



Assessment of Public Awareness, Attitude, and Practice Regarding Antibiotic Resistance in Kemissie Town, Northeast Ethiopia: Community-Based Cross-Sectional Study

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Background: Antibiotic resistance is increasing to dangerously high levels globally with subsequent higher medical costs, prolonged hospital stays and increased levels of mortality. Ensuring patients' knowledge, attitude, and proper use of antimicrobials is one of the strategies to control resistance. The aim of this study is to evaluate the public awareness, attitude, and practice regarding antimicrobial use and resistance in Kemissie Town, Northeast Ethiopia.

Methods: A community-based, cross-sectional study was conducted on 385 adults selected using systematic random sampling in Kemissie town from March 1 to May 1, 2019. A home-to-home visit interview was done using a structured interview guide. The data were coded individually and entered into a computer using Epi-info version 3.5.1 and then exported to SPSS version 23.0 for analysis. Univariate analyses were used to describe the categorical variables.

Results: Of the 345 respondents who took antibiotics, three quarters (74.78%) received antibiotics with a prescription. Of the total respondents, 17.7% of the participants believed unnecessary use of antibiotics enhances resistance to bacteria. Of those who took antibiotics, the majority (72.5 %) finished the full course of treatment. Out of the total 374 respondents, 41.6% had awareness on the fact that antibiotics resistance can affect the development of resistance in the whole community. More than half (51.9%) of the respondents believed that the rational use of antibiotics can reduce the risk of antimicrobial resistance.

Conclusion: The majority of the respondents were still unaware of antibiotic resistance and its implications. This requires close attention from policy-makers and healthcare professionals. The community of Kemissie town had a positive attitude towards finishing antibiotic regimens. This study also identified crucial gaps in the practices of the community about the use of antibiotics.

Keywords: antibiotic resistance, attitude, knowledge, practice

Introduction

Antibiotics are agents that reduce and inhibit the growth of microorganisms.¹ The emergence of antibiotics has become breakthrough in the modern medicine; they have been an integral part of human and animal health, which allowed the treatment of life-threatening bacterial infections.^{2,3}

The effectiveness of antibiotics has been compromised by the emergence of resistant micro-organism. Antibiotic resistance threatens public health throughout the world. It is exacerbated by the irrational use of antibiotics, poor infection

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prevention, and control programs, poor-quality medicines, and diminished regulatory enforcements to assure access to high-quality antimicrobial medicines and their appropriate use.⁴ The emergence of multi-resistant bacteria that resist treatment with previous antibiotics is the other factor that makes antimicrobial resistance (AMR) a huge concern for many countries.^{5,6}

The trends of infections and drug resistance are increasing.⁷ Several studies identified different risk factors for antibiotics resistance, such as low adherence to treatment guidelines, a shortage of antimicrobials and infection prevention materials, inadequate knowledge and practices among healthcare providers on the antimicrobial selection, and health facilities' limited action on AMR prevention and containment, patient non-compliance, sharing of drugs, and more use of leftover antibiotics.⁸⁻¹² Most of these risk factors are directly related to low awareness of the public towards antimicrobial use and resistance. These all require multiple interventions that can form a synergy to prevent and contain AMR.¹³

The emergence of multi-resistant antibacteria that were effective previously had brought global health and economic consequences.¹⁴ In addition to the low awareness of community members and their limited knowledge associated with irrational use of antibiotics are contributing to antibiotic resistance.^{15,16} It is known that antibiotics knowledge is poor among patients and the general public in many countries.¹⁷

Public awareness, attitude, and practice regarding antibiotics resistance is the primary step in formulating a template for effective antibiotic stewardship. In Ethiopia, the problem of AMR is significant. For example, the misuse of antimicrobials by different healthcare providers and drug users coupled with the rapid spread of resistant bacteria has exacerbated the problem.¹⁸ In light of this fact, the present study aimed to assess public awareness, attitude, and practice regarding antimicrobial resistance among the community of Kemissie town, Northeast Ethiopia.

Methods

Study Area and Period

A community-based cross-sectional study design was adopted. The study was conducted in Kemissie town, located 325 Km North East of Addis Ababa, the capital of Ethiopia from March 1 to May 1, 2019. Kemissie town has seven Districts (kebeles). Based on the 2015 Central Statistical Agency of Ethiopia (CSA) census, the town had a total population of 19,420.

Source and Study Population

The source population for this study was all households of Kemissie town. Household members who were selected by the sampling techniques and who fulfilled the inclusion criteria were included in the present study.

Inclusion and Exclusion Criteria

Household members who lived at least for 6 months in Kemissie town, whose age was above 18 years, and who were free of mental illness were included in this study. Those household members who had difficulty in hearing or speaking were excluded from the study.

Sample Size Determination

Sample size was determined using single population proportion formula. Using a 5% margin of error, 95% confidence interval, and 50% proportion, the final sample size was found to be 385. Then, the required sample size was proportionately allocated to each district (kebele).

Sampling Procedures and Data Collection

Kemissie town has seven districts (kebeles). Out of these, three districts (district 01, 03, and 05) were selected using a simple random sampling technique. Districts 01, 03, and 05 had total households of 1,562, 1,347, and 1,016, which accounts for 40%, 34%, and 26% of the total population of kemissie town, respectively. Then samples of 154, 131, and 100 households were selected from districts 01, 03, and 05s respectively using a systematic random sampling proportional to sample size technique. The sampling interval for each Kebele was calculated as: $K=N/n$. The first household was selected by random lottery method and then every 10th household was selected until the required sample size was obtained. A standardized questionnaire that was first prepared in English, and later, for the sake of simplicity, translated to local language, Amharic, was used to collect data. The questionnaire consisted of socio-demographic characteristics, awareness, attitude, and practice regarding antimicrobial resistance.

Data Quality Assurance

To ensure data quality, the data collection tool was pre-tested on 10 households. Daily supervision was also made by the principal investigator during the data collection period and any inconsistencies were amended on time. Regular cross-checking, inspection, and scrutinizing of

information on the data collection tool were also done to ensure completeness of the data.

Data Analysis

The collected data were coded and entered in a computer using Epi-info version 3.5.1 and then exported to SPSS version 23.0 for analysis. Univariate analyses were used to describe the categorical variables (frequency and percentage distributions of different characteristics).

Results

Socio-Demographic Variables

Out of the total 385 respondents, 374 participants responded to the questionnaire producing a response rate of 97%. The majority of the participants (251, 67%) were females. One-third of respondents (124, 33.2%) were in the age group of >40 years, and the vast majority (318, 83.9%) were Muslims (Table 1).

Sources of Antibiotics

The vast majority of the respondents (345, 92%) took antibiotics. Of these, 258 (74.78%) obtained the antibiotics from hospitals/healthcare facilities with a prescription, 14 (4%) from drug retail outlets, and seven (2%) obtained the antibiotics by sharing from others (Table 2).

Table 1 Socio-Demographic Characteristics of Respondents in Kemissie Town, Northeast Ethiopia, May 2019 (N=374)

Variables	Category	Frequency (%)
Sex	Male	123 (33%)
	Female	251 (67%)
Age category	18–26	113 (30.1%)
	27–35	86 (23.1%)
	36–40	49 (13%)
	>40	124 (33.2%)
Religion	Muslim	14 (83.9%)
	Orthodox	50 (13.5)
	Protestant	10 (2.6%)
Education status	Illiterate	115 (31%)
	Elementary	99 (26.5%)
	High school	82 (21.8%)
	Higher education	78 (20.9%)
Monthly income	150–300 birr	49 (13.0)
	300–500 birr	57 (15.3%)
	500–1,000 birr	109 (29.1%)
	>1,000 birr	159 (42.6%)

Table 2 Common Source of Antibiotics (n=345) in Kemissie Town, Northeast Ethiopia, May 2019

I usually obtain antibiotics from hospital/healthcare facility with prescription	258 (74.8%)
Retail outlet pharmacy	14 (4%)
By sharing with others	7 (1.8%)

Participants Practice of Antibiotic Use

Out of those who obtained antibiotics from hospitals/healthcare facilities, 342 (99.13%) obtained clear information with verbal and/or written information. Of these, the vast majority (308, 90%) followed the instructions they received from healthcare professionals. The majority (297, 86.8%) followed the instruction on the time gap to take the antibiotic, and 248 (72.5%) finished the full course of antibiotic treatment. Of the 94 respondents who did not complete the full course of antibiotic treatment, 71 (75.5%) discontinued the treatment due to early improvement, 34 (36.2%) due to absence of response, 21 (22.3%) due to time deviation, and 34 because of negligence, being fed up, and being bored (Table 3).

Respondents Attitude Towards Antibiotic Use and Resistance

Out of the total 374 respondents, 200 (28.4%) believed in rational use of antibiotics, 188 (26.6%) believed in using antibiotic according to instruction and advice given, 149 (19.3%) did not share antibiotics with other people, 136 (21.2%) bought antibiotics with prescription and with the necessary information, while 32 (4.5%) stated that other solutions could be the possible solution to reduce the risk factors for medication resistance (Table 3).

Participants Awareness on Antimicrobial Resistance

The majority, (222, 59.4%) of the respondents had heard the term antimicrobial resistance. Among these, 144 (64.8%) heard the term from healthcare professionals, 81 (36.5%) from mass media, and 67 (30.2%) from their friends. Among those who heard the term antibiotic resistance, more than three-quarters 171 (77%) had correct knowledge on the meaning of antimicrobial resistance.

Nearly half (178, 47.6%) of the total respondents realized the risk factors for AMR. Overuse/underuse of antibiotics, failure to complete the full course of therapy, sharing antibiotics with other people, obtaining antibiotics without prescription, taking antibiotics without

Table 3 The Respondent's Attitude and Practice Towards the Use of Antibiotics in Kemissie Town, Northeast Ethiopia, May 2019 (N=374)

Variables	Yes (%)
I take the antibiotic as advised by the health professional	342 (99.13%)
I finish the antibiotic as advised by the health professional	248 (72.52%)
I consider the time gap advised between doses during antibiotics use	297 (86.42%)
I stop taking antibiotics If I feel better after a few days	71 (75.53%)
I stop the drug due to time deviation from the normal schedule	21 (22.34%)
I have stopped an antibiotic due to negligence, being fed up, and bored	34 (36.17%)
Take without prescription	122 (35.67%)
I have suffered from different microbial infection during my lifetime	359 (96.10%)
I have never suffered from microbial infection	15 (3.90%)
I took antibiotics to treat that specific microbial infection	345 (96.20%)
Attitude about how to reduce antibiotic resistance (n=374)	
Rational use of antibiotics	200 (28.4%)
Using antibiotics according to advice and information are given	188 (26.2%)
Not sharing antibiotics with others	136 (19.3%)
Using antibiotics with prescription	149 (21.2%)

considering dose, and time gap were mentioned by 17.7%, 23.7%, 17.7%, and 18.3% of the respondents, respectively, as risk factors for antimicrobial resistance (Table 4).

Out of the 222 respondents who heard about the term antimicrobial resistance, 112 (50.4%) were aware of the problems of antibiotic resistance. 153 (23.4%), 131 (20.0%), 187 (28.6%), 148 (22.6%) of the respondents were aware of the fact that resistance has a decreasing effect on the activity of the antibiotic, there will be a need for expensive drugs, they will not be cured of the diseases, and there will be increased intensity and duration of diseases, respectively (Table 4).

Discussion

The present study intended to assess public awareness, attitude, and practice regarding antimicrobial resistance. Three-quarters (74.7%) of the respondents obtained antibiotics from a hospital/healthcare facility with a prescription, which was higher than studies done in Harar city, Eastern Ethiopia (65%)¹⁹ and Malaysia (43%),²⁰ but lower than a study conducted in the UK (95.7%).²¹ These differences might be due to differences in regulation of antimicrobial stewardship and its enforcement. The finding of the present study calls for

Table 4 Awareness About Microbial Resistance in Kemissie Town, Northeast Ethiopia, May 2019 (N=374)

Variables	Yes (%)
I heard/encountered the term "Antibiotic resistance" before Source of information (N=222)*	222 (59.36%)
Healthcare professional	144 (64.8%)
Mass media	81 (36.5%)
Friends	67 (30.2)
I know what the term "Antibiotic resistance" means	171 (77.03%)
I have been informed about "How often" and "How much" to take the antibiotic verbally and/or with any written material?	129 (19.3%)
I think that the development of Antibiotic resistance has a problem	178 (47.59%)
Unnecessary use of antibiotics can increase the resistance of bacteria to them	118 (17.7%)
Resistance to antibiotics is a worldwide problem	154 (41.6%)
What do you think are risk factors of antibiotic resistance (N=174)	
Over or underuse of antibiotic	118 (17.7%)
Failure to complete the course of therapy	158 (23.7%)
Sharing antibiotics with others	118 (17.7%)
Taking antibiotics without prescription	122 (18.3%)
Taking antibiotic without considering the dose and time gap	129 (19.3%)
Others	22 (3.3%)
What do you think are the consequences of the antibiotic resistance (N=374)	
Decrease antibiotic activity	153 (23.4%)
Need for expensive drug	131 (20%)
Not cured from the diseases	287 (28.6%)
Increases intensity and duration of the diseases	148 (22.6%)

Note: *Multiple responses were possible so that the percentage may exceed 100%.

stringent control by regulatory bodies and pharmacists when dispensing antibiotics.

In the present study only 1.8% of the respondents share antibiotics with others. Surprisingly, comparable findings were obtained in the study done in the UK (1.7%).²¹ About one fifth (19.3%) of the respondents emphasized the need for prescriptions for antibiotics. This was far lower than a study done in Hara city, Eastern Ethiopia (73.1%).¹⁹ This might be due to differences in awareness of the community. Regarding the course of antibiotic regimen, the majority (72.5%) completed their antibiotic regimen. This was higher than studies done in China (50%)²² and Harar city, East Ethiopia (64%).¹⁹ Though this finding was higher than findings from other areas, still there is a gap in finishing the full antibiotic regimen among the community of Kemissie

town, which is related with enhancement of antibiotic resistance.

In the present study, 59.4% of respondents heard the term antibiotic resistance which was lower than a study done in Egypt (75.1%).²³ This implies that efforts such as patient education should be done to create awareness among the community of Kemissie town on antimicrobial resistance. Patient education has paramount importance in reducing AMR as supported by a study done in Hungary.¹²

Out of total of 222 respondents who heard the term antibiotic resistance, half (50.4%) were aware of the impact of antimicrobial resistance. This was higher than studies done in Scotland and the UK, in which 45% and 19% of respondents, respectively, stated that they were not concerned about antibiotic resistance.²⁴ These differences might be due to differences in study time, since the later were done earlier, the respondents of the present study might become aware of antibiotic resistance through media publicity and public information campaigns.

In the present study, only 17.7% of the participants believed unnecessary use of antibiotics enhances resistance to bacteria which is again lower than a study done in Harar, Eastern Ethiopia (78.3%) and Bahirdar, Western Ethiopia (69.7%).²⁵ Out of these, only 41.6% realized antimicrobial resistance is a worldwide problem which is higher than a study done in Eastern Ethiopia (31%)¹⁹ and lower than a study done in Saudi Arabia (66.5%).²⁶

Concerning the consequences of antibiotic resistance, about 29% of the participants believed they were not cured because of AMR and, hence, 20% of them believed that it is better to shift to other expensive drugs or to natural products available in the local area. The intention of the participants to shift to natural products to treat AMR resistant bacteria can be supported by the findings from the following studies; Essential oils like lavender oil,²⁷ *Rosmarinus officinalis*, *Melaleuca alternifolia*, and *Thymus vulgaris*,²⁸ *Melaleuca alternifolia*, and *Thymus vulgaris*—red thyme geraniol²⁹ have been shown to have antibacterial activity against *Pseudomonas aeruginosa* bacteria. A new approach could be using new drugs such as inhibitors of applicable pump.³⁰

Limitations of the Study

Since this study employed a descriptive cross-sectional design, we were unable to identify factors associated with the awareness, attitude, and practice of the participants regarding antimicrobial resistance.

Conclusion

The majority of the respondents obtained antibiotics with prescriptions. This implies the majority of the respondents use appropriate sources of antibiotics. The majority of the respondents had positive attitude towards finishing the full antibiotic regimen. There was a gap in awareness and attitude regarding the cause of antibiotic resistance, need for a prescription. The level of awareness and concern about the consequences of antibiotics resistance was low. This study also identified crucial gaps in the practices of the community about the use of antibiotics. Health facilities should conduct health and drug education to increase public awareness on the appropriate use of antibiotics. Antibiotic awareness campaigns and patient counseling should be promoted to fill up the gaps in awareness on antibiotic resistance.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Informed Consent

Ethical clearance was issued from the College of Medicine and Health Science Ethical Committee, Wollo University (CMHS/225/025/19). Letter of cooperation was written to kemissie administrative health office. Permission was obtained from the management of Kemissie administrative health office before starting data collection. The participants were informed about the purpose of the study and verbal consent was obtained from each participant. The College of Medicine and Health Science Ethical Committee, Wollo University also approved the informed verbal consent process and to ensure patient confidentiality, participants were not identified by names or other personal identifiers. The study was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors made substantial contributions to the conception and design, acquisition of data, or analysis and

interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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The authors report no conflicts of interest in study.

References

- Dugassa J, Shukuri N. Review on antibiotic resistance and its mechanism of development. *J Health Med Nurs*. 2017;1(3):1–17.
- Laws M, Shaaban A, Rahman KM. Antibiotic resistance breakers: current approaches and future directions. *FEMS Microbiol Rev*. 2019;43(5):490–516.
- Gajdács M, Albericio F. *Antibiotic Resistance: From the Bench to Patients*. Multidisciplinary Digital Publishing Institute; 2019.
- WHO. *Worldwide Country Situation Analysis: Response to Antimicrobial Resistance: Summary*. World Health Organization; 2015.
- Tornimbene B, Eremin S, Escher M, Griskeviciene J, Manglani S, Pessoa-Silva CL. WHO global antimicrobial resistance surveillance system early implementation 2016–17. *Lancet Infect Dis*. 2018;18(3):241. doi:10.1016/S1473-3099(18)30060-4
- Gajdács M. The concept of an ideal antibiotic: implications for drug design. *Molecules*. 2019;24(5):892.
- Infectious disease society of America. Annual meeting; 2004. [cited Feb 27, 2019]. Available from: WWW.idsociety.org/content.aspx?
- Kandakai TL, Price JH, Telljohann SK, Holiday-Goodman M. Knowledge, beliefs, and use of prescribed antibiotic medications among low-socioeconomic African Americans. *J Natl Med Assoc*. 1996;88(5):289.
- Kardas P. Noncompliance in current antibiotic practice. *Infect Dis Clin Pract*. 2006;14(4):S11–S4. doi:10.1097/01.idc.0000230544.11499.8b
- Pecheur J-C, Hughes D, Kardas P, Cornaglia G. Non-compliance with antibiotic therapy for acute community infections: a global survey. *Int J Antimicrob Agents*. 2007;29(3):245–253. doi:10.1016/j.ijantimicag.2006.09.026
- Shehadeh M, Suaifan G, Darwish RM, Wazaify M, Zaru L, Alja'fari S. Knowledge, attitudes and behavior regarding antibiotics use and misuse among adults in the community of Jordan. A pilot study. *Saudi Pharm J*. 2012;20(2):125–133. doi:10.1016/j.jsps.2011.11.005
- Gajdács M, Paulik E, Szabó A. Knowledge, attitude and practice of community pharmacists regarding antibiotic use and infectious diseases: a cross-sectional survey in Hungary (KAPPhA-HU). *Antibiotics*. 2020;9(2):41. doi:10.3390/antibiotics9020041
- Andualem T, Mekonnen N, Daniel G, Joshi M, Keene D, Lee D. Magnitude of and contributing factors to antibacterial resistance in Ethiopia; 2011. Available from: http://www.inrud.org/ICIUM/ConferenceMaterials/309-andualem_t-_a.pdf.
- Gajdács M, Bátor Z, Ábrók M, Lázár A, Burián K. Characterization of resistance in gram-negative urinary isolates using existing and novel indicators of clinical relevance: a 10-year data analysis. *Life*. 2020;10(2):16. doi:10.3390/life10020016
- Thriemer K, Katuala Y, Batoko B, et al. Antibiotic prescribing in DR Congo: a knowledge, attitude and practice survey among medical doctors and students. *PLoS One*. 2013;8(2):e55495. doi:10.1371/journal.pone.0055495
- Pulcini C, Williams F, Molinari N, Davey P, Nathwani D. Junior doctors' knowledge and perceptions of antibiotic resistance and prescribing: a survey in France and Scotland. *Clin Microbiol Infect*. 2011;17(1):80–87. doi:10.1111/j.1469-0691.2010.03179.x
- Davis ME, Liu T-L, Taylor YJ, et al. Exploring patient awareness and perceptions of the appropriate use of antibiotics: a mixed-methods study. *Antibiotics*. 2017;6(4):23. doi:10.3390/antibiotics6040023
- Ethiopian Food, Medicine and Healthcare Administration and Control Authority. *National Strategic Frame Work for Prevention and Containment of Antimicrobial Resistance for Ethiopia*. Second Edn. 2015.
- Jifar A, Ayele Y. Assessment of knowledge, attitude, and practice toward antibiotic use among harar city and its surrounding community, Eastern Ethiopia. *Interdiscip Perspect Infect Dis*. 2018;20(18):1–6. doi:10.1155/2018/8492740
- Hassali MA, Arief M, Saleem F, et al. Assessment of attitudes and practices of young Malaysian adults about antibiotics use: a cross-sectional study. *Pharm Pract (Granada)*. 2017;15(2).
- McNulty CA, Collin SM, Cooper E, Lecky DM, Butler CC. Public understanding and use of antibiotics in England: findings from a household survey in 2017. *BMJ Open*. 2019;9(10):10. doi:10.1136/bmjopen-2019-030845
- Chen C, Chen Y-M, Hwang K-L, et al. Behavior, attitudes and knowledge about antibiotic usage among residents of Changhua, Taiwan. *J Microbiol Immunol Infect*. 2005;38(1):53–59.
- Refaei SA, Emam SA. *The Concept of Antibiotic Resistance Among the Rural Population*.
- Scotland HP, Division IS. *Scottish Antimicrobial Use and Resistance in Humans in 2015*. 2016.
- Tesfaye Z. Patient knowledge and practice on antimicrobial use and resistance in Felege Hiwot hospital, Bahir Dar, Ethiopia. *J Basic Clin Pharm*. 2017;8.
- Abujheisha KY, Al-Shdefat R, Ahmed N, Fouda MI. Public knowledge and behaviours regarding antibiotics use: a survey among the general public. *Int J Med Res Health Sci*. 2017;6(6):82–88.
- Donadu M, Usai D, Pinna A, et al. In vitro activity of hybrid lavender essential oils against multidrug resistant strains of *Pseudomonas aeruginosa*. *J Infect Dev Ctries*. 2018;12(01):009–14. doi:10.3855/jidc.9920
- Cannas S, Usai D, Pinna A, et al. Essential oils in ocular pathology: an experimental study. *J Infect Dev Ctries*. 2015;9(06):650–654. doi:10.3855/jidc.6842
- Amorese V, Donadu M, Usai D, et al. In vitro activity of essential oils against *Pseudomonas aeruginosa* isolated from infected hip implants. *J Infect Dev Ctries*. 2018;12(11):996–1001. doi:10.3855/jidc.10988
- Usai D, Donadu M, Bua A, et al. Enhancement of antimicrobial activity of pump inhibitors associating drugs. *J Infect Dev Ctries*. 2019;13(02):162–164. doi:10.3855/jidc.11102

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