

Research Article

Knowledge, Attitudes and Practices on Antibiotics Use among Cattle Keepers in Nyagatare District, Rwanda

Mushayija JP¹, Nikwigize S¹, Karangwa C²,
Manishimwe R², Habimana R² and Rutayisire E^{1*}

¹Department of Public Health, Mount Kenya University
Rwanda, Kigali, Rwanda

²Rwanda Food and Drugs Authority, Kigali, Rwanda

*Corresponding author: Erigene Rutayisire, Head
of Public Health Department, Mount Kenya University
Rwanda, Kigali City, Kicukiro District, Kigali, Rwanda

Received: October 18, 2021; Accepted: November 09,
2021; Published: November 16, 2021

Abstract

The dairy subsector in Rwanda is the most important portion of the livestock sector and antibiotics are frequently used in veterinary aspects to treat zoonotic agents. The present study aimed to determine knowledge, attitudes, and practices on antibiotics use among cattle keepers in Nyagatare District. The target population was 384 cattle keepers and cross sectional study design was conducted. A structured questionnaire was used by researcher to collect the data and SPSS version 21 has been analyzed used to analyze the data. The study findings show that 86.7% were male, 76.0% were married, 85.9% had more than 5 years in keeping cattle, 39.3% had between 11-20 cows in their farms while 34.1% had to make between 1 and 3 kilometers to reach a veterinary pharmacy from their farms. The present study revealed that 64.3% of respondents had a low level of knowledge towards antibiotic use in cattle and 73.7% of the respondents had positive attitude towards antibiotic use in cattle. Cattle keepers who required to walk less than one km from farm to veterinary pharmacy were less likely (AOR=0.06; 95% CI: (0.01-0.30); p=001) to have poor practice on antibiotic use in cattle than those living far from the vet pharmacy. In conclusion, cattle keepers from Nyagatare district demonstrated poor knowledge, positive attitude and poor practices towards antibiotic use. Therefore, educational programs are urgently needed to train to raise farmer's awareness about proper antibiotics use with particular attention to public health problems that may rise due to poor use of antibiotics in cattle.

Keywords: Knowledge; Attitudes; Practices; Antibiotics use; Cattle keepers

Abbreviations

AOR: Adjusted Odd Ratio; CI: Confidence Interval; GDP: Gross Domestic Product; NISR: National Institute of Statistics in Rwanda; SPSS: Statistical Package for Social Sciences

Introduction

Developing countries' rising consumption, which have increased from 2680kcal in 1997/99 to 2850kcal in 2015 and roughly 3000kcal in 2030, will be reflected in worldwide averages [1]. Rwanda's agriculture sector, which accounts for 26% of the country's GDP and employs over 40.5% of the labor force, As Rwanda transitions to a knowledge-based economy, it provides the backbone for long-term economic growth, ensuring high-quality livelihoods and living conditions for the population. Livestock and livestock products contribute 312 billion FRW, and exports of meat [2]. Rural development, poverty alleviation, and food and nutrition security are all dependent on livestock husbandry. Many livestock-keeping households, as well as others who provide services and value addition across the supply chain, benefit from it. Such contribution is predicted to climb considerably as a result of rising population, urbanization, and preferences for animal-source diets, which are all driving this significant growth [3]. The dairy subsector in Rwanda is the most important portion of the livestock sector; it accounts for 10.5 percent of agricultural GDP and is agriculture's fastest-growing sub-sector. Whereby Annual milk output is currently valued at around 117.0 billion Rwandan Francs at the farm gate. To diversify the livestock, some farmers have adopted

beef farming through the use of feedlots [3].

Antibiotics are bioactive molecules or drugs having antibacterial qualities that help humans and animals fight diseases caused by bacteria by either eliminating the germs or making it impossible for them to multiply and grow and their application in human and veterinary medicine has progressively risen since then [4]. Antibiotics have a number of advantages in food-producing animal agriculture, including the production of big quantities of nutritious, high-quality, low-cost food for human consumption, as well as healthier, more productive animals, lower illness incidence, morbidity, and mortality, and the production of large quantities of nutritious, high-quality, low-cost food for human use [5].

Antibiotics are frequently used in veterinary aspects to treat zoonotic agents which are infectious as well as non-zoonotic animal disorders, to cure bacterial infections in farm animals, to promote animal welfare and to avoid the large-scale spread of contagious animal diseases, to improve animal production efficiency, reduce zoonotic disease transmission from animals to humans, and ensure farm animal safety [6]. To avoid cross-resistance, antibiotics used in veterinary medicine must be comparable to or closely related to antibiotics used in human medicine. Antibiotic use in veterinary medicine, including growth promoters in cattle, is thought to be a risk factor for antibiotic resistance in human infections, and antibiotic use in livestock is one of the origins of antibiotic-resistant bacterium strains in both animals and humans [5]. However, the overuse, misuse and abuse of antibiotics lead microbes to adapt

in response to antimicrobial medicines, antimicrobial resistance develops spontaneously over time and keeps accelerating the process significantly [7].

Materials and Methods

A structured questionnaire was used to collect the data. Questions were planned and created in advance, which means that all respondents were asked the same questions in the same order.

To assess level of knowledge, attitudes, and practices about practices on antibiotic use among cow caretakers in Nyagatare District, a cross-sectional study design was used. A quantitative research method was used in this research and was purposively focused on first six highly cattle populated sectors in Nyagatare District, namely Nyagatare, Karangazi, Katabagemu, Matimba, Rwempasha, and Rwimiyaga. Nyagatare District, located in Rwanda's eastern province, is known as the "Milk Shed and Food Basket" because it is one of the few areas in the country that can support extensive and semi-extensive livestock production. A total of 384 livestock keepers sampled to participate in the research and chosen from the first six

Table 1: Sociodemographic characteristics of respondents.

Variables		Frequency (n)	Percent (%)
Sector (Residence)	Rwempasha	170	44.3
	Karangazi	78	20.3
	Katabagemu	84	21.9
	Nyagatare	13	3.4
	Matimba	19	4.9
	Rwimiyaga	20	5.2
Age category	18-35 years	98	25.5
	36-45 years	205	53.3
	>45 years	81	21.2
Gender	Male	333	86.7
	Female	13.3	13.3
Marital status	Single	92	24
	Married	292	76
Level of education	Primary	276	71.9
	Secondary	78	20.3
	University	30	7.8
Years in cattle keeping	1-2 years	20	5.2
	3-5 years	34	8.9
	Above 5 years	330	85.9
Number of cows in farm	1-10	83	21.6
	11-20	151	39.3
	20-50	108	28.1
	Above 50 years	42	10.9
Distance from farm to vet pharmacy	<1km	98	25.5
	1-3km	131	34.1
	4-6km	104	27.1
	7-9km	31	8.1
	10km and above	20	5.2

Table 2: Knowledge level towards antibiotics use among cattle keepers.

Variables		Frequency (n)	Percent (%)
Ever heard of antibiotics.	Yes	384	100
Antibiotics improve weight gain for animals	Yes	278	72.4
	No	106	27.6
Antibiotics prevent animals from getting sick	Yes	258	67.2
	No	126	32.8
Antibiotics cure sick animals.	Yes	319	83.1
	No	65	16.9
Antibiotics do not kill bacteria.	Yes	218	56.8
	No	166	43.2
All commercialized antibiotics show the same curative effects in animals.	Yes	200	52.1
	No	184	47.9
Antibiotics are not harmful for beneficial bacteria living in the body of animal.	Yes	225	58.6
	No	159	41.4
Antibiotics use do not have negative side effects on animals.	Yes	261	68
	No	123	32
Antibiotics are painkillers and antipyretics.	Yes	291	75.8
	No	93	24.2
Antibiotics have effects on ectoparasites and endoparasites.	Yes	270	70.3
	No	114	29.7
Purpose of using antibiotics	Infection treatment	141	36.7
	Infection prevention	243	63.3

Source: Primary data (2021).

densely inhabited cattle-producing areas of Nyagatare District and these farmers were selected basing on how simple it is to contact or reach on their farms. A vast list of cattle keepers in excel sheets was acquired from Nyagatare District, and they were separated into stages to make the sampling method more realistic.

Results

Those are socio-demographic characteristics of 384 livestock keepers all reached and data collected using questionnaire through face to face interview.

Findings presented in Table 1. revealed that 44.3% of cattle keepers surveyed were coming from Rwempasha sector, 53.3% were age 36-45 years, 86.7% were male, 76.0% were married, 71.9% had primary level of education, 85.9% had more than 5 years in keeping cattle, 39.3% had between 11-20 cows in their farms while 34.1% had to make between 1 and 3 kilometers to reach a veterinary pharmacy from their farms.

Knowledge on antibiotics use among cattle keepers in Nyagatare District

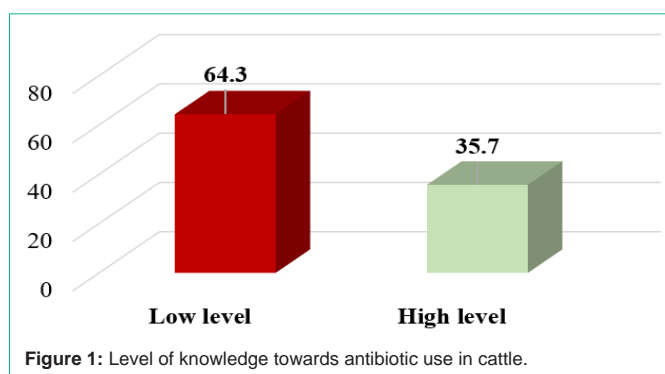
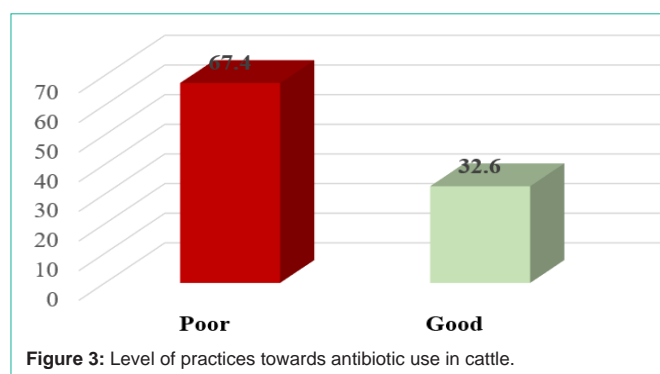
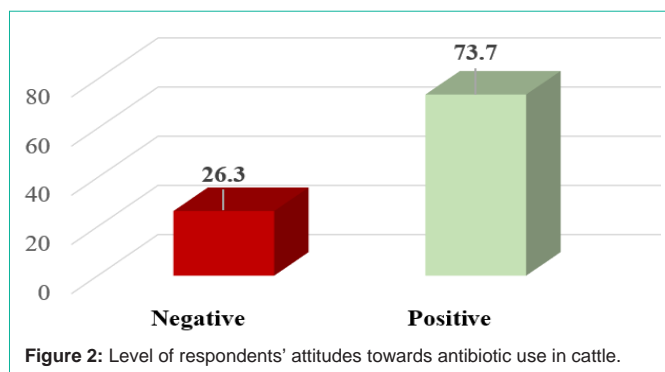
The first objective of this study was to assess the cattle keepers' level of knowledge towards antibiotics use in Nyagatare District. Findings are presented in Table 2.

According to the results in Table 2, the researcher found that all (100%) study participants had ever heard antibiotics used in cattle, 72.4% knew that antibiotics improve weight gain for animals, 67.2% knew that antibiotics prevent animals from getting sick, 83.1% knew

Table 3: Attitudes towards antibiotics use among cattle keepers.

Variables	n (%)			
	Strongly agree n(%)	Agree n(%)	Strongly disagree n(%)	Disagree n(%)
When a cow get sick, it is better to use antibiotics before consulting a veterinarian.	262(68.2)	76(19.8)	46(12.0)	-
I don't consult a veterinarian to ask whether, I need to use antibiotics.	205(53.4)	96(25.0)	82(21.4)	1(0.3)
Antibiotics can be used for the treatment of any kind of diseases in cows.	207(53.9)	118(30.7)	57(14.8)	2(0.5)
It is important to use antibiotics to promote growth of cows.	157(40.9)	167(43.5)	57(14.8)	3(0.8)
It is not necessary read the prospectus before using antibiotics.	151(39.3)	148(38.5)	82(21.4)	3(0.8)
To avoid injuring animals, it is usually a good idea to minimize the amount or dose of antibiotics prescribed by the veterinarian.	169(44.0)	143(37.2)	71(18.5)	1(0.3)
I usually store leftover antibiotics at home for a long period in case they are needed in the future.	212(55.2)	110(28.6)	62(16.1)	-
It is important to use antibiotics for disease prevention in cows.	319(83.1)	55(14.3)	10(2.6)	-

Source: Primary data (2021).

**Figure 1:** Level of knowledge towards antibiotic use in cattle.**Figure 3:** Level of practices towards antibiotic use in cattle.**Figure 2:** Level of respondents' attitudes towards antibiotic use in cattle.

that antibiotics cure sick animals, 56.8% knew that antibiotics do not kill bacteria, 52.1% knew that all commercialized antibiotics show the same curative effects in animals, 58.6% knew that antibiotics are not harmful for beneficial bacteria living in the body of animal, 68.0% knew that antibiotics use do not have negative side effects on animals, 75.8% knew that antibiotics are painkillers and antipyretics, 70.3% knew that antibiotics have effects on ectoparasites and endoparasites and 63.3% knew that antibiotics are used in infection prevention.

Overall knowledge score

Fifteen (15) questions related to the knowledge towards antibiotics use among cattle keepers were assessed by using SPSS score assessment and the score was one (1) mark for each correct answer and zero (0) for false answer. An overall knowledge score was calculated by adding up the total score for each respondent across all 15 questions. A respondent scored less than 7.5 marks out of 15 marks was considered as low level of knowledge whereas someone

scored more than 7.5 marks out of 15 marks was considered as with a high level of knowledge.

Findings in Figure 1 show that 64.3% of respondents had a low level of knowledge towards antibiotic use in cattle whereas 35.7% had a high level of knowledge towards antibiotic use in cattle. The mean knowledge score for all respondents was 11.36 marks with a standard deviation of 1.7.

Attitude towards antibiotics use among cattle keepers in Nyagatare District

This section presents the results on cattle keepers' attitude towards antibiotics in Nyagatare District. Attitudes were assessed through Likert scale questions as described in Table 3.

Findings in Table 3 revealed that 68.2% strongly agreed that when a cow get sick, it is better to use antibiotics before consulting a veterinarian, 53.4% strongly agreed that they do not consult a veterinarian to ask whether they need to use antibiotics, 53.9% strongly agreed that antibiotics can be used for the treatment of any kind of diseases in cows, 43.5% agreed that it is important to use antibiotics to promote growth weight of cows, 39.3% strongly agreed that it is not necessary to read the prospectus before using antibiotics, 44.0% strongly agreed that to avoid injuring animals, it is usually a good idea to minimize the amount or dose of antibiotics prescribed by the veterinarian, 55.2% strongly agreed that they usually store leftover antibiotics at home for a long period in case they are needed in the future while 83.1% strongly agreed that it is important to use antibiotics for disease prevention in cows.

Overall attitude score

The overall attitude score was calculated for each respondent by

Table 4: Respondent's practices towards antibiotic use in cattle.

Variables		Frequency (n)	Percent (%)
Do you treat diseased cows in your herd with antibiotics?	Yes	269	70.1
	No	115	29.9
Frequency of providing antibiotics to animal(s) in the last 12 months.	Not at all	105	27.3
	Once or twice a year	120	31.3
	Once or twice a month	138	35.9
	Usually everyday	21	5.5
Who prescribe the antibiotics used in cows?	Animal health personnel	166	43.2
	Self-prescription	154	40.1
	All of above	64	16.7
Use of antibiotics	Never used antibiotics	105	27.3
	Used antibiotics	279	72.7
Where they got antibiotics.	Veterinary drug shops	159	41.4
	Human drug shop	120	31.3
	Animal drug hawkers	105	27.3
Who administers antibiotics to cows in herd?	Sector animal health officer	173	45.1
	Traditional or local healer	169	44
	Private vet clinic	35	9.1
	Myself	7	1.8
How is antimicrobial dosage determined per cow?	From instructions on the label	185	48.2
	Arbitrary	199	51.8
Frequency of daily antibiotics usage on lactating cows	As prescribed	147	38.3
	One single high dose	128	33.3
	Once daily until the cows recovered	35	9.1
	Twice daily until the cows recovered	74	19.3
Prevalent illness conditions of lactating cows	Mastitis	134	34.9
	Foot and mouth diseases	114	29.7
	Udder injuries	120	31.3
	Other	16	4.1
Antimicrobials most frequently used in farm.	Penistreptomycin	113	29.4
	Oxytetracycline	253	65.9
	Gentamicin	13	3.4
	Other antibiotics	5	1.3

adding up the total score across the ten (10) attitude-related questions. The true answer counted 2.5 marks and the false answer got zero. The answers were ranged in the Likert scale format. Respondents with negative attitudes towards antibiotic use in cattle were those scored less than 12.5 marks out of 25 marks whereas those score more than 12.5 marks out of 25 marks were considered as having positive attitudes towards antibiotic use in cattle.

From the findings presented in Figure 2, the researcher found that 73.7% of the respondents had positive attitude towards antibiotic use in cattle while 26.3% presented negative attitudes towards antibiotic use in cattle. The mean attitude score for all respondents was 14.02 with standard deviation of out of 2.3.

Practices on antibiotics use by cattle keepers in Nyagatare District

It was very important to analyze what are cattle keepers' practices towards antibiotics use in Nyagatare District. Findings are presented in Table 4.

Findings in Table 4 display that 70.1% accepted they are treating cows in their herd with antibiotics, 35.9% accepted they provided antibiotics to their cows in the last 12 months once or twice a month, 43.2% said that antibiotics used in cows are prescribed by animal health personnel, 72.7% said they are using antibiotics in cattle but only 41.4% got it from veterinary drug shops, 45.1% indicated that antibiotics are administered by sector animal health officer in their herd, 51.8% said that antimicrobial dosage was determined per cow arbitrary, 38.3% said that daily antibiotics usage on lactating cows is done as prescribed, 34.9% said that the prevalent illness condition for lactating cows was the mastitis and 65.9% said that they are frequently use Oxytetracycline in treatment.

Overall practice Score

The practice's section checked fourteen (14) questions related to antibiotic use in cattle and were marked for each respondent. If a respondent provided a correct response, he/she scored 2 marks. If he/she provided a false response, he/she was marked by zero. An overall practices score was determined for each respondent by adding up the

Table 5: Factors associated with practices towards antibiotic use: Multivariate analysis.

Variables		Adjusted OR 95% CI	P-value
Gender	Female	Ref.	
	Male	0.25(0.09-0.67)	0.006
Level of education	Primary	0.92(1.71-4.94)	0.923
	Secondary and above	Ref.	
Years in cattle keeping	1-2 years	0.38(0.10-1.37)	0.143
	3-5 years	1.48(0.57-3.78)	0.413
	Above 5 years	Ref.	
Distance from farm to vet pharmacy	<1km	0.06(0.01-0.30)	0.001
	1-3 km	0.50(0.10-2.54)	0.41
	4-6 km	0.44(0.08-2.23)	0.322
	7-9 km	0.24(0.04-1.45)	0.121
	10km and above	Ref.	
Level of knowledge	High	0.06(0.01-0.33)	0.001
	Low	Ref.	
Level of attitudes	Positive	0.40(0.21-0.77)	0.006
	Negative	Ref.	

Source: Primary data (2021).

scores across the 14 practice-related questions. The total score was 28 marks. Respondents scored less than 14 marks were considered as they had poor practice whereas those scored more than 14 marks out 28 marks were considered as their had good practice towards antibiotic use in cattle.

Research findings presented in Figure 3 indicate that there were 32.6% of respondents with good practice while 67.4% revealed poor practice towards antibiotic use in cattle. The mean practice score for all respondents was 11.9 with standard deviation of 3.8.

Factors associated with practices' level towards antibiotics use by cattle keepers

Findings revealed that male cattle keepers were less likely (AOR=0.25; 95% CI: (0.09-0.67), $p=0.006$) to have poor practice on antibiotic use compared to females.

Cattle keepers who were required to walk less than one km from farm to veterinary pharmacy were less likely (AOR=0.06; 95% CI: (0.01-0.30); $p=0.001$) to have poor practice on antibiotic use in cattle than those living far from the vet pharmacy. Cattle keepers with high level of knowledge on antibiotic use were less likely (AOR=0.06; 95% CI: (0.01-0.33); $p=0.001$) to have poor practice towards antibiotic use compared to those with low level of knowledge. Similarly, cattle keepers with positive attitude towards antibiotic use were less likely (AOR=0.40; 95% CI: (0.21-0.77); $p=0.006$) compared to those with negative attitude towards antibiotic use in cattle.

Discussion

In this study, the researcher found that participants had low levels of knowledge on what antibiotics are, on how and why antibiotics should be used. These knowledge levels were similar, however, to other studies conducted among animal farmers in low-and middle-income countries including Cambodia [8].

In this study, 63.3% of respondents knew that antibiotics are used in infection prevention. These findings are different with what found in a KAP study conducted in rural Shandong province, China where only a minority of participants knew which pig diseases normally need to be treated with antibiotics [9].

In our study, 34.9% said that the prevalent illness condition for lactating cows was the mastitis, but in rural Shandong province, China, diarrhea was the disease most frequently mentioned by participants that should be treated with antibiotics, and several of the most common diarrheal disease in pigs are of bacterial origin (e.g. neonatal diarrhea, weaning diarrhea, swine dysentery and porcine proliferative enteritis) [9].

Antibiotics are among the chemicals used as growth factors in animals as stated [4]. However, it was interesting to note that some farmers (41%) participating in this study conducted in Turkey were believing that antibiotics can be used to improve weight gain in animals. This was somehow similar to what found in our study where 72.4% of participants knew that antibiotics improve weight gain for animals.

In this study, in addition to the knowledge on antibiotic use, the researcher found that 73.7% of the respondents had positive attitude towards antibiotic use in cattle. This was different with found in a study carried out in cattle farms located in Bingol province and its central villages, in eastern Turkey where the participants were observed to have insufficient awareness in terms of rational use of antibiotics. Approximately half of the respondents stated that when their animals became diseased they used antibiotics which they had readily available before they contacted the veterinarian [4].

In a recent survey conducted in ruminant farmers in Selangor, Malaysia, more than 70% of respondents stated that all sick animals should be given antimicrobial agents, and 63% thought that antibiotics had no side effects in animals [10]. These findings were somehow similar with found in our study where 70.1% accepted they are treating cows in their herd with antibiotics when there was sick. The Ox tetracycline was the most used at 65.9%.

In the present study, a statistically significant association was found between practice towards antibiotic use in cattle and demographic parameters such as gender, educational level, experience in cattle keeping, distance from farm to vet pharmacy, level of knowledge towards antibiotic use in cattle and attitudes towards antibiotic use in cattle. These findings were consistent with what found in Turkey where people dealing with animal husbandry generally live in rural areas, have low education levels, and are relatively old people [4].

Having a high level of knowledge on antibiotic use in cattle (AOR=0.006; 95% CI: (0.02-0.33); $p=0.001$) and positive attitude on antibiotic use in cattle (AOR=0.40; 95% CI: (0.21-0.77); $p=0.006$) were found to an influence on developing good practices towards antibiotic use among cattle keepers. Similarly, as a matter of fact, the practices in dairy farms in India showed that it was affected by knowledge and beliefs [2]. Reported that the lack of commercial veterinary services in the community, easy access to antibiotics, and the need to provide profits and minimize losses caused an increase in non-prescription antibiotic consumption.

A total of 72.7% said they were using antibiotics in cattle. This

finding was in contrast with what found in a study done in China where only a fifth of respondents reported that they always or often used antibiotics in feed to keep pigs healthy and prevent diseases [9]. This was likely to be an under-estimate of the use of antibiotics as growth promoters because farmers might not always be aware of the contents of commercial feed used by three-quarters of respondents in China.

Conclusion

The purpose of this study was to determine knowledge, attitudes, practices on antibiotics use among cattle keepers in Nyagatare District. Cattle keepers from Nyagatare district demonstrated poor knowledge, Positive attitude and poor practices towards antibiotic use. This study discovered viewpoints of cattle keepers located in Nyagatare district on antibiotics knowledge, attitudes and practices towards antibiotic use which may help the authorities to draw a direction toward taking necessary steps in order to minimize antimicrobial resistance and other related public health treats. Furthermore, cattle keepers should be encouraged to collaborate with veterinarians or paraprofessionals when their cows are sick to ensure a proper clinical diagnosis, particularly if they are considering initiating treatments.

References

1. Thornber K, Huso D, Rahman MM, Biswas H, Rahman MH, Brum E, et al. Raising awareness of antimicrobial resistance in rural aquaculture practice in Bangladesh through digital communications: a pilot study. *Global Health Action*. 2019; 12.
2. NISR. Rwanda statistical yearbook 2020. 2020.
3. IFAD. Rwanda Dairy Development Project. Detailed design report. 2016.
4. Almeida A, Duarte S, Nunes R, Rocha H, Pena A & Meisel L. Human and veterinary antibiotics used in Portugal-A ranking for ecosurveillance. *Toxics*. 2014; 2: 188-225.
5. Katakweba AAS, Møller KS, Muumba J, Muhairwa AP, Damborg P, Rosenkrantz JT, et al. Antimicrobial resistance in faecal samples from buffalo, wildebeest and zebra grazing together with and without cattle in Tanzania. *Journal of Applied Microbiology*. 2015; 118: 966-975.
6. Ungemach FR, Müller-Bahr D & Abraham G. Guidelines for prudent use of antimicrobials and their implications on antibiotic usage in veterinary medicine. *International Journal of Medical Microbiology*. 2016; 296: 33-38.
7. Mikecz O, Pica-Ciamarra U, Felis A, Nizeyimana G, Okello P & Brunelli C. Data on antimicrobial use in livestock: Lessons from Uganda. *One Health*. 2020; 10: 100165.
8. Omulo S, Thumbi SM, Njenga MK & Call DR. A review of 40 years of enteric antimicrobial resistance research in Eastern Africa: What can be done better? *Antimicrobial Resistance and Infection Control*. 2015; 4.
9. Dyar OJ, Zhang T, Peng Y, Sun M, Sun C, Yin J, et al. Knowledge, attitudes and practices relating to antibiotic use and antibiotic resistance among backyard pig farmers in rural Shandong province, China. *Preventive Veterinary Medicine*. 2020; 175: 104858.
10. Sadiq MB, Syed-Hussain SS, Ramanan SZ, Saharee AA, Ahmad NI, Noraziah MZ, et al. Knowledge, attitude and perception regarding antimicrobial resistance and usage among ruminant farmers in Selangor, Malaysia. *Preventive Veterinary Medicine*. 2018; 156: 76-83.