent was obtained from each participant voluntarily, and participation was entirely optional. Participants were assured of the confidentiality of their responses, as no identifying personal information was collected, and all data were handled with strict privacy and used exclusively for research purposes.

**Results:**

A total of 400 Libyan citizens from Al-Bayda city participated in this study by completing questionnaires available in both English and Arabic. The questionnaire consisted of two main sections: demographic data and general information regarding behavior and knowledge about antibiotic use. Data collection was conducted between June 17, 2023, and May 6, 2025. The questionnaire included 15 questions adapted from the European demographic scale and modified to suit the local Libyan context. After data cleaning, 293 valid responses (73.25% of the total collected) were analyzed. All research activities were independently performed by the research team. The sample size (n = 420) was determined prior to data collection using a statistical sampling method in consultation with a professional statistician to ensure representativeness of Al-Bayda's population.

**Table:(1). Summarizes the sociodemographic characteristics of the 293 valid participants.**

| Variable | Category | Percentage (%) |
|---|---|---|
| Nationality | Libyan | 95.0% |
| | Non-Libyan | 5.0% |
| Age Group (years) | 15–24 | 38.22% |
| | 25–34 | 24.90% |
| | 35–44 | 16.04% |
| | 45-54 | 17.40% |
| | 55-64 | 2.38% |
| Gender | Male | 51.19% |
| | Female | 48.81% (calculated) |
| Household Size | 4 members or more | 83.95% |
| | Fewer than 4 members | 16.05% (calculated) |
| Occupational Status | Government employees | 44.70% |
| | University students | 24.91% |
| | Unemployed | 15.35% |
| | Others | 15.04% (calculated) |
| Educational Level | University or higher | 15.01% |

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|---|---|---|
| | **Secondary/Intermediate** | **84.29%** |
| | **Below intermediate** | **0.70%** |

Nearly all participants (98.63%) reported having used antibiotics within the past 12 months. Only four participants (1.36%) had not taken antibiotics during that period. Approximately one-third (34.47%, n=101) obtained antibiotics without a prescription from pharmacies, while 58.02% (n=170) acquired them through a doctor's prescription. The most common reason for antibiotic use was treatment of cold and flu infections (32.08%, n=94), followed by other reasons not specified in the questionnaire (21.16%). Dental and gum infections accounted for about one-fifth of antibiotic use, while throat infections, which are mostly viral, accounted for 10.58% (n=31). Other indications such as urinary tract infections, skin infections, and wounds each accounted for 7.84%. Diarrhea treatment and use during surgical operations comprised less than 5% of reported antibiotic use (4.48%, n=13).

**Table: (2). Answers about knowledge of antibiotics usage and how they work.**

| **Knowledge of antibiotic uses and resistance of bacteria to it (AMR)** | | | |
|---|---|---|---|
| **Question: 12 (true or false)?** | **Total number (293)** | **Answer** | **Percentage** |
| **a-antibiotics kill viruses** | **183** | **yes** | **62.45%** |
| | **113** | **No** | **37.54%** |
| **b-antibiotics are effective against colds & flu** | **238** | **yes** | **81.22%** |
| | **55** | **No** | **18.77%** |

When asked if antibiotics kill viruses, 62.45% (n=183) incorrectly answered "yes," indicating a significant knowledge gap across all demographic groups. Additionally, 81.22% (n=238) incorrectly believed that antibiotics are effective against colds and flu. However, when asked whether unnecessary antibiotic use reduces their effectiveness, 87.37% (n=256) correctly responded "yes," demonstrating awareness of antibiotic misuse consequences despite gaps in pathogen-specific knowledge **(Figure 1)**.

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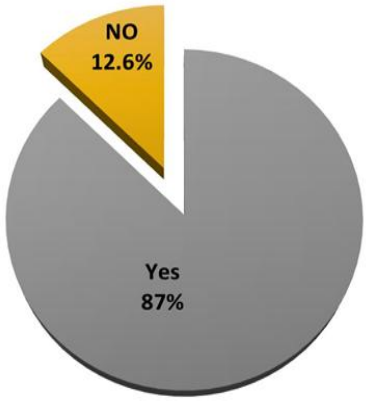


Figure: (1). Answers distribution about unnecessary use of antibiotics and their efficacy.

Participants reported their first source of information about avoiding unnecessary antibiotic use as follows: doctors (39.24%), family or friends (19.79%), pharmacists (13.99%), nurses (3.07%), media (TV/radio) (2.04%), internet social media (11.26%), leaflets (1.36%), and others (9.21%). Regarding side effects, 48.80% (n=143) recognized diarrhea as a common antibiotic side effect, while the remainder were unaware, underscoring a knowledge deficit.

**Table:(3). Behavior and attitude of participants toward time to stop antibiotics**

| Variable | Number (n) | Percentage (%) |
|---|---|---|
| **When feeling better** | **112** | **38.22** |
| **After completing the full course** | **174** | **59.38** |
| **Other** | **7** | **2.38** |

About 38.22% (n=112) reported stopping antibiotics when feeling better, while 59.38% (n=174) completed the prescribed course, indicating a mixed level of adherence to treatment guidelines
Independent samples t-test showed a significant difference in awareness about whether antibiotics kill viruses between genders ($p = 0.000$), with females scoring higher on average. One way

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ANOVA revealed statistically significant differences in awareness across age groups ($p = 0.03$), with the 25–34 age group showing the highest correct knowledge, followed by the 35–44 group. Similarly, educational level was significantly associated with awareness ($p = 0.002$), with higher education correlating with better knowledge. Regression analysis showed no significant effect of gender, age, place of residence, or education on antibiotic misuse ($p > 0.005$). However, gender and age significantly influenced awareness about antibiotics killing viruses ($p = 0.000$ and 0.019, respectively). The chi square test found no significant association between awareness level and antibiotic misuse ($\chi^2 = 10.375$, $df = 11$, $p = 0.497$), suggesting that factors beyond awareness, such as cultural habits or antibiotic availability, may influence misuse behaviors.

**Discussion:**

Our study in Al-Bayda (2023–2025) shows that almost all participants (98.6%) used antibiotics in the past 12 months, with more than one third (34.4%) obtaining these drugs without a prescription. A considerable part (32%) of respondents stated that they took antibiotics for cold and flu; almost two-thirds (62%) believed that antibiotics work against viruses, while 81.22% of participants demonstrated an erroneous belief in the view that antibiotics cure flu, highlighting dee rooted misconceptions. Sources of information about antibiotics include doctors (40%), family or friends (20%), and pharmacists (14%). When compared with other Libyan studies, similarities and differences emerge. At Zawiya University, students distinguished well between antibiotics treating bacterial infections (88% correctly), and only 15% thought they treat viral infections, making this much lower rate of misconception than in our study. The pattern regarding nonprescription antibiotic use appeared to be the same, however (40%), with doctors being the most important source of information (Hana Smedaa, 2020). Conversely, in Sabha, 20% of respondents thought they could stop antibiotics once they felt better; in our sample, this value was less than double (38.22%), suggesting impaired adherence to treatment courses. This is alarming, especially for patients with chronic renal failure, where misuse can significantly worsen existing physiological imbalances and prognostic outcome (Fawzia *et al.*, 2022). Another study in Benghazi revealed gender related differences in self-medication behavior that favored men (91.5%) over women (67.3%), while women had a better understanding that antibiotics are ineffective

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against viruses. These tendencies were reflected in the present study whereby female participants also displayed relatively better awareness (Mohamed F. Ghaith, 2015). At the regional level, findings from Jordan show even higher rates of misconceptions 91.5% of respondents asserted that antibiotics are effective against flu. Nevertheless, 93.9% of the Jordanian sample correctly stated that misuse leads to resistance; this is in line with our finding, whereby 87.3% stated the same (Derar and Abdel Qader, 2020). The study conducted in Derna and Tripoli in 2020 among 1,600 respondents reported a very close number to ours: 67.9% were found to have a poor understanding of antibiotic use, while 67.6% believed antibiotics treat colds and flu (Raga A. Elzahaf, 2021).

International comparisons have enunciated both similarities and dissimilarities. In Italy, one study among veterinary and high school students identified 70% believing antibiotics act against viruses and 33% said they took it for colds and flu, which are almost identical to our results (62% and 32%, respectively). An interesting contrast arises in that the Italians reported their being informed mostly by Internet and TV (over 50%); only 11.26% of respondents in our group indicated such sources. Large scale surveys from Europe further reveal that differences exist. Only 23% of EU nationals reported antibiotic treatment the previous year far below the rate of 98.6% scored by us. So, 62% were able to identify in Europe that antibiotics do not act on colds and flu, versus just 18.8% in our survey. On the other hand, very much in agreement was the misuse hazard, where 82% of Europeans and 87% in our data thought irrational use fosters resistance. Interestingly, better prospect of the European participants to get antibiotics through prescriptions (74% versus 58% in our study) while only 8% received them without prescription as compared to 34.4% in Al-Bayda. Globally, antibiotic resistance is acknowledged to present tremendous threats to health, causing around 4.95 million deaths in 2019 and enormous economic costs, including an annual 1.5 billion burden on health systems in Europe (Collaborators, 2022). Besides compromising treatment efficacy, the over and misuse of antibiotics place burden on already fragile health systems, especially in countries like Libya where medical supply chains, vaccination availability, and health infrastructure are under stress. In Libya, research on public knowledge and attitudes toward health practices has been limited. Mukhtar et al. (2025). Overall, findings support the notion that

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misconceptions and irrational use are highly prevalent in Al-Bayda, confirming results from other studies carried out in Libya and in the region. Still, these studies indicated that the level of knowledge there remains lower than that noted in some European countries, where better knowledge is reflected in rational behavior. Therefore, these results highlight an urgent need for awareness campaigns with targeted purposes, regulations on the sale of antibiotics, and a better health communication strategy to curb misuse and delay resistance.

**Conclusion:**

This study in Al-Bayda, Libya, revealed extensive antibiotic misuse, with 98.6% of participants reporting use in the past year and over one-third obtaining them without prescription.

Widespread misconceptions persisted, as many believed antibiotics treat colds and flu, though 87.3% recognized misuse causes bacterial resistance. However, awareness did not translate into proper behavior, suggesting social and systemic influences.

Physicians were the main information source, while pharmacists and media played limited roles. These findings emphasize the urgent need for coordinated efforts combining regulation, education, and community engagement to promote rational antibiotic use and curb antimicrobial resistance.

**Recommendations**:

- Enforce prescription only policies.
- Launch public education campaigns.
- Empower pharmacists & use media for awareness.

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