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Assessment of Knowledge, Attitude, and Practices on Antimicrobial Use among Poult Keepers in Dar Es Salaam, Tanzania

Saxon J. Mwambene[a*],Augustino A. Chengula[b],Adelard B. Mtenga[c],Abubakar S. Hoza[d]

[a,c]*Tanzania Medicines and Medical Devices Authority, P. O. Box 77150 Dar es Salaam, Tanzania*

[a,b,d]*Department of Veterinary Microbiology, Parasitology and Biotechnology, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture, P.O. Box 3019, Morogoro, Tanzania*

[a]*Email:mahalasaxon@gmail.com*

[b]*Email:abhoza@sua.ac.tz*

[c]*Email:achengula@sua.ac.tz*

[d]*Email:adelard.mtenga@tmda.go.tz*

Abstract

Background: Antimicrobial resistance (AMR) is an emerging public health issue posing a threat to humans, livestock, and ecosystems globally, In Tanzania, the poultry sector contributes the majority share of animal-source protein. The irrational and excessive use of antimicrobials in the poultry sector may increase the risk of AMR residue contamination in the poultry products value chain. Addressing the challenge of AMR requires interventions from multiple stockholders including the poultry farmers. Therefore, this study was carried out to evaluate KAP regarding the use of antimicrobials among poultry keepers in Dar es Salaam, Tanzania. The findings of the current investigation provide baseline evidence about the KAP of poultry farmers from Low-income resources and offer insights into designing interventions and policies for the use of AMU and AMR in Dar es Salaam, Tanzania.

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* *Corresponding author.*

Methods: A cross-sectional study was conducted from January to June 2023 using a quantitative research approach. A semi-structured questionnaire was used to collect socio-demographic and KAP data through face-to-face interviews. Responses related to the KAP triad were assigned scorers and aggregated for each participant. Data was analyzed using the Statistical Package for Social Sciences. Multivariate logistic regression analysis was conducted to determine predictors of KAP scores.

Results: The results demonstrated that most of the respondents, 91.1%, had sufficient knowledge ($\chi 2$ =151.143, $p<0.001$) regarding AMU and AMR. Furthermore, 61.2% of respondents had a negative attitude ($\chi 2$ =11.161, $p<0.001$) and 89.7% had bad practice ($\chi 2$ =141.416, $p<0.001$) towards AMU. Additionally, sex, age category, marital status, level of education, and occupation did not influence practice regarding AMU. The respondents' practices from different districts varied significantly, with respondents from Temeke district having 4.282 poor practices compared to those from other districts (p=0.012, AOR=4.282, C. I 1.373-13.357). Surprisingly, the results also showed that having a secondary school education had an impact 0.42 times as other education levels on the knowledge of the AMU (p=0.01, AOR=0.42, C.I. =0.22-0.81)

Conclusion: The findings showed that having good knowledge regarding the use of antimicrobials does not guarantee one has good practices or a positive attitude regarding the use of antimicrobials in poultry production. The government should ensure education and advisory services for poultry farmers on proper AMU, enforce current veterinary laws and regulations on antimicrobials, and implement an AMU surveillance system. It is, therefore, necessary to create and bolster policies that support the responsible use of antimicrobials in poultry.

Keywords: Antimicrobial; Attitude Resistance; Dar es Salaam; Knowledge; Practices.

1.Background information

Antimicrobials continue to constitute the most prescribed drugs for managing diseases caused by bacteria in poultry farming [1]. Antimicrobial misuse and overuse, however, have resulted in drug resistance development. Reference [2]. Antimicrobial residues in the food chain can interact with the microbiome of a person's body and lead to the development of antimicrobial-resistant bacteria that can linger in the gut of a person for years [3].

In Tanzania, increased demand for short-cycle animal stocks, such as poultry and poultry products, has led to intensive animal production [4]. In most settings, poultry is managed by women as a major source of income and empowerment[5]. The increase in poultry production has been attributed to several factors, including increased urbanization and trade [6,4]. The high frequency of bacterial infections has compelled farmers to excessively use antimicrobial agents as prophylaxis and or for therapeutic purposes [7]. The majority of farmers obtain antimicrobial agents from a variety of sources, however, previous studies indicate that a large proportion of such drugs are obtained from hawkers and unregistered drug sellers [8]. In Tanzania, the factors that influence the usage and development of antimicrobial resistance in animal and environmental sectors have received considerably less attention than in the human health sector [9,10]. Demand for the rapid growth of poultry for marketing with minimal costs of production results in high AMU, which is likely to hasten the establishment and dissemination of AMR isolates from poultry and the environment with eventual consequences to public health,

animal production, and environmental contamination[11,12].

Antimicrobial resistance results in ineffective treatment of infectious diseases. To regulate antimicrobial use, various data are needed. Analyzing knowledge, attitude, and practice(KAP) regarding antimicrobial use among poultry keepers is a crucial first step in gathering data from many sources so that appropriate antimicrobial use strategies can be developed [13]. The majority of poultry production activities in Africa are carried out on a small-scale basis and offer households investment opportunities in addition to increased income. [14]. Since a larger portion of poultry production activities in low and middle-income countries are small-scale in nature, evaluation of KAP regarding the use of antimicrobials among this category of farmers is necessary to allow veterinary extension authorities to design and disseminate appropriate intervention strategies to engage farmers on prudent use of antimicrobials and improve farm biosecurity that will minimize use of antimicrobial and consequently slow the development of antimicrobial-resistant bacteria and promote production of safe poultry products [14]. Therefore, this study was carried out to evaluate KAP regarding the use of antimicrobials among poultry keepers in Dar es Salaam, Tanzania. The result of this is anticipated to further inform policy development on the prudent use of antimicrobials in poultry production systems in the country.

2.Materials and Methods

2.1Study Period and Location

The study was conducted in urban and peri-urban areas of Ilala district, located at 6.9276ºS,39.1336ºE, Kigamboni district at 6.8227ºS, 39.3024ºE, and Temeke district at 6.9488ºS,39.4450ºE in Dar es Salaam, from January through March 2023. The Dar es Salaam region has an estimated population (Fig.1) of 5,383,728 people in 2022 Reference [15]. The major economic activities in the study area include commerce, agriculture, livestock keeping, fishing as well as small- and large-scale industrial production (NBS, 2012).

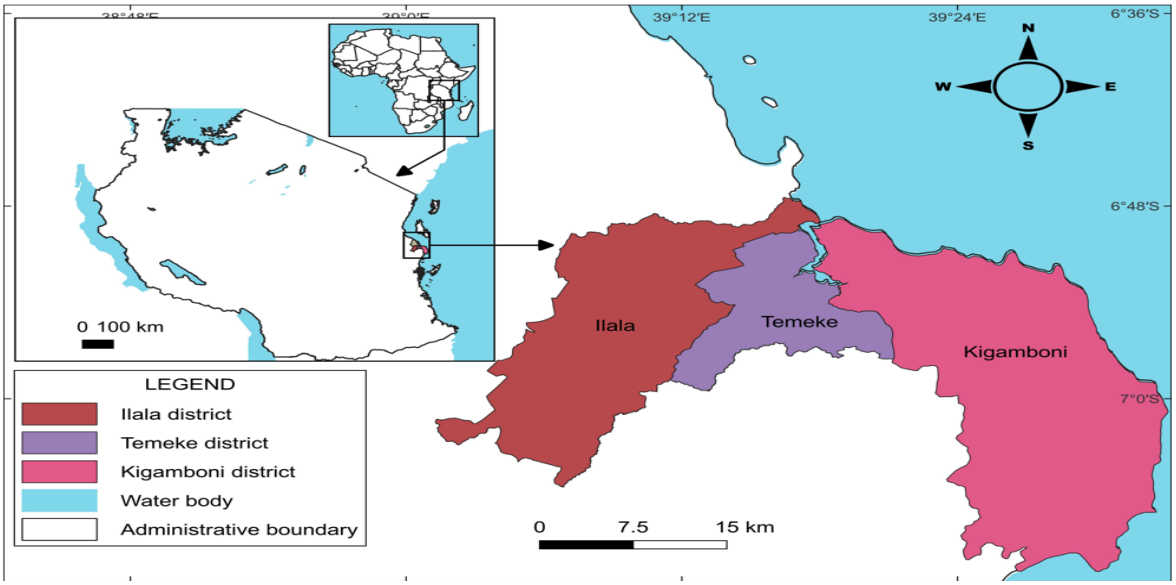

Figure 1: Map of Dar Es Salaam showing the districts of Ilala, Kigamboni, and Temeke where the study was conducted

2.2Study design and study population

A descriptive cross-sectional study design using a quantitative approach was employed. The study population consisted of poultry keepers from Temeke, Ilala, and Kigamboni districts. The data on social demographics and KAP regarding the use of antimicrobials in poultry farming were gathered using semi-structured questionnaires through face-to-face interviews conducted from January 2023 through March 2023.

2.3Sample size and sampling procedures

The sample size was calculated using the formula ($N=Z^2 p(1-p)/d2$). $N = (1.96)^2 \times 0.5 \times (1-0.5) \div (0.05)^2$ according to Kothari (2004).

Where p = expected prevalence of 50%, d = desired precision of 5%, N=number of sample/target population, and Z = Z-statistical.

Therefore, the total sample size for this study was N=384.16~384 Samples

2.4Data collection

To assess farmers' KAP on the use of antimicrobials, a snowball approach was used to select farmers, in which new sample units were recruited by other units to form part of the sample. A total of 224 poultry keepers were interviewed during the study period**.** Due to the near vicinity of the Dar es Salaam districts, the study population was chosen based on the number of chickens kept by a particular farmer as an inclusion criterion, whereby farmers with more than 50 chickens were eligible for an interview.

2.5 Assessment of KAP on antimicrobial use in poultry keeping

Information on antimicrobial use, knowledge, attitude, and practices was gathered using both closed- and open-ended questions. Knowledge of antimicrobial use was measured using five out of thirteen (5/13) closed questions; other questions were follow-up questions; hence they were irrelevant to measure KAP on antimicrobial use. Score measurements and classification were done as per [16] with some modifications. Those who scored 80% and above were considered to have high knowledge, and those with less than 80% were considered to have low knowledge. Regarding the attitude on the use of antimicrobials, six out of eight (6/8) closed questions were used to assess positive and negative attitudes among poultry keepers., Those who scored 80% and above were considered to have a positive attitude, and those who scored below 80% were considered to have a negative attitude. Practices were measured using nine out of twelve (9/12) questions to measure good practices and poor practices; those who scored 80% and above were considered to have good practices, and those who scored below 80% were considered to have poor practices [16] with some modification.

2.6Data analysis

Data were entered and coded in Microsoft Excel spreadsheets, and analytical statistics were done using Statistical

Package for Social Sciences (SPSS) for Windows version 20. Categorical variables were summarized as proportions. *The chi-square* test was used to check the association between social demographic characteristics and the variable parameters, including KAP on antimicrobial use in poultry farming. Multivariate logistic regression was performed to identify factors that influence KAP with regard to antimicrobial use. Odds ratios with their respective 95% confidence interval (CI) were used to measure the strength of associations. A Pearson correlation coefficient was performed to determine the positive and/or negative relationship between Knowledge-Attitude, Attitude-Practice, and finally knowledge-practices if there was a statistically significant. In all statistical analyses, a two-sided *p*-value of less than 0.05 was considered statistically significant.

3.Ethical clearance

Ethical clearance was obtained from the Sokoine University of Agriculture Research Ethics Review Committee (SUA-REC) with reference code RPGS/R/E/ETHICS. Furthermore, permission for data collection was granted by the Dar es Salaam district through the ministry responsible for local government authorities. The purpose of the study was explained to participants, whose consent was requested, and confidentiality was guaranteed prior to data collection.

4.Results

4.1Social demographic characteristics of the study population

Table 1 summarizes the social demographic characteristics of the respondents. A total of 224 respondents were included in the study, with females constituting 51.8% of all respondents and males being 48.2%. The majority of the respondents (23.2%) were those grouped between 45-54 years, followed by the age group 35-44 (21.9%), and the least were those grouped above 65 (6.3%) years of age. The findings further showed that the majority of the respondents were married (60.3%), single was 30.8%, and widower/widowed (8.9%). Most of the respondents in the study were from Temeke (43.3%), followed by Ilala and Kigamboni, 33.5% and 23.2% respectively. Results on the level of education showed that the majority of the respondents (43.8%) had a Secondary education level, 37.5% had primary education, and 18.8% had college and above. The results also revealed that poultry farming was mostly for business purposes (89.3%), as seen in Table 1

Table 1: Social Demographic Characteristics

Social Demographic Characteristics		Frequency (n)	Percent (%)
Sex	Female	116	51.8
	Male	108	48.2
	Total	**224**	**100.0**
Age Category	15-24	44	19.6
	25-34	40	17.9
	35-44	49	21.9
	45-54	52	23.2
	55-64	25	11.2
	>65	14	6.3
	Total	**224**	**100.0**
Marital status	Married	135	60.3
	Single	69	30.8
	Widow	20	8.9
	Total	**224**	**100.0**
District	Ilala	75	33.5
	Kigamboni	52	23.2
	Temeke	97	43.3
	Total	**224**	**100.0**
Level of education	Primary school	84	37.5
	Secondary school	98	43.8
	College and above	42	18.8
	Total	**224**	**100.0**
Occupation	Businessman/woman	200	89.3
	Formal employment	24	10.7
	Total	**224**	**100.0**

Descriptive statistics were performed to assess KAP, and the findings revealed that the majority of the respondents (91.1%) had knowledge of antimicrobial use While 61.2% had negative attitude regarding the use of antimicrobials and 89.7% had poor practice on antimicrobial use as detailed in table 2.

Table 2: Descriptive statistics analysis on the assessment of knowledge, attitude, and practices on antimicrobial use

KAP Regarding Antimicrobial Use		Frequency (n)	Percent (%)
Knowledge	Low knowledge	20	8.9
	High knowledge	204	91.1
	Total	**224**	**100.0**
Attitude	Negative attitude	137	61.2
	Positive attitude	87	38.8
	Total	**224**	**100.0**
Practice	Bad Practice	201	89.7
	Good Practice	23	10.3
	Total	**224**	**100.0**

Scores for KAP were prepared as per [16] with some modifications, and the obtained data were analyzed to check the correlation between the scores as indicated in Table 3. The findings showed that there was significantly weak very relationship between knowledge and attitude ($r=0.267$, $p<0.001$), while there was a significantly weak and positive relationship between Knowledge and Practices ($r=0.332$, $p<0.001$) and that there was a significantly moderate and positive relationship between attitude and practices ($r=0.308$, $p<0.001$) table 3.

Table 3: Correlation analysis between scores of knowledge, attitude and Practices

Variables	Correlation coefficient	p- Value
Knowledge -attitude	0.267	<0.001
Knowledge-Practice	0.332	<0.001
Attitude-Practice	0.308	<0.001

*Correlation coefficient at 0.01 levels (2tailed)

The results in Table 4 revealed that all social demographic characteristics were associated with knowledge of antimicrobial use except for sex. The proportion of respondents with the age category above 65 and those between 55-64 years of age demonstrated higher knowledge compared to other age categories ($\chi2 =88.107$, $p<0.001$), being married or widow/widower in this study was associated with having high knowledge on antimicrobial use ($\chi2 =89.205$, $p<0.001$). In addition, the area of domicile was significantly associated with knowledge of antimicrobial use ($\chi2 =13.563$, $p<0.001$). With regards to the level of education of the respondents, the results revealed that knowledge was associated with having a secondary school education to other levels of education ($\chi2 =22.750$, $p<0.001$).

The results of the *Chi*-square test to ascertain whether respondents' attitude on antimicrobial use was associated with social demographic characteristics showed that all social demographic characteristics were associated with

a negative attitude on the use of antimicrobials with the exception of sex ($\chi2 = 0.286$, $p = 0.593$). Further, the findings showed that the proportion of respondents in each age category had a negative attitude ($\chi2 = 88.107$, $p<0.001$), with regards to marital status the findings revealed that being married, widow/widower is associated with having a negative attitude regarding the use of antimicrobial ($\chi2 = 89.205$, $p<0.001$). Also, the findings showed that the location of the respondents was significantly associated with negative attitudes regarding the use of antimicrobials ($\chi2 = 13.5632$, $p<0.001$). Likewise, the results showed that all the levels of education had negative attitudes regarding the use of antimicrobials ($\chi2 = 144.259$, $p< 0.001$). Businessmen and /or women and formally employed respondents also had negative attitudes regarding the use of antimicrobials ($\chi2 = 493.643$, $p<0.001$) Table 4.

Table 4: Association between social demographic characteristics and KAP

Characteristics		KNOWLEDGE			ATTITUDE			PRACTICE		
		High n (%)	**Low** n (%)	**Chi-Square test**	**Positive** n (%)	**Negative** n (%)	**Chi-Square test**	**Good** n (%)	**Bad** n (%)	**Chi-Square test**
Sex	Female	106(91.4)	10(8.6)	X^2 = 0.286, p = 0.593	45(38.8)	71(61.2)	X^2 = 0.286, p = 0.593	11(9.5)	105(90.5)	X^2 = 0.29, p = 0.593
	Male	98(90.7)	10(9.3)		42(38.9)	66(61.1)		12(11.1)	96(88.9)	
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Age category	15-24	42(95.4)	2(4.5)	$\chi 2$ =29.446, p<0.001	16(36.4)	28(63.6)	$\chi 2$ =29.446, p<0.001	4(9.1)	40(90.9)	$\chi 2$ =29.45, p<0.001
	25-34	36(90.0)	4(10.0)		15(37.5)	25(62.5)		6(15.0)	34(85.0)	
	35-44	43(87.8)	6(12.2)		18(36.7)	31(63.3)		5(10.2)	44(89.8)	
	45-54	45(86.5)	7(13.5)		23(44.2)	29(55.8)		5(9.6)	47(90.4)	
	55-64	24(96.0)	1(4.0)		8(32.0)	17(68.0)		0(0.0)	25(100)	
	>65	14(100)	0(0.0)		7(50.0)	7(50.0)		3(21.4)	11(78.6)	
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Marital status	Married	126(93.3)	9(6.7)	X^2 = 89.205, p = <0.001	50(37.0)	85(63.0)	X^2 = 89.205, p = <0.001	15(11.1)	120(88.9)	X^2 = 89.21, p = <0.001
	Single	59(85.5)	10(14.5)		32(46.4)	37(53.6)		6(8.7)	63(91.3)	
	Widow w/widower	19(95.0)	1(5.0)		5(25.0)	15(75.0)		2(10.0)	18(90.0)	
	Total	**204(91.1)**	**20(8.9)**		**137(61.2)**	**87(38.8)**		**223(99.6)**	**201(89.7)**	
Location/ Dist	Ilala	71(94.7)	4(5.3)	X^2 = 13.563, p = <0.001	31(41.3)	44(58.7)	X^2 = 13.563, p = <0.001	6(8.0)	69(92.0)	X^2 = 13.56, p = <0.001
	Kigamboni	43(82.7)	9(17.3)		17(32.7)	35(67.3)		11(21.2)	41(78.8)	

ricts	Temeke	90(92.8)	7(7.2)		39(40.2)	58(59.8)		6(6.2)	91(93.8)	
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Education Level	College >	36(85.7)	6(14.3)	X^2 = 22.75, p = <0.001	9(21.4)	33(78.6)	X^2 = 22.75, p = <0.001	1(2.4)	41(97.6)	X^2 = 22.75, p = <0.001
	Primary and low	77(91.7)	7(8.3)		40(47.6)	44(52.4)		13(15.5)	71(84.5)	
	Secondary	91(92.9)	7(7.1)		38(38.8)	60(61.2)		9(9.2)	89(90.8)	
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Occupation	Business	183(91.5)	17(8.5)	X^2 = 138.286, p = <0.001	78(39.0)	112(61.0)	X^2 = 138.286, p = <0.001	19(9.5)	181(0.0)	X^2 = 138.28, p = <0.001
	Employment	21(87.5)	3(12.5)		9(37.9)	15(62.5)		4(16.7)	20(88.3)	
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	

Furthermore, the results of the chi-square test also revealed that with the exception of sex ($X^2 = 0.286$, $p = 0.593$), all social demographic characteristics were associated with poor practice on antimicrobial use. These findings showed that the proportion of respondents with all age categories had bad practices regarding the antimicrobial use ($\chi2 = 88.107$, $p<0.001$), with regards to marital status the findings revealed that the majority i.e., more than fifty percent had bad practices on antimicrobial use ($\chi2 = 89.205$, $p<0.001$). Also, the findings observed that location of the respondents was significantly associated with bad practices regarding the use of antimicrobial ($\chi2 = 13.5632$, $p<0.001$). Furthermore, the findings demonstrated that having bad practices or good practices does not depend on the level of education since all levels of education showed bad practices regarding the use of antimicrobial ($\chi2 = 22.750$, $p<0.001$). Moreover, the results revealed that occupation of the respondent was significantly associated with the bad practices on the antimicrobial use ($\chi2 = 138.286$, $p<0.001$).

Non-parametric C*hi*-square test was conducted to check whether KAP regarding the use of antimicrobial was associated with social demographic characteristics. The results are presented in table 4.

A multivariate logistic regression analysis was performed using Statistical Package for Social Sciences (SPSS) to obtain p-value, adjusted odds ratios and 95% confidence intervals to check the association between social demographic factors (predictor variables) and outcome (response variable) variables measuring the knowledge, attitude and practices on antimicrobial use as shown in table 5.

Table 5: Multivariate Logistic regression analysis on the factors influencing the use of antimicrobial KAP

Characteristics		KNOWLEDGE			ATTITUDE			PRACTICE		
		High n (%)	**Low n (%)**	**OR | 95% CI | *p***	**Positive n (%)**	**Negative n (%)**	**OR | 95% CI | *p***	**Good n (%)**	**Bad n (%)**	**OR | 95% CI | *p***
Sex	Female			*Ref*			*Ref*			*Ref*
	Male	98(90.7)	10(9.3)	1.18|0.64-2.17|0.59	42(38.9)	66(61.1)	1.74|0.89-3.40|0.11	12(11.1)	96(88.9)	0.72 | 0.27-1.94 | 0.52
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Age Category	15-24	42(95.4)	2(4.5)	Ref	16(36.4)	28(63.6)	Ref	4(9.1)	40(90.9)	Ref
	25-34	36(90.0)	4(10.0)	1.22|0.36-4.09|0.751	15(37.5)	25(62.5)	0.57|0.170-1.925|0.37	6(15.0)	34(85.0)	0.367 |0.071-1.888|0.230
	35-44	43(87.8)	6(12.2)	1.80|0.53-6.17|0.347	18(36.7)	31(63.3)	0.6|0.176-2.048|0.45	5(10.2)	44(89.8)	0.647|0.138-3.029|0.580
	45-54	45(86.5)	7(13.5)	1.64|0.493-5.43|0.42	23(44.2)	29(55.8)	0.58|0.175-1.924|0.37	5(9.6)	47(90.4)	0.417|0.086-2.016|0.276
	55-64	24(96.0)	1(4.0)	1.56 | 0.47-5.12|0.47	8(32.0)	17(68.0)	0.79|0.243-2.586|0.70	0(0.0)	25(100)	0.390|0.081-1.884|0.241
	>65	14(100)	0(0.0)	1.23|0.33-4.59 | 0.44	7(50.0)	7(50.0)	0.47|0.123-1.803|0.27	3(21.4)	11(78.6)	0.0|0-1.994|0.998
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Marital status	Married			*Ref*			*Ref*			*Ref*
	Single	59(85	10(1	0.69|0.1	32(46	37(53	0.26|0.	6(8.7	63(91	2.58|0.25-

		.5)	4.5)	7-2.71|0.59	.4)	.6)	04-1.63|1.15	)	.3)	26.07|0.42
	Widow/widower	19(95.0)	1(5.0)	0.68|0.19-2.41|0.55	5(25.0)	15(75.0)	0.18|0.03-1.04|0.05	2(10.0)	18(90.0)	1.06|0.13-8.79|0.95
	Total	**204(91.1)**	**20(8.9)**		**137(61.2)**	**87(38.8)**		**223(99.6)**	**201(89.7)**	
Districts	Ilala			*Ref*			*Ref*			*Ref*
	Kigamboni	43(82.7)	9(17.3)	3.7|1.91-7.14|<0.001*	17(32.7)	35(67.3)	1.01|0.49-2.04|0.98	11(21.2)	41(78.8)	1.16|0.34-3.94|0.81
	Temeke	90(92.8)	7(7.2)	2.76|1.31-5.83|0.01*	39(40.2)	58(59.8)	1.86|0.76-4.54|0.17	6(6.2)	91(93.8)	4.28|1.37-13.35|0.012*
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Level of education	College			*Ref*			*Ref*			*Ref*
	Primary and low	77(91.7)	7(8.3)	1.18|0.51-2.69|0.70	40(47.6)	44(52.4)	2.66|0.87-8.11|0.08	13(15.5)	71(84.5)	0.132|0.01-1.26 |0.08
	Secondary school	91(92.9)	7(7.1)	0.42|0.22-0.81|<0.01*	38(38.8)	60(61.2)	0.50|0.25-1.00|0.05	9(9.2)	89(90.8)	1.45|0.55-3.85 |0.45
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	
Occupation	Business			*Ref*			*Ref*			*Ref*
	employment	21(87.5)	3(12.5)	0.58|0.21-1.62|0.3	9(37.9)	15(62.5)	1.21|0.40-3.55|0.73	4(16.7)	20(88.3)	0.29|0.06-1.34|0.12
	Total	**204(91.1)**	**20(8.9)**		**87(38.8)**	**137(61.2)**		**23(10.3)**	**201(89.7)**	

The results revealed that, respondents residing at Kigamboni had 3.693 higher knowledge on antimicrobial use compared to Temeke, while Temeke had 2.768 times knowledgeable compared to Ilala ($p<0.001$, OR=3.693, C. I=1.910-7.141 and $p=0.007$, OR=2.768, C. I=1.314-5.832) respectively. The results further showed that, sex, age category, marital status, level of education and occupation had no influence on practice regarding antimicrobial use. The results also, revealed that respondents who reside at Temeke districts had 4.282 bad practices compared to those residing in other districts ($p=0.012$, OR=4.282, C. I 1.373-13.357). Sex, age category, marital status, level of education and occupation were not a contributing factor for bad or good influence on practice on antimicrobial use. Having a secondary school level had an impact of 0.42 times other education levels on the knowledge on the AMU ($p=0.01$, OR=0.42. C. I=0.22-0.81).

5.Discussion

5.1Antimicrobial Use and Antimicrobial Resistance

According to the World Health Organization, the misuse and overuse of antimicrobials have increased the emergence of antimicrobial resistance (AMR) and posed a critical threat to public health, animal health, and the ecosystem[2]. The finding of this study aligned with the global observations, as most poultry farmers in Dar Es Salaam, Tanzania demonstrated knowledge about antimicrobial use (91.1%), yet a significant proportion (61.2%) displayed negative attitude and 89.7% exhibited poor practices. This pattern is consistent with other studies conducted globally, where knowledge levels are high but attitudes and practices are inconsistent [17]. In Africa, studies show similar results as well, according to Efendi and his colleagues 2022 and Chah and his colleagues 2022, demonstrated the knowledge gaps and improper practices in antimicrobial use in livestock farming,[18,13]. They observed that small scale poultry farmers in Nigeria and Cameroon had basic knowledge of antimicrobials, but their practices were influenced by informal networks and lack of structured veterinary guidance. This underscore the critical gap between knowledge and practices in the region. Similar finding were reported in East Africa, where inappropriate sourcing and usage of antimicrobials were major contributors to AMR[12]. The study revealed that, it is possible that the problem of antimicrobial resistance was escalated by the behavior of some farmers use different veterinary antimicrobial agents for treatment of bacterial infections, with some in Kigamboni district in the village called Mtipesa and Zahanadi Mtipesa confessing to use antimicrobials intended for treatment of human diseases. The farmers argue that such antimicrobials for human use are effective compared to veterinary medicines, the same findings were also reported in a study conducted in Dar es Salaam by [12]. Arguably, this might be due to the loss of veterinary medicine's effectiveness due to misuse and overuse that resulted in the development of resistance. However, this needs to be investigated further to generate evidence-based results.

5.2Social Demographic Characteristics

The majority of the respondents in this study were female (51.8%), reflecting the fact that poultry production has often been a gender-based occupation in resource-limited settings, serving as a primary income source for women[19,16]. Most respondents were aged between 45-54 years (23.2%), followed closely by those between 35-44 years (21.9%), a trend similarly reported by Said and his colleagues (2017)[5]. These findings may reflect the life stages typical in Tanzania, where youth aged 18-24 are often still in school, while those aged 35-44 are

either employed or engaged in business activities. The older age group (45-54 years) is closer to retirement, often leading individuals to explore income-generating ventures such as poultry farming due to the rising demand for protein-rich products like eggs and meat[16]. Additionally, the study revealed that most poultry keepers were married (60.3%), emphasizing the significance of poultry farming as a critical source of income and empowerment for families, a trend consistent with findings by Lenox and Said (2018)[5]. Educationally, the majority of respondents had attained a secondary level of education (43.8%), yet many lacked formal training in poultry management. This gap can contribute to the misuse of antimicrobials, which could result in antimicrobial resistance (AMR), as also suggested by Hassan and his colleagues (2021)[20]. In Tanzania, secondary education often lacks courses on antimicrobial use (AMU) and the risks of AMR, highlighting the need for targeted education and awareness campaigns among poultry farmers [18].

Furthermore, the majority of respondents were primarily engaged in business (89.3%), while a smaller percentage were formally employed (10.7%). This suggests that employed individuals may have less time to engage in poultry farming compared to those treating it as their primary income-generating activity [21].

6.Knowledge, Attitude, and Practice (KAP) Assessment

The study assessed knowledge regarding antimicrobial use (AMU) among respondents, revealing that 91.1% were knowledgeable about the use of antimicrobial agents, findings consistent with Efendi and his colleagues. (2022) and Hassan and his colleagues (2021). This high knowledge level could be linked to informal education programs focusing on both prophylactic and therapeutic antimicrobial use provided to farmer groups. However, despite their awareness of the need for antimicrobials in treating bacterial infections, respondents often lacked the knowledge required for proper application, as observed in previous studies[22].

Statistical analysis revealed significant associations between social demographic factors and KAP concerning AMU, with the exception of sex ($\chi2 = 0.286$, $p=0.593$). Factors such as age ($\chi2 = 88.107$, $p<0.001$), marital status ($\chi2 = 89.205$, $p<0.001$), location ($\chi2 = 13.563$, $p<0.001$), education level ($\chi2 = 22.750$, $p<0.001$), and occupation ($\chi2 = 138.286$, $p<0.001$) were all significantly linked to variations in KAP, as presented in Table 4. These results suggest that gender does not significantly influence knowledge, attitudes, or practices regarding antimicrobial use in poultry management. However, factors such as education level, age, and location were shown to affect AMU awareness, as previously reported by Amin (2020) and Mudenda and his colleagues (2022)[23].

Concerning attitudes towards AMU, the results showed that most respondents (61.2%) had negative attitudes toward antimicrobial use, aligning with findings from Said and his colleagues (2017). Though there was a significant association between most demographic factors and attitude, sex remained non-significant ($\chi2 = 0.286$, $p=0.593$). This suggests that knowledge alone does not automatically translate into positive attitudes toward AMU. Farmers with adequate knowledge of antimicrobial use might still hold negative attitudes, which could hinder responsible use.

Regarding practice, most respondents (89.7%) demonstrated poor antimicrobial use practices, a result consistent with prior studies by Hassan and his colleagues (2021) and Efendi and his colleagues (2022)[24,18]. While

respondents were generally knowledgeable, they lacked both positive attitudes and proper practices, emphasizing the need for a comprehensive approach to AMU education. Misuse of antimicrobials contributes to AMR and multidrug resistance (MDR), as highlighted by Amin (2020) and Mudenda and his colleagues (2022).

7.Multivariate Analysis of Factors Influencing KAP

Logistic regression analysis revealed that location significantly influenced KAP. Farmers in Kigamboni were 3.7 times more likely to have good knowledge than those in Ilala ($p<0.001$). However, location also played a role in poor practices, with farmers in Temeke being 4.3 times more likely to exhibit bad practices compared to other districts ($p=0.012$). These findings suggest that localized interventions tailored to specific community dynamics are necessary.

8.Correlation Between Knowledge, Attitude, and Practices

Weak correlations were observed between knowledge-attitude ($r=0.267$, $p<0.001$), knowledge-practice ($r=0.332$, $p<0.001$), and attitude-practice ($r=0.308$, $p<0.001$). These results indicate that knowledge alone is insufficient to drive behavior change. Each component of KAP must be addressed individually to create meaningful interventions, as also emphasized by Moffo and his colleagues (2020) and Chah and his colleagues (2022)[17,13]**.**

9.Limitations of The Study

9.1Self-Reported Data Bias

The study relied on self-reported data through face-to-face interviews, which may have introduced recall bias or social desirability bias, where respondents might have provided answers they perceived as favorable rather than truthful.

9.2Limited Geographic Scope

The study was restricted to three districts within Dar es Salaam (Ilala, Temeke, and Kigamboni), limiting the generalizability of findings to other regions in Tanzania or rural areas with different agricultural practices.

9.3Cross-Sectional Study Design

The cross-sectional nature of the study captures data at a single point in time, which limits the ability to assess causal relationships between knowledge, attitudes, and practices (KAP) regarding antimicrobial use and the development of antimicrobial resistance over time.

9.4Sample Size and Representation

Although the sample size of 224 respondents was calculated using standard formulas, it may not fully represent the entire population of poultry keepers in Dar es Salaam, especially since only those with more than 50 chickens were included.

9.5Potential Underreporting

Farmers might have underreported the use of human antimicrobials or non-compliance with veterinary prescriptions due to fear of regulatory repercussions.

10.Conclusions

Antimicrobials are essential agents whose efficacy must be preserved through careful and responsible use. However, this study revealed that antimicrobials are frequently misused in Tanzanian poultry production. The rising demand for poultry products has created valuable business opportunities but also resulted in routine, often inappropriate use of antimicrobial agents. Addressing AMU and AMR among poultry farmers and other key stakeholders is crucial for mitigating public health risks. Effective behavior change campaigns, advocacy, and proper AMU training can play a significant role in reducing AMR threats. The Tanzanian government should strengthen veterinary extension services in urban, peri-urban, and rural settings to work closely with farmers and educate them on the proper use of antimicrobials. A multi-sectoral "One Health" approach, emphasizing cross-sector collaboration and community engagement, is essential to combat AMR effectively in the poultry sector.

11.Recommendation

We recommend that further research have to be done on knowledge, attitudes, and practices regarding AMU in populated areas like Dar es Salaam, where cycle cycled short-cycled animals like poultry are in high demand as a source of animal protein. We also recommend that regulatory authorities both (human and livestock) strengthen regulatory mechanisms and restrict the use of human medicines formulations in poultry production systems through joint inspection of both human and veterinary premises dispensing antimicrobials. It is necessary to create and bolster policies that support the responsible use of antimicrobials in poultry production systems.

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12.Ethical Clearance

Ethical clearance was obtained from the Sokoine University of Agriculture Research Ethics Review Committee (SUA-REC) with reference code RPGS/R/E/ETHICS. Furthermore, permission for data collection was granted by Dar es Salaam districts through the ministry responsible for local government authorities. The purpose of the study was explained to participants whose consent was requested and confidentiality was guaranteed prior to data collection.

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