









Original Articles

## Veterinary assistance and knowledge of farmers about antimicrobials in Goiás, Brazil

Atuação da assistência veterinária e conhecimento dos produtores rurais sobre antimicrobianos em Goiás, Brasil

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### ABSTRACT

The objective of this research was to evaluate the influence of veterinary care on milk production and quality variables in rural properties of Goiás. The objective was also to verify the farmers' knowledge on antimicrobials. A total of 132 farms were visited in the state of Goiás, where interviews were carried out in order to characterize the farm, the influence of veterinary assistance on productive and sanitary aspects, and the way antimicrobials were used. Pearson's chi-square test ( $\chi^2$ ) was used to verify the dependency or independence of variables. It was verified that 55.3% of the farms had dairy production below 250 L per day. However, 60.2% of the total milk produced on the 132 farms visited came from only 15 farms (11.4%), with production above 1,000 L per day. Veterinary assistance was present in 56% of the farms and a significant association was identified between veterinary assistance and the variables: type of farm ( $p = 0.025$ ), husbandry system ( $p = 0.015$ ), number of milkings per day ( $p = 0.0007$ ), daily production per cow ( $p = 0.0006$ ), and antimicrobial prescription ( $p < 0.0001$ ). The farmers know that milk with antimicrobial residues must be discarded; however, they do not do it properly. Farms with lower average daily production per cow showed higher use of antimicrobials on their own initiative ( $p = 0.02$ ). With urgency, the expansion of technical assistance and training of farmers regarding milk production is required to prevent risks associated with public health in Goiás.

### RESUMO

O objetivo desta pesquisa foi avaliar a influência da assistência veterinária em variáveis de produção e qualidade do leite em propriedades rurais de Goiás. Objetivou-se, também, verificar o conhecimento dos produtores sobre antimicrobianos. Foram visitadas 132 propriedades rurais no estado de Goiás, onde foram realizadas entrevistas visando a caracterização da propriedade, a influência da assistência veterinária em aspectos produtivos e sanitários, e a forma como os antimicrobianos eram usados. O teste qui-quadrado ( $\chi^2$ ) de Pearson foi utilizado para verificar a dependência ou independência das variáveis. Verificou-se que 55,3% das propriedades apresentavam produção leiteira abaixo de 250 L por dia. No entanto, 60,2% do total de leite produzido nas 132 propriedades visitadas era proveniente de apenas 15 fazendas (11,4%) com produção acima de 1.000 L por dia. A assistência veterinária estava presente em 56% das propriedades e identificou-se uma associação significativa entre assistência veterinária e as variáveis tipo de exploração ( $p = 0,025$ ), sistema de criação ( $p = 0,015$ ), número de ordenhas por dia ( $p = 0,0007$ ), produção diária por vaca ( $p = 0,0006$ ) e prescrição de antimicrobiano ( $p < 0,0001$ ). Os produtores sabem que é necessário descartar o leite com resíduos de antimicrobianos, no entanto não o fazem adequadamente. Propriedades com menor produção média diária por vaca apresentaram maior uso de antimicrobianos por iniciativa própria ( $p = 0,02$ ). Com urgência, faz-se necessária a ampliação da assistência técnica e a capacitação dos produtores quanto à produção de leite para prevenir riscos associados à saúde em Goiás.

*Palavras-chave:*

Antibiótico

Assistência técnica

Qualidade do leite

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## INTRODUCTION

Dairy cattle farming is one of the most important livestock activities in Brazil, positioning the country as the fifth largest milk producer worldwide (USDA, 2020). The state of Goiás, in the Midwest region, is the fourth largest milk producer in the country (IBGE, 2018), which demonstrates the importance of this activity to the economy of the state (FAEG, 2019). Although the volume of milk is fundamental for the profitability, the quality of this product is a growing concern of public health agencies, especially regarding antimicrobial residues (DU et al., 2019; WANG et al., 2017).

The consumption of milk with antimicrobial residues is a public health problem, as it can cause allergic, toxic reactions and intestinal microbiota imbalances (BEM et al., 2019; MENKEM et al., 2019). In addition, there is growing concern in terms of bacterial resistance to antimicrobials, which can be accelerated by the presence of residues of these drugs in milk consumed by humans and other animals (MAYNOU; BACH; TERRÉ, 2017; MENKEM et al., 2019). The presence of antimicrobials in milk also causes damages to dairy products, because these substances inhibit the multiplication of important dairy bacteria for fermentation, which compromises the organoleptic properties of the final products, besides harming the coagulation and the maturation of dairy products (BERRUGA et al., 2016). Antimicrobial residues also cause damage to the environment because they contaminate the soil when they are eliminated through milk, urine and/or feces, which can damage the quality of the microflora, microfauna and groundwater (BERRUGA et al., 2016; KEMPER, 2008).

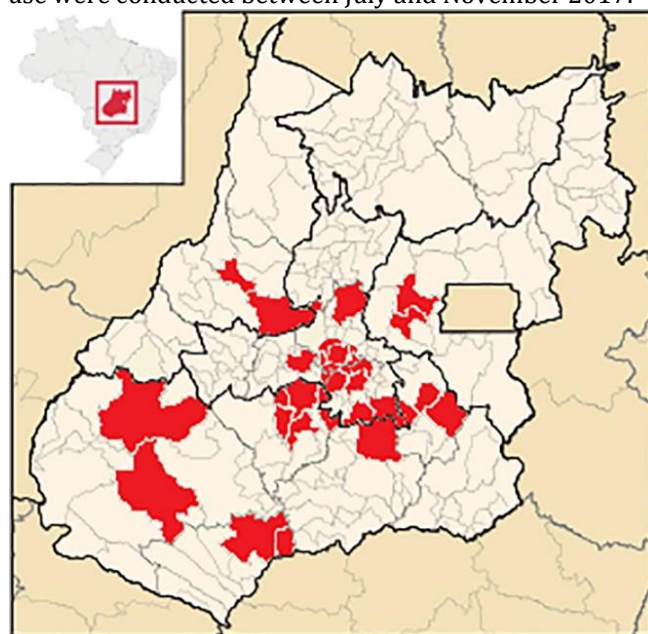
The veterinary assumes an important role in milk production, especially with regard to the presence of antimicrobial residues in this product, because this professional can act in all stages of production. Thus, the veterinary work is essential to ensure the health of dairy herds and the safety of products of animal origin that reach the consumer (CRMV-RS, 2014). In this context, research to assess the influence of veterinary technical assistance on dairy farms is important to guide the actions of rural extension agencies and substantiate the performance of both public and private technical assistance. Moreover, considering the risk of indiscriminate use of antimicrobials for public health (BEM et al., 2019), it is important to collect information on the knowledge of farmers and the characteristics of the use of these substances on farms. This information may be used in the future for the creation of educational programs aiming to reduce the indiscriminate use of these drugs in dairy cows.

This study aimed to evaluate the influence of veterinary care on milk production and quality variables in rural properties in the state of Goiás. It also aimed to identify the level of knowledge of dairy farmers on antimicrobials, in addition to aspects related to the use of these drugs on farms.

## MATERIAL AND METHODS

This study was developed in the state of Goiás, Brazil, between July and November 2017. A total of 132 rural properties were visited in 33 municipalities in Goiás (Figure 1). The selection of the farms took place by simple occasional sampling. Before beginning data collection, the project was approved by the Research Ethics Committee of the Federal University of Goiás, under number 1,986,348/2017. For information on veterinary care and the use of antimicrobials, an interview was conducted with the owner or collaborator responsible for milking and management of cows on each farm, according to a questionnaire adapted from Nunes et al. (NUNES et al., 2016).

Figure 1. Municipalities of Goiás, site of 132 dairy farms where interviews on veterinary care and antimicrobial use were conducted between July and November 2017.



The questions raised in the interviews were aimed at the general characterization of the farm, the identification of the influence of veterinary care on productive and sanitary aspects, and the verification on how antimicrobials were used. The first part of the questionnaire included the owner's education, type of farm, husbandry system, milking parlor floor and hygiene, number of milkings per day, predominant breed of cattle, total number of cows, number of cows in lactation, daily milk production, presence of veterinary assistance, facilities, and aspects related to the cleaning of the environment. The second part of the questionnaire addressed questions on the use of antimicrobials, asking the interviewees about who was prescribing antimicrobials, in which situations antimicrobials were used, which diseases were treated, which were the active principles or the commercial names of the drugs, and the frequency of application. In the cases of citation of the commercial name of the medicines, the package leaflet of

the product was checked for identifying the active principle(s). In addition, the interviewees were asked about the separation of the cows during the treatment with antimicrobial and about the destination of the milk with antimicrobial residues.

The farms were grouped according to the daily milk production into four categories: below 250 liters, from 250 to 500 liters, from 501 to 1,000 liters, and above 1,000 liters. This classification was intended to facilitate the presentation, comparison and discussion of results. The R software (Version 3.3.1 - 2016 - The R Foundation for Statistical Computing) was used to perform descriptive statistics from absolute and relative frequencies, and to perform Pearson's chi-square test ( $\chi^2$ ) to verify dependence or independence of the evaluated variables.

## RESULTS

There were 132 interviews in dairy farms in the state of Goiás, Brazil. The herd was composed of mixed animals

Table 1. Production parameters of 132 dairy farms in the state of Goiás, Brazil, where interviews were conducted between July and November 2017

Variables	Milk Production				Total
	< 250 L	250 to 500 L	501 to 1,000 L	> 1,000 L	
Number of farms	73 (55.3%)	27 (20.4%)	17 (12.9%)	15 (11.4%)	132
Milk volume/day (L)	5,239 (7.4%)	9,405 (13.3%)	13,430 (19.1%)	42,458 (60.2%)	70,532
Average production/farm (L) <b>daily</b>	71.8	348.3	790	2,830.5	534.3
Lactating cows	967 (20.8%)	768 (16.5%)	940 (20.2%)	1,973 (42.5%)	4,648
Average of cows in lactation/farm	13	28	55	131	36
Average daily production $\pm$ SD	6.1 $\pm$ 3.2	12.5 $\pm$ 3.4	15.8 $\pm$ 4.9	19.6 $\pm$ 4.0	10.1 $\pm$ 6.1
Presence of veterinary assistance	33 (45%)	12 (44%)	14 (82%)	15 (100%)	74 (56%)

SD: standard deviation.

Pearson's chi-square test ( $\chi^2$ ) demonstrated a statistically significant association between veterinary care and the variables: type of farming ( $p = 0.025$ ), husbandry system ( $p = 0.015$ ), number of milkings per day ( $p = 0.0007$ ), average daily production ( $p = 0.0006$ ), and antimicrobial prescription ( $< 0.0001$ ) (Table 2).

Table 3 shows the schooling of the farmers interviewed. In 10 farms it was not possible to obtain information on

in 81.1% (107/132) of the farms. European dairy breeds were observed in 15.1% (20/132) and other breeds in 3.8% (5/132) of the farms. In milking parlors, cement flooring was observed in 67.4% (89/132), beaten flooring in 27.3% (36/132) and other types of flooring in 5.3% (7/132). The cleaning of the milking facilities was performed on 93.2% (123/132) of the farms, of which 86.2% (106/132) performed it daily. Regarding the type of cleaning, 47% (62/132) of the farmers cleaned the facilities with running water, 37.1% (49/132) performed only the collection (removal of feces), and 9.8% (13/132) performed sweeping and collection.

Table 1 shows the production data of dairy farms grouped according to milk volume produced. There was veterinary care in 56% of the farms (74/132). There, professional assistance occurred weekly in 12.2% (9/74), biweekly in 12.2% (9/74), monthly in 43.2% (32/74), quarterly in 17.5% (13/74), and biannually in 14.9% (11/74).

the education level of the owner, since he was not present at the time of the interview and the interviewee did not know how to inform the education of the farmer. The comparison of the levels of primary, secondary, and higher education with the production levels by means of the chi-square test ( $\chi^2$ ) showed that there was no significant relationship between these variables ( $p = 0.394$ ).

Table 2. Association between veterinary care, production variables and aspects related to the use of antimicrobials in 132 dairy farms located in the state of Goiás, Brazil, visited between July and November 2017.

Variables	Veterinary Care				p-value
	Yes		No		
	n	%	n	%	
<b>Type of Operation</b>					
Dairy (n = 98)	61	62.2	37	37.8	0.025*
Mixed (n = 34)	13	38.2	21	61.8	
<b>Husbandry system</b>					
Intensive (n = 14)	11	78.6	3	21.4	0.015*
Semi-intensive (n = 72)	44	61.1	28	38.9	
Extensive (n = 45)	18	40.0	27	60.0	
<b>Number of milkings/day</b>					
One (n = 59)	23	39.0	36	61.0	0.0007*
Two or three (n = 73)	51	69.9	22	31.1	
<b>Average daily production</b>					
<12 liters (n = 85)	37	43.5	48	56.5	0.0006*
≥12 and ≤17 liters (n = 25)	18	72.0	7	28.0	
>17 liters (n = 20)	17	85.0	3	15.0	
<b>Cleaning the premises</b>					
Yes (n = 123)	70	56.9	53	43.1	0.704
No (n = 9)	4	44.4	5	55.5	
<b>Antimicrobial prescription</b>					
Own initiative or shopkeeper (n = 54)	11	20.4	43	79.6	< 0.0001*
Veterinary (n = 64)	55	85.9	9	14.1	
<b>Separation of the animal under treatment</b>					
Yes (n = 70)	45	64.3	25	35.7	0.052
No (n = 61)	28	45.9	33	54.1	
<b>Disposal of milk from all quarters</b>					
Yes (n = 123)	68	55.3	55	44.7	0.975
No (n = 8)	5	62.5	3	37.5	
<b>Destination of milk with residues</b>					
Animals (n = 98)	54	55.1	44	44.9	0.87
Wash water without treatment (n = 21)	11	52.4	10	47.6	
Pastures or other destinations (n = 13)	8	61.5	5	38.5	

\*Values of  $p \leq 0.05$  are considered significant by Pearson's chi-square test ( $\chi^2$ ).

Table 3. Schooling of interviewees from 132 dairy farms located in the state of Goiás, Brazil, visited between July and November 2017

Schooling	Milk Production				Total*
	< 250 L	250 to 500 L	501 to 1,000 L	> 1,000 L	
Elementary school	26 (38.2%)	9 (36%)	5 (31.2%)	2 (15.4%)	42 (31.8%)
High School	16 (23.5%)	7 (28.0%)	3 (18.7%)	2 (15.4%)	28 (21.2%)
Higher Education	24 (33%)	8 (30%)	8 (47%)	9 (60%)	49 (37.1%)
Illiterate	2 (2.7%)	1 (3.7%)	0	0	3 (2.3%)
Did not inform schooling	5 (6.8%)	2 (7.4%)	1 (5.9%)	2 (13.3%)	10 (7.6%)
<b>Total</b>	<b>73 (55.3%)</b>	<b>27 (20.4%)</b>	<b>17 (12.9%)</b>	<b>15 (11.4%)</b>	<b>132 (100%)</b>

\* There was no significant difference by Pearson's chi-square test ( $\chi^2$ ) ( $p = 0.394$ ).

As for the use of antimicrobials, it was verified that in 72% (95/132) of the farms, these drugs were used when some clinical sign was observed in the animal; in 25.7% (34/132), these drugs were used after the identification of clinical sign and at the time of drying-off dairy cows; and in 2.3% (3/132) of the farms, the interviewees affirmed not to use antimicrobials. According to the interviewees, the treatment with antimicrobials was carried out for 2 to 3 days in 88.4% (114/132) and for 4 to 5 days in 6.1% (8/132) of the farms. After the use of the antimicrobials, 97.7% (129/132) of the interviewed affirmed that they discarded the milk with residues and only 2.3% (3/132) affirmed not to discard. However, in 6.0% (8/132) of the farms, the discarding of milk with residues was only performed from the breast where the antimicrobial was applied. The time of milk disposal adopted in 75.4% (98/132) of the farms was three days or more, and in 23.8% (31/132) of the farms, those responsible for applying the antimicrobials followed the instructions in the package leaflet of the drug used.

Figure 2 shows the antimicrobials cited during the interviews. The interviewees mentioned the use of 23 active principles of antimicrobials, of which tetracycline (24.7%), penicillin (15.8%) and streptomycin (14.9%) stood out. Among the antimicrobials used, it was verified a great variety of classes that included  $\beta$ -Lactams (24.9%) (penicillins and cephalosporins of 1<sup>st</sup> and 3<sup>rd</sup> generation), aminoglycosides (15.0%), macrolides (6.3%), polypeptides (3.1%), sulfonamides (2.6%), trimethoprim (2.3%), and quinolones (2.3%). In 62.1% (82/132) of the farms, when questioned about the antimicrobials used, the interviewees cited other classes of drugs, such as antipyretics (42.9%), anti-inflammatory (23.5%), anti-parasitic (11.8%), and vitamin complexes (2.5%) (Figure 3). The diseases treated with antimicrobials, according to the interviewees, are related in Figure 4.

Figure 2. Antimicrobials used in 132 dairy farms in the state of Goiás, Brazil, visited between July and November 2017.

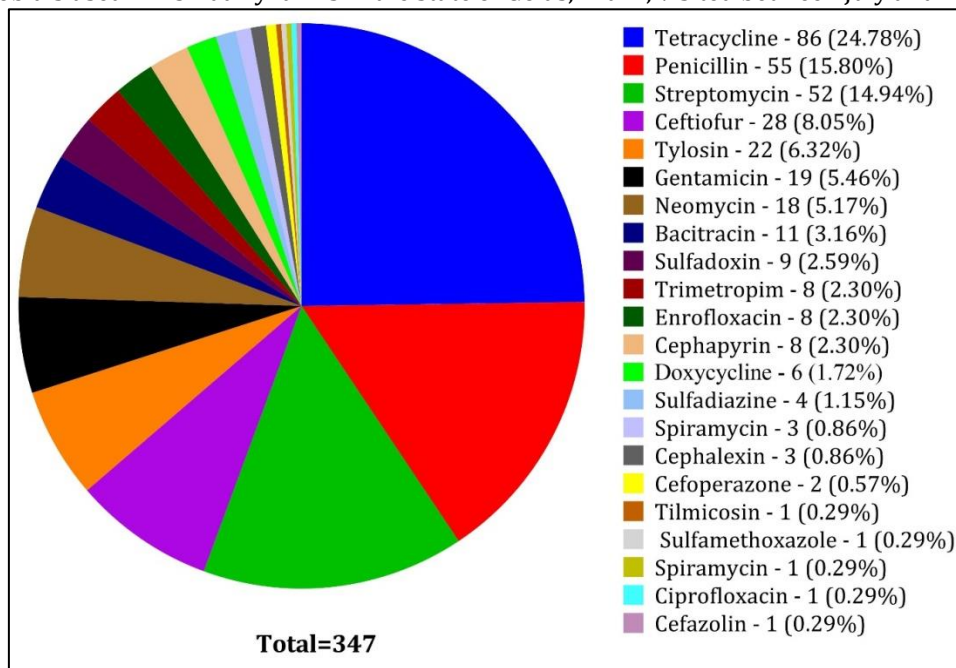


Figure 3. Drugs confused with antimicrobials by the interviewees in 132 dairy farms in the state of Goiás, Brazil, visited between July and November 2017.

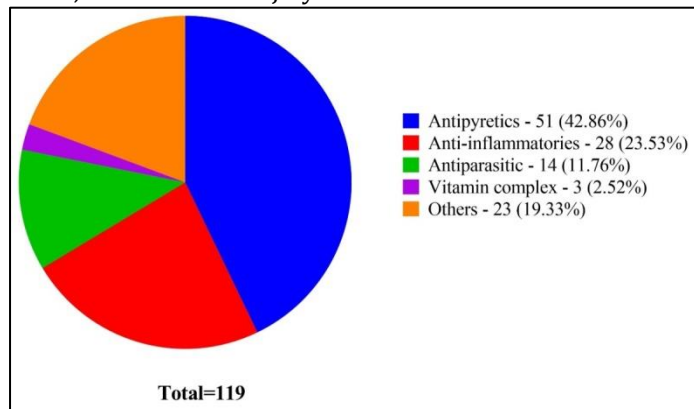
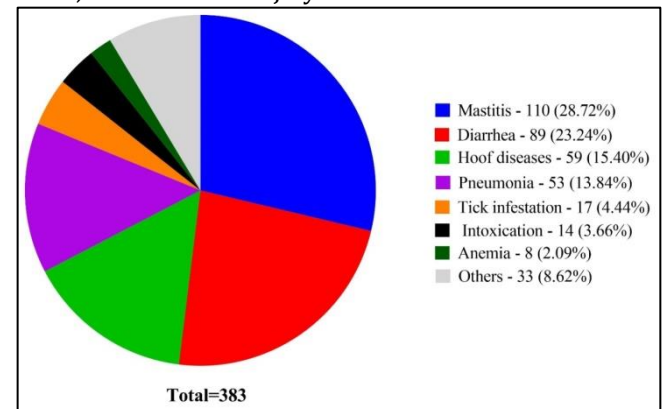


Figure 4. Diseases treated with antimicrobials according to the interviewees of 132 dairy farms in the state of Goiás, visited between July and November 2017.





Pearson's chi-square test ( $\chi^2$ ) has shown that there was a significant association ( $p = 0.02$ ) between the average daily productivity of the herd and the one responsible for recommending the use of the antimicrobial (Table 4). Farms with a daily production lower than 12 liters per

cow presented higher use of antimicrobials by their own initiative, while farms with average production higher than 12 liters/day presented more recommendations of antimicrobials performed by veterinarians.

Table 4. Association between the person responsible for recommending the antimicrobial and average daily production of cows from 132 dairy farms located in the state of Goiás, visited between July and November 2017.

Average daily production	Who recommended the use of antimicrobial						p-value
	Own initiative		Storekeeper		Veterinarian		
	n	%	n	%	n	%	
<12 liters (n = 76)	40	52.6	2	2.6	34	44.7	
≥12 and ≤17 liters (n = 23)	7	30.4	2	8.7	14	60.9	0.02*
>17 liters (n = 17)	3	17.6	0	0	14	82.4	

Values of  $p \leq 0.05^*$  are considered significant by Pearson's chi-square test ( $\chi^2$ ).

## DISCUSSION

This study presented a survey of data on milk production, schooling, veterinary technical assistance and use of antimicrobials in 132 dairy farms in the state of Goiás, Brazil. In this context, it was sought to contribute to the situational diagnosis of the influence of veterinary assistance on parameters of production and use of antimicrobials, as well as to identify aspects related to the use of these drugs in these farms. Although the presence of antimicrobials has already been identified in samples of pasteurized milk in Goiás (BORGES et al., 2000), no studies were found that evaluated the knowledge of farmers on these drugs in this state. Data surveys such as this are important to substantiate the upgrading of technical assistance and rural extension services in order to promote milk production with greater food security (BORSANELLI et al., 2014).

The interviews revealed that, in general, there is a concern of the farmers regarding the cleaning of the milking facilities. However, the use of beaten flooring (27.3%), the failure to perform daily cleaning of the facilities (13.8%), and cleaning by collection and/or sweeping (47.0%) demonstrated that, in many farms, hygiene does not meet the standards required to obtain milk with food safety (OLIVEIRA et al., 2017), putting public and animal health at risk. Proper hygienization of milking equipment is essential for the production of quality milk and should be carried out immediately after the end of each milking (MENDONÇA; GUIMARÃES; BRITO, 2012). The information obtained on cleaning the milking facilities reinforces the need for training of farmers and staff involved in milking to make them aware of the health risk of marketing milk outside

quality standards. In 2019, it was found that in Goiás only 23% of farmers and 10% of employees participated in some training program on dairy activities (FAEG, 2019), which demonstrates the urgent need to implement training programs to improve milk quality rates in the state of Goiás.

The results showed a predominance of farms with low daily milk production volume (<500L), low productivity per cow, and low presence of veterinary assistance (Table 1). This information shows that, although Goiás is the fourth state with the highest milk production in the country (IBGE, 2018) and has shown an increase in production in recent years (FAEG, 2019), there is still a predominance of farms with low technification, low productivity, and low profitability. These results are similar to those observed in a recent survey of the dairy chain in the state of Goiás (FAEG, 2019), which showed that 52.64% of the farms produce up to 200 liters of milk per day and 79% do not receive continuous technical assistance. On the other hand, in the sampling of this study, a smaller portion of the farms was responsible for the greater amount of milk produced. This finding corroborates the national data, because 82% of the Brazilian milk production is concentrated in only 17% of the farms (VILELA et al., 2017).

A statistically significant relationship was identified between the presence of veterinary assistance and a specialized dairy farm, with greater intensification of the production system, two or three milkings per day and higher average production per cow (Table 2). These results demonstrate the importance of technical assistance to increase production rates, which was also demonstrated by Gonçalves et al. (2014). Nevertheless, it is observed that in Goiás there is still a deficiency in the

transmission of quality technical information, since neighbors and social networks still represent an important source of consultation (FAEG, 2019). On the other hand, it is also important to highlight the importance of the commitment of farmers who invest in technical assistance and in technologies that enable greater intensification of milk production. The technicians have the responsibility to bring to the farmers modern methodologies and information capable of improving the zootechnical indexes of the herd. However, farmers who are not willing to adopt them become responsible for maintaining low zootechnical indexes (FERREIRA; MIRANDA, 2007).

The veterinary care had no significant association with the variables cleaning of the facilities, separation of the animal under treatment, disposal of milk from all quarters, and destination of milk with residues (Table 2). These results indicate that veterinary care had little focus on health issues related to food safety. This may have occurred because, in 75.6% (56/74) of the farms receiving assistance, it occurred monthly, quarterly, or semiannually. Thus, during the visit, the technician focuses his efforts on improving reproductive rates, formulating diets, grouping dairy cows, and weighing calves. Obviously, these activities are fundamental for the improvement of the zootechnical indexes; however, the greatest concern of society regarding the food safety of milk (LI et al., 2019a; LI et al., 2019b) highlights the need for greater attention from technicians regarding the quality of this product. According to Borsanelli et al. (2014), there is an urgent need for the execution of current sanitary programs focusing on the concept of unique health, in addition to the realization of sanitary education actions in rural areas.

The producer's schooling did not show significant association with the volume of milk produced. This result agrees with that observed in the Dairy Chain Diagnosis of Goiás in 2019 (FAEG, 2019), which found little relationship between education level and milk production ranges. Nonetheless, Borsanelli et al. (2014) have shown that primary school farmers are more likely to milk animals treated with acaricides and not to discard milk from cows undergoing mastitis treatment. The results of this survey showed that 33% (24/73) of farmers who produced less than 250 liters of milk had completed higher education. This finding indicates that these farmers possibly have other main sources of income and, therefore, use the dairy activity only for milk consumption on the farm and, in many cases, keep the farm just for leisure.

According to the interviewees, tetracyclines (24.78%) and penicillins (15.80%) are the most used antimicrobials in the farms. The identification of these antibiotics as the most used by farmers in Santa Catarina (KORB et al., 2011) and the largest presence in milk samples in Paraná (SCHLEMPER; SACHET, 2017) indicate that they are widely used throughout Brazil. This may be related to the increased availability of these drugs on the market, low cost and possibility of use in

the treatment of various infections. The great variety of classes and bases used demonstrates the wide availability of antimicrobials on the market and the easy access of farmers to these drugs. This scenario exposes a worrying situation, which is the possible indiscriminate use of antimicrobials. The use of these drugs in livestock is important for the treatment of infections; however, the frequent application of underdose contributes to the increase of antimicrobial resistance (VAN et al., 2020). This concern is reinforced by the use, often without criteria of aminoglycosides, 3<sup>rd</sup> generation cephalosporins, macrolides and quinolones, antimicrobials considered critically important for the treatment of infections in humans by the World Health Organization (WHO, 2019).

The classification of other classes of drugs as antimicrobials by 62.1% of respondents demonstrates the little knowledge in terms of the use of these drugs. This statement is corroborated by the use of antimicrobials for the treatment of diseases that should not be treated with these drugs, such as infestation by ticks (4.44%) and intoxication (3.66%), besides diseases that do not always need use, such as diarrhea (23.24%) and hoof affections (15.40%). Interviews with farmers in Santa Catarina have also shown limited knowledge regarding antimicrobials and microbial resistance (KORB et al., 2011). These observations highlight the importance of the veterinarian to perform the diagnosis and selection of the antimicrobial, which should occur based on the identification of the pathogen and performance of the antibiogram (UNGEMACH; MÜLLER-BAHRDT; ABRAHAM, 2006). In addition, farmers should be aware that antimicrobials can be prescribed only by veterinarians and used by the owners according to the instructions indicated by these professionals (KORB et al., 2011).

The significant relationship between lower productivity and higher use of antimicrobials by own initiative (Table 4) demonstrates that the risk of using these drugs in an inappropriate way and without criteria is higher in small rural properties. This result may be associated with the lower presence of veterinary assistance, since these farms do not have financial conditions to pay for this service. This perception is ratified by the finding that 55% (55/100) of farms producing less than 500 liters/day do not have any type of veterinary care (Table 1). Redding et al. (2014) noted that small dairy farmers showed a greater tendency to treat diseases with antimicrobials and justified this finding to the low level of education and worse management practices. Moreover, many farmers request veterinary service only in severe cases and buy antimicrobials, without the need for prescription, for treating simple clinical cases (KORB et al., 2011). This situation is associated with the use of antimicrobials in incorrect doses and periods (TEMPINI et al., 2018). Therefore, there is a greater risk of developing bacterial resistance on small rural properties, which represents a public health problem (REDDING et al., 2014), because in many of these farms, milk is

consumed by the producer's family or used for cheese production that will be marketed in the community.

Although veterinary assistance is present in 56% of farms, it was observed that 97.7% (129/132) of the farms discard milk after the use of antimicrobial, which demonstrates that there is a general knowledge of farmers about the risks associated with the consumption of milk with antimicrobial residues. A similar result was observed by Redding et al. (2014), who evaluated the use of antimicrobials on small dairy farms in Peru. However, in this research, it was found that the disposal of milk was often carried out for a shorter time than recommended and/or incorrectly. In the latter case, it was identified that the disposal of milk with residues is a challenge in all farms, as there are no adequate disposal methods to reduce the risk of development of resistant bacteria. It was observed that most farms supplied the waste milk to other animals (74.2%). According to Pereira et al. (2014), feeding calves with milk containing low concentrations of antimicrobials for six weeks resulted in the selection of multi-resistant strains of *E. coli*. Therefore, the implementation of adequate practices for the disposal of milk with residues, such as pasteurization, is fundamental. This technique reduces the risk of exposure of calves to multi-resistant bacteria and reduces the spread of these microorganisms in the environment (AWOSILE; SMITH, 2017).

## CONCLUSIONS

Veterinary technical assistance in the state of Goiás, Brazil, is associated with higher milk productivity; nevertheless, it is not associated with the improvement of variables related to milk food safety. Farms with lower milk productivity present greater use of antimicrobials on their own initiative. Farmers in Goiás know the need to dispose of milk with antimicrobial residues, but they do not do it properly. There is an urgent need to expand technical assistance and training for farmers in the production of milk with food safety in order to prevent risks associated with animal and public health in the state of Goiás.

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