Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

Original article

Knowledge, Attitudes, and Practices Regarding Antimicrobial Resistance Among the General Public in Benghazi, Libya-2025.

Amenh B. Yousif

Department of Family and Community Medicine, Faculty of Medicine, University of Benghazi, Benghazi, Libya.
Corresponding email. *amenh.yousif@uob.edu.ly*

***Keywords**:*
Antimicrobial resistance, knowledge, attitudes, practices, general public, Benghazi, Libya.

ABSTRACT

The overuse and misuse of antibiotics are primary drivers of antimicrobial resistance (AMR), resulting in a major global health problem that compromises the efficacy of these drugs and complicates the treatment of bacterial infections. A descriptive cross-sectional study was conducted over two months, from October 1 to November 30, 2025. A sample of 200 participants was selected via convenience sampling. Data were collected via a structured questionnaire adapted from a WHO survey tool. KAP scores were dichotomized (good/poor for knowledge and practice; positive/negative for attitude). Data were analyzed by SPSS version 25, using descriptive statistics, Chi-square tests, and multivariate logistic regression. The results indicated that 78.0% of participants had good knowledge, 85.0% had positive attitudes, while only 42.0% reported good practices. Prevalent misconceptions included the belief that antibiotics are effective against viral infections (32.0%) and the incorrect belief that AMR occurs when the human body becomes resistant (64.0%). The study revealed that 28.5% of respondents had used antibiotics without a prescription, and 48.0% reported stopping a prescribed course of antibiotics when their symptoms subsided. Multivariate analysis identified lower education as an independent predictor of poor knowledge (Adjusted Odds Ratio, AOR = 3.2) and younger age (18–34 years) as a strong independent predictor of poor practice (AOR = 4.1). Despite moderate knowledge and positive attitudes, dangerous practices regarding antibiotic use are common. This underscores an urgent need for context-specific public health interventions and stringent enforcement of dispensing regulations in Libya to combat AMR

Introduction

Antimicrobials, including antibiotics, antivirals, antifungals, and antiparasitics, are medicines used to prevent and treat infectious diseases in humans, animals, and plants. Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi, and parasites no longer respond to antimicrobial medicines. As a result of drug resistance, antibiotics and other antimicrobial medicines become ineffective and infections become difficult or impossible to treat, increasing the risk of disease spread, severe illness, disability, and death. AMR is a natural process that happens over time through genetic changes in pathogens. Its emergence and spread are accelerated by human activity, mainly the misuse and overuse of antimicrobials to treat, prevent, or control infections in humans, animals, and plants. This silent pandemic transcends geographical and economic boundaries, posing a universal threat to modern medicine, including routine surgeries, cancer chemotherapy, and organ transplantation [1,2].

The global burden of AMR is staggering in both human and economic terms. A landmark 2019 analysis estimated that bacterial AMR contributed to nearly 4.95 million more deaths worldwide. If left unchecked, this figure could rise dramatically, with projections suggesting that AMR could cause 10 million deaths annually by 2050 and inflict a cumulative economic cost of $100 trillion on global output. This burden is felt most acutely in low- and middle-income countries, where healthcare systems are often least equipped to manage complex, drug-resistant infections [3,4].

The primary driver of this crisis is the widespread and often inappropriate use of antimicrobials in human health, agriculture, and veterinary medicine. This misuse accelerates the natural selection of resistant bacteria. Every exposure of a bacterial population to an antibiotic creates selective pressure, favoring the survival and proliferation of resistant strains that possess or acquire genetic resistance mechanisms. This process is exacerbated by subtherapeutic dosing, unnecessary prescriptions, and the routine use of these drugs to promote growth in livestock [5,6]. The consequences of this selection pressure are severe and multifaceted. The proliferation of resistant pathogens results in increased treatment failures, prolonged illness, higher healthcare costs, and increased mortality. Patients infected with resistant bacteria experience longer hospital stays, require more expensive second or third-line drugs that are often more toxic, and face

***Received**: 12-12-2025 - **Accepted**: 20-12-2025 - **Published**: 23-12-2025*

Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

a significantly higher risk of poor outcomes [7,8]. For example, infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA) are associated with a mortality rate nearly 64% higher than those caused by susceptible strains [9]. The economic impact is profound, stemming from extended hospitalization, lost productivity, and the soaring costs of research and development for new antimicrobial agents [10].
Addressing the AMR crisis, therefore, requires a multi-pronged, "One Health" strategy that encompasses human medicine, animal husbandry, and environmental stewardship. Reliable diagnostic data are essential for guiding appropriate treatment in this endeavor. Precise antimicrobial susceptibility testing (AST) forms the foundation of successful antimicrobial stewardship, guaranteeing that patients receive the right antibiotic without delay while preventing the use of unneeded or ineffective treatments [11]. However, the reliability of AST itself is contingent upon strict adherence to internationally standardized laboratory protocols. Deviations from these standards can generate misleading results, directly contributing to the cycle of misuse and resistance [12]. Simultaneously, there is a pressing requirement for novel treatments to address the shrinking pipeline of effective antibiotics. Promising research into new antimicrobial agents, such as modified glycosides, highlights ongoing efforts to develop therapies against resistant pathogens [13].
Public understanding and behavior are essential in the fight against AMR. The knowledge, attitudes, and practices (KAP) of a population directly influence antibiotic demand and usage patterns, thereby driving the development and spread of resistance [14]. Therefore, this study aims to assess the knowledge, attitudes, and practices regarding antimicrobial resistance among the general public in Benghazi, Libya.

Methods

Study Design and Setting

A descriptive, cross-sectional study was conducted in Benghazi, Libya, from October 1 to November 30, 2025.

Study Population and Sampling

The target population was the general adult public in Benghazi. A sample of 200 participants was recruited using a convenience sampling method. A structured questionnaire was developed to assess participants' Knowledge, Attitudes, and Practices (KAP) regarding antibiotic use and antimicrobial resistance. The instrument was adapted from the validated English-language framework of the World Health Organization's "Antibiotic Resistance: Multi-Country Public Awareness Survey" (WHO, 2015) [15]. Modifications were made to ensure cultural relevance and contextual appropriateness for the Libyan population.

Questionnaire Adaptation, Translation, and Validation

The English version of the questionnaire was translated into Arabic by two independent bilingual translators, and the two translations were synthesized into a single Arabic draft. This draft was then back-translated into English by a third translator to verify conceptual accuracy and identify any discrepancies. The research team reviewed all versions to resolve inconsistencies and finalize the Arabic translation. Subsequently, the Arabic questionnaire was pilot-tested with 20 individuals from the target population to assess comprehension, clarity, flow, and average completion time. Feedback from this pilot phase informed minor final wording adjustments. Data from the pilot test were excluded from the final analysis. The reliability of the multi-item scales was assessed using Cronbach's alpha. The resulting coefficients indicated good to excellent internal consistency: 0.85 for the knowledge scale, 0.92 for the attitude scale, and 0.87 for the practice scale. The final questionnaire comprised four sections: (A) Socio-demographic characteristics (e.g., age, gender, educational level). (B) Knowledge assessment (7 items covering the definition and mechanism of AMR, antibiotic efficacy). (C) Attitudes assessment (5 items assessing perceived severity, personal concern, and responsibility regarding AMR). (D) Practices evaluation (3 items related to prescription adherence and self-medication behaviors).

Data Collection and Scoring

Data were collected using a mixed-methods approach. This included an anonymous, self-administered online survey (via Google Forms) supplemented by structured face-to-face interviews in community settings to enhance accessibility and reach participants. Scoring for the KAP domains was conducted as follows: Knowledge Score: One point was awarded for each correct answer from the 7 knowledge items, yielding a total score out of 7. A score greater than 50% (>4 points) was classified as "good" knowledge, while a score of ≤50% was classified as "poor." Attitude Score: Responses to the 5 attitude items were summed. A total score exceeding 50% of the possible points (>3 points) was categorized as a "positive" attitude; a score of ≤50% was categorized as "negative." Practice Score: For the 2 practice items, one point was assigned for each response indicative of safe antibiotic use (e.g., non-prescription use, reporting complete adherence to

***Received**: 12-12-2025 - **Accepted**: 20-12-2025 - **Published**: 23-12-2025*

Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

a prescribed course). A total score greater than 50% was defined as "good" practice, and a score of ≤50% as "poor" practice.

Statistical Analysis
Data analysis was performed using IBM SPSS Statistics, version 25.0. Descriptive statistics, including frequencies and percentages, were computed for all variables. Associations between categorical variables (e.g., socio-demographic factors and KAP categories) were examined using the Chi-square test. To identify independent predictors of "poor" knowledge and "poor" practice, multivariate binary logistic regression analyses were conducted, with results reported as adjusted odds ratios (AOR) and 95% confidence intervals. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations
Before participation, all individuals received a complete explanation of the study's purpose and procedures. For the online survey, consent was indicated by proceeding to the questionnaire after reading a digital information sheet, while for face-to-face interviews, verbal consent was obtained from each participant. No personally identifiable information was collected at any stage. Participant confidentiality was protected throughout the study by collecting, handling, and storing all data anonymously.

Results
The socio-demographic profile of the participants (N=200) is presented in (Table 1). The sample was predominantly female (87.0%) and comprised mainly middle-aged adults, with the largest proportion belonging to the 45–54 age group (36.0%). Educationally, the participants had attained higher education, with 40.0% holding a bachelor's degree and 21.0% a postgraduate qualification.

Table 1. Socio-demographic characteristics of participants (N = 200).

Characteristic	Category	N	%
Gender	Female	174	87.0
	Male	26	13.0
Age Group (years)	18–24	22	11.0
	25–34	50	25.0
	35–44	56	28.0
	45–54	72	36.0
Educational Level	Preparatory /Secondary school	20	10.0
	Diploma	58	29.0
	Bachelor's degree	80	40.0
	Postgraduate	42	21.0

Assessment of the knowledge of participants regarding antimicrobial resistance
As shown in Table 2, a strong majority of participants correctly grasped important AMR concepts. High proportions understood person-to-person transmission (87.0%), how misuse speeds resistance (94.0%), the agricultural link (84.0%), and preventive measures like handwashing (92.5%) and vaccination (79.0%). However, two critical misconceptions were widespread. Most critically, 32.0% erroneously believed antibiotics are effective against viral infections like colds and flu, a misconception that directly fuels inappropriate antibiotic demand. Additionally, 64.0% misunderstood the core mechanism of AMR, falsely attributing resistance to the human body instead of bacteria.

Table 2. Response of participants regarding the knowledge questions (N = 200).

Statement	Correct Answer	Correct Responses N (%)		Incorrect Responses N (%)	
1. Antibiotics are effective against viral colds/flu.	No	136	(68.0)	64	(32.0)
2. AMR occurs when the human body becomes resistant.	No	72	(36.0)	128	(64.0)
3. Resistant bacteria can spread person-to-person.	Yes	174	(87.0)	26	(13.0)
4. Misuse speeds up resistance spread.	Yes	188	(94.0)	12	(6.0)
5. Animal antibiotic use contributes to human AMR.	Yes	168	(84.0)	32	(16.0)
6. Handwashing prevents the spread of resistant bacteria.	Yes	185	(92.5)	15	(7.5)
7. Vaccinations help reduce antibiotic resistance.	Yes	158	(79.0)	42	(21.0)

Received: 12-12-2025 - **Accepted**: 20-12-2025 - **Published**: 23-12-2025

Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

The knowledge levels among participants revealed that 78.0% demonstrated good knowledge, indicating that the core information or training objectives are being effectively understood and retained by the target population. While the remaining 22.0% with poor knowledge (Table 3)

Table 3. Knowledge Assessment

Knowledge Level	N	%
Good Knowledge	156	78.0%
Poor Knowledge	44	22.0%

The assessment of attitudes revealed a strong normative consensus on appropriate antibiotic use, with 96.0% of respondents agreeing that everyone must use antibiotics responsibly and 92.0% expressing trust in physician prescribing. In contrast, perceptions of risk were markedly lower, as only 27.5% identified antimicrobial resistance (AMR) as a leading global issue and merely 45.5% reported concern about its potential impact on their family (Table 4).

Table 4. Response of participants regarding attitude questions (N = 200).

Statement	Yes: N (%)	No: N (%)
AMR is a top global problem	55 (27.5)	145 (72.5)
Worried about AMR impact on family	91 (45.5)	109 (54.5)
Everyone must use antibiotics responsibly	192 (96.0)	8 (4.0)
Doctors prescribe only when needed	184 (92.0)	16 (8.0)
Use only when prescribed	172 (86.0)	28 (14.0)

The data indicate a highly favorable overall attitude among the participants. A significant majority (85.0%) demonstrated a positive attitude, while a relatively small proportion (15.0%) held a negative attitude (Table 5).

Table 5. Attitude Assessment

Attitude Level	N	%
Positive Attitude	170	85.0%
Negative Attitude	30	15.0%
Total	200	100.0%

The assessment of practice revealed a concerning level of non-adherence to recommended antibiotic use guidelines. Notably, a substantial portion of participants (28.5%) reported using antibiotics without a prescription, a major driver of antimicrobial resistance. Furthermore, nearly half (48.0%) indicated they stop taking antibiotics once symptoms improve, a practice that can lead to incomplete treatment and promote the development of resistant bacteria (Table 6).

Table 6. Response of participants regarding the practice questions (N = 200).

Statement	Yes n (%)	No n (%)
Used antibiotics without a prescription	57 (28.5)	143 (71.5)
Stop antibiotics when symptoms improve	96 (48.0)	104 (52.0)

Based on (Table 7), the data indicate that a majority of participants (58.0%) demonstrated poor practice levels, while less than half (42.0%) exhibited good practice.

Table 7. Practice Assessment

Practice Level	n	%
Good Practice	84	42.0%
Poor Practice	116	58.0%
Total	200	100.0%

The bivariate analysis revealed significant associations between KAP levels and socio-demographic factors (Tables 8,9,10). Lower educational level was significantly associated with both poor knowledge (p=0.001) and a negative attitude (p=0.040). Furthermore, younger age (18-34 years) was strongly linked to poor practice (p=0.001). No significant associations were found between gender and any of the KAP domains."

Received*: 12-12-2025 -* ***Accepted****: 20-12-2025 -* ***Published****: 23-12-2025*

Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

Table 8. Factors Associated with Knowledge Level

Factor	Category	Good Knowledge N (%)	Poor Knowledge N (%)	p-value
Gender	Female	136 (78.2%)	38 (21.8%)	0.832
	Male	20 (76.9%)	6 (23.1%)	
Age Group	18–34 years	48 (66.7%)	24 (33.3%)	0.012*
	35–54 years	108 (84.4%)	20 (15.6%)	
Education	Below Bachelor's	52 (66.7%)	26 (33.3%)	0.001*
	Bachelor's or higher	104 (85.2%)	18 (14.8%)	

Table 9. Factors Associated with Attitude Level

Factor	Category	Positive Attitude N (%)	Negative Attitude N (%)	p-value
Gender	Female	148 (85.1%)	26 (14.9%)	0.956
	Male	22 (84.6%)	4 (15.4%)	
Age Group	18–34 years	58 (80.6%)	14 (19.4%)	0.210
	35–54 years	112 (87.5%)	16 (12.5%)	
Education	Below Bachelor's	62 (79.5%)	16 (20.5%)	0.040*
	Bachelor's or higher	108 (88.5%)	14 (11.5%)	

Table 10. Factors Associated with Practice Level

Factor	Category	Good Practice N (%)	Poor Practice N (%)	p-value
Gender	Female	74 (42.5%)	100 (57.5%)	0.447
	Male	10 (38.5%)	16 (61.5%)	
Age Group	18–34 years	18 (25.0%)	54 (75.0%)	0.001*
	35–54 years	66 (51.6%)	62 (48.4%)	
Education	Below Bachelor's	28 (35.9%)	50 (64.1%)	0.089
	Bachelor's or higher	56 (45.9%)	66 (54.1%)	

Multivariate analysis identified lower education (AOR=3.2) as a predictor of poor knowledge. Younger age (AOR=4.1) was an independent predictor of poor practice (Table 11).

Table 11. Multivariate Logistic Regression: Predictor for outcome

Outcome	Predictor	AOR	95% CI	p-value
Poor Knowledge	Low education	3.2	1.50–6.82	0.002
Poor Practice	Younger age	4.1	2.00–8.40	0.001

Discussion

This study assessed the knowledge, attitudes, and practices (KAP) concerning antimicrobial resistance (AMR) among the general public in Benghazi, Libya. The results reveal a concerning pattern: while a large portion of participants demonstrated good general knowledge and positive attitudes, many still held critical misunderstandings and engaged in risky behaviors. A key finding was the major gap between what people know and what they actually do. While 78.0% had good knowledge and 85.0% had positive attitudes, only 42.0% reported good practices. This gap is even larger than those found in similar studies from Kuwait and Saudi Arabia, indicating that changing behavior is a particularly challenging task in Libya [16,17].

The study identified fundamental misconceptions; 68.0% of participants incorrectly believed antibiotics are effective against viral infections. This misconception is widespread across the Middle East and North Africa (MENA) region, with comparable figures reported in Egypt (72%) and Jordan (65%) [18,19]. This remains a global issue, though it is less common in Northern European countries like Sweden due to ongoing public health campaigns. This specific misunderstanding is notably higher than the approximately 30% found in public surveys in the United Kingdom and appears particularly widespread in our setting, indicating a critical gap in foundational public health messaging [20,21].

The present study revealed generally poor medication practices. The rate of antibiotic self-medication without a prescription (28.5%) was significantly higher than that reported in Sudan [22], suggesting potentially less stringent regulatory oversight of pharmacy sales in Libya. However, it remained lower than rates documented in some South Asian countries, such as India, where it exceeds 50% [23]. Furthermore,

***Received**: 12-12-2025 - **Accepted**: 20-12-2025 - **Published**: 23-12-2025*

Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

the widespread practice of discontinuing treatment once symptoms improve (48.0%) mirrored rates observed in Pakistan [24]. In contrast, studies from Malaysia report a generally lower prevalence of antibiotic self-medication, with recent population-based surveys indicating rates between 12.5% and 15.1% [25,26].

The present study found that low educational attainment was a strong predictor of significant gaps in knowledge about antimicrobial resistance (AMR). This result is consistent with findings from diverse countries, including Nigeria and Indonesia, confirming that formal education is a universal cornerstone of health literacy [27,28]. Furthermore, the current study identified younger adults (aged 18–34) as the demographic at the highest independent risk for unsafe antibiotic practices. They were over four times more likely to report poor antibiotic use habits than older groups, even after adjusting for knowledge level. This strong age-based association is consistent with studies from Jordan and Egypt, where younger adults also exhibit higher rates of self-medication. This risky behavior is driven by a combination of factors: a feeling of invulnerability, a greater trust in online sources or advice from friends than in doctors, easier access to medicines without a prescription, and different habits for when to seek medical help [18,19]. For these reasons, broad public health messages tend to be ineffective in reaching and influencing these younger adults.

The present study reveals a critical 'perception gap.' While there was overwhelming agreement with abstract principles of responsible use (96.0%) and trust in physician prescribing (92.0%), a striking deficit existed in the sense of personal risk. Only 27.5% recognized AMR as a major global threat, and merely 45.5% were concerned about its impact on their own families. This dissociation between acknowledged principles and personal risk perception is a well-documented barrier to behavioral change, observed in diverse settings from Greece to Switzerland [29,30]. Therefore, public health efforts must do more than just share information. To truly change behavior, campaigns need to address the real reasons people make decisions: their knowledge, social influences, personal risk-benefit calculations, and underlying values.

Conclusion

Despite relatively good reported knowledge and positive attitudes toward antimicrobial resistance, dangerous practices involving antibiotics continue to be prevalent. Many participants do not demonstrate safe usage, indicating a troubling trend of misuse. Key issues include the use of antibiotics without prescriptions and discontinuing treatment when symptoms improve. The study highlights that young adults and individuals with lower education levels are particularly vulnerable, showing higher instances of poor knowledge and unsafe practices. This underscores the urgent need for targeted interventions to improve understanding and promote safer antibiotic use.

Recommendations

Based on the study findings, several targeted interventions are recommended to promote prudent antibiotic use in Libya. First, targeted education should be directed at high-risk groups, particularly young adults, through interactive programs designed to correct misconceptions about antibiotics. In addition, strict enforcement of prescription-only laws is necessary to prevent the sale of antibiotics over the counter without medical supervision. Healthcare professionals should also receive training in antibiotic stewardship and patient communication so they can better guide individuals in the appropriate use of these medications. Furthermore, conducting national research is essential to identify the root causes of antibiotic misuse and to develop evidence-based solutions tailored to the Libyan context. Finally, mobile applications can be utilized to support patient adherence and awareness by providing reminders, tracking usage, and delivering educational messages that reinforce responsible antibiotic practices.

Acknowledgments

I would like to express my sincere gratitude to Prof. Lubna Abdulmalek and Dr. Asma Salem for their guidance and continuous support during this study. Also, we are deeply thankful to all the study participants for their time and contribution, which formed the essential foundation of this work. Furthermore, we acknowledge the importance of community engagement in addressing antibiotic resistance, which is vital for the success of future initiatives.

Conflict of Interest

The author declares no conflicts of interest.

References

1. World Health Organization. WHO bacterial priority pathogens list, 2024: bacterial pathogens of public health importance, to guide research, development, and strategies to prevent and control antimicrobial resistance. Geneva: World Health Organization; 2024.

***Received**: 12-12-2025 - **Accepted**: 20-12-2025 - **Published**: 23-12-2025*

Libyan Med J. 2025;17(4):461-467
https://doi.org/10.69667/lmj.2517416
Libyan Medical Journal
https://lmj.ly/index.php/ojs/index eISSN: 2079-1224

2. Dadgostar P. Antimicrobial resistance: implications and costs. Infection and drug resistance. 2019; 12:3903–3910.
3. Murray CJL, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. Lancet. 2022;399(10325):629-655.
4. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. The Review on Antimicrobial Resistance. London: HM Government; 2016.
5. Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. P T. 2015;40(4):277-83.
6. Endale H, Mathewos M, Abdeta D. Potential causes of spread of antimicrobial resistance and preventive measures in one health perspective review. Infect Drug Resist. 2023;16:7515-45.
7. Cosgrove SE. The relationship between antimicrobial resistance and patient outcomes: mortality, length of hospital stays, and health care costs. Clin Infect Dis. 2006;42 Suppl 2:S82-9.
8. Atia A, Gzllal N, Gharibe M. Evaluation of drug prescription pattern using who prescribing indicators in Libya: A cross-sectional study. Iraqi Journal of Pharmaceutical Sciences. 2023 Jun 27;32(1):266-73.
9. Klein EY, Sun L, Smith DL, Laxminarayan R. The impact of antimicrobial resistance on health and economic outcomes. Clin Infect Dis. 2013;56(9):1308-14.
10. Smith R, Coast J. The true cost of antimicrobial resistance. *BMJ*. 2013;346: f1493.
11. Kumar A, Schwatz DE, Kethireddy S, Kaye KS, O'Brien J. Antimicrobial stewardship: the need to cover all fronts. J Antimicrob Chemother. 2013;68(9):1947-50.
12. Almshawit H, Shagshog R, Tahar W. Deviations from standard disk diffusion protocols for antimicrobial susceptibility testing in medical laboratories in Gharyan. Libyan Med J. 2025;17(4):426-31.
13. Islam AU, Hadni H, Ali F, Abuzreda A, Kawsar SMA. Synthesis, antimicrobial activity, molecular docking, molecular dynamics simulation, and ADMET properties of the mannopyranoside derivatives as antimicrobial agents. J Taibah Univ Sci. 2024;18(1):2327101.
14. McCullough AR, Parekh S, Rathbone J, Del Mar CB, Hoffmann TC. A systematic review of the public's knowledge and beliefs about antibiotic resistance. J Antimicrob Chemother. 2016;71(1):27-33.
15. World Health Organization. Antibiotic resistance: multi-country public awareness survey. Geneva: World Health Organization; 2015.
16. Awad AI, Aboud EA. Knowledge, attitude, and practice towards antibiotic use among the public in Kuwait. PLoS One. 2015;10(2):e0117910.
17. Alrasheedy AA, Alsalloum MA, Almuqbil FA, Almuzaini MA, Aba Alkhayl BS, Albishri AS, et al. The impact of law enforcement on dispensing antibiotics without prescription: a multi-method study from Saudi Arabia. Expert Rev Anti Infect Ther. 2020;18(1):87-97.
18. Elkhadry SW, Tahoon MA. Health literacy and its association with antibiotic use and knowledge of antibiotics among the Egyptian population: cross-sectional study. BMC Public Health. 2024;24(1):2508.
19. Al-Azzam SI, Al-Husein BA, Alzoubi F, Masadeh MM, Al-Horani S. Self-medication with antibiotics in the Jordanian population. Int J Occup Med Environ Health. 2007;20(4):373-80.
20. Vallin M, Polyzoi M, Marrone G, Rosales-Klintz S, Tegmark Wisell K, Stålsby Lundborg C. Knowledge and attitudes towards antibiotic use and resistance: a latent class analysis of a Swedish population-based sample. PLoS One. 2016;11(4):e0152160.
21. McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. The public's attitudes to and compliance with antibiotics. J Antimicrob Chemother. 2007;60(1):63-8.
22. Omran S, Kheyar M, Alfatih N, Abdelatti A, Alamin MF, Hamadalneel YB. Public knowledge, attitudes, and practices toward antibiotic use among the adult Sudanese community: a cross-sectional descriptive study. J Public Health Res. 2025;14(3):22799036251365577.
23. Kotwani A, Holloway K. Trends in antibiotic use among outpatients in New Delhi, India. BMC Infect Dis. 2011;11:99.
24. Ahmed T, Mangi AA, Ahmed W, Abbas J, Shaikh B, Qazi M, Irfan R, et al. Evaluation of self-medication practice along with prescribed medicines among the local population of Karachi, Pakistan. J Pharm Res Int. 2021;32(42):28-34.
25. Kong L, Islahudin F, Muthupalaniappen L, Chong W. Knowledge and expectations on antibiotic use among the general public in Malaysia: a nationwide cross-sectional survey. Patient Prefer Adherence. 2021;15:2405-16.
26. Aslam A, Zin CS, Ab Rahman NS, Gajdács M, Ahmed SI, Jamshed S. Self-medication practices with antibiotics and associated factors among the public of Malaysia: a cross-sectional study. Drug Healthc Patient Saf. 2021;13:171-81.
27. Chukwu EE, Oladele DA, Awoderu OB, Afocha EE, Lawal RG, Abdus-Salam I, et al. A national survey of public awareness of antimicrobial resistance in Nigeria. Antimicrob Resist Infect Control. 2020;9(1):72.
28. Karuniawati H, Hassali MA, Suryawati S, Ismail WI, Taufik T, Hossain MS. Assessment of knowledge, attitude, and practice of antibiotic use among the population of Boyolali, Indonesia: a cross-sectional study. Int J Environ Res Public Health. 2021;18(16):8258.
29. Papadimou D, Malmqvist E, Ancillotti M. Socio-cultural determinants of antibiotic resistance: a qualitative study of Greeks' attitudes, perceptions and values. BMC Public Health. 2022;22(1):1439.
30. Visschers VH, Feck V, Herrmann A. Knowledge, social influences, perceived risks and benefits, and cultural values explain the public's decisions related to prudent antibiotic use. Risk Anal. 2022;42(7):1488-503.

***Received**: 12-12-2025 - **Accepted**: 20-12-2025 - **Published**: 23-12-2025*