



Original Articles

Characterization of goat and sheep production in the state of Sergipe, Northeast of Brazil

Caracterização do sistema de produção de caprinos e ovinos no estado de Sergipe, Nordeste do Brasil

Jeferson Silva Carvalho¹, Tatiane Rodrigues da Silva², Paulo Vinícius de Moraes Santos³, Fabio Franco Almeida⁴, Taile Katiele Souza de Jesus⁵, Huber Rizzo^{6*}

¹ Doutorando do Departamento de Clínica Médica da Faculdade de Medicina Veterinária e Zootecnia da Universidade de São Paulo

² Docente da Unidade Acadêmica de Medicina Veterinária, Universidade Federal de Campina Grande

³ Mestrando do Programa de Pós-graduação em Medicina Veterinária do Departamento Veterinária da Universidade Federal de Viçosa

⁴ Doutoranda do Departamento de Medicina Veterinária da Universidade Federal Rural de Pernambuco

⁵ Médico Veterinário, FertVet Consultoria Veterinária

⁶ Docente do Departamento de Medicina Veterinária da Universidade Federal Rural de Pernambuco

ARTICLE INFO

Article history

Received 24 March 2020

Accepted 19 May 2020

Keywords:

Sheep and goat farming in Sergipe

Health

Characterization of properties

Consumer market

Small ruminants

ABSTRACT

Characterization of the profile of goat and sheep production in Sergipe enables better understanding of the main barriers linked to low productivity, generating important information for the development of this sector. The objective was to identify and characterize the production of goats and sheep in Sergipe. From 2011 to 2014, 41 goat properties and 60 sheep properties were analyzed, located in 25 municipalities in the three mesoregions of the State (Leste, Agreste, and Sertão). The information was obtained through application of a structured questionnaire to the farmers addressing topics such as: characterization of the property, herd, facilities, sanitary, nutritional, and reproductive management, and socioeconomic aspects of the farmer. The results demonstrated that 58.5% (24/41) of goat farms had an area less than 30 hectares (ha), reared predominantly mixed breed animals (SRD), with low use of technologies, aiming at family consumption, and complementing income through local marketing. On the sheep properties, 58.3% (35/60) were over 100 ha and used for the production of Santa Inês sheep and crossbreeds together with cattle. Significant flaws were also observed in feed, sanitary, and reproductive management, emphasizing the non-use of preserved foods and forages typical of the region, factors that contribute to the low level of productivity and sustainability of production in a viable and homogeneous manner. The findings led to the conclusion that more organized production is necessary, mainly through investment in technologies and qualified and continuous rural extension, aiming at improving the production, productivity, income, and quality of life of the breeders.

RESUMO

A caracterização do perfil das criações possibilita um maior entendimento dos principais entraves ligados a baixa produtividade e auxilia na disponibilização de dados importantes para a busca de soluções para crescimento da ovinocaprinocultura. O presente trabalho teve como objetivo caracterizar o sistema de produção de caprinos e ovinos no estado de Sergipe. Foram visitadas entre os anos de 2011 e 2014, 41 e 60 propriedades de caprinos e ovinos, respectivamente, localizadas em 25 municípios distribuídos nas três mesorregiões do Estado (Leste, Agreste e Sertão). O levantamento dos dados ocorreu pela aplicação de questionário junto aos proprietários, com temas referentes às características do rebanho, instalações, manejo sanitário, nutricional e reprodutivo e perfil do criador. A caprinocultura foi caracterizada como atividade complementar da renda de pequenos produtores rurais, com a maioria do rebanho representado por animais de padrão racial não definido e pela raça Saanen. A atividade é voltada ao consumo familiar com baixo uso tecnológico e produção leiteira para atendimento do comércio local. Enquanto que na ovinocultura, os rebanhos são compostos por animais puros e mestiços da raça Santa Inês mantidos em grandes áreas de terra devido a sua

Palavras-chave:

Ovinocaprinocultura Sergipana

Sanidade

Sistemas produtivos

Mercado consumidor

Pequenos ruminantes

* Corresponding author: hubervet@gmail.com

criação consorciada com bovinos. As falhas de manejo observadas nos rebanhos caprinos e ovinos comprometem a viabilidade do sistema de produção, contribuindo com maiores desafios para ovinocaprinocultura sergipana em atender a demanda do mercado consumidor do Estado.

INTRODUCTION

Goat and sheep farming in Brazil is concentrated mainly in the Northeast region, with 12.6 million sheep and 10.1 million goats, representing 93.9% and 66.7% of the national herd, respectively (IBGE, 2018). Although the sector presents a highly promising market, improvements are still required in all stages of production. The mean consumption of sheep meat in the country is low, at around 0.62 kg/per capita/year (FAO, 2013). Owing to the low availability of a quality product on the market, a large part of domestic demand is met by imports from Uruguay, Chile, Argentina, and New Zealand. According to data from the Ministry of Agriculture, Foreign Trade and Services, in 2019 Brazil imported a volume of approximately 600.5 tons of lamb meat (BRASIL, 2020).

Sheep production in the Northeast region of Brazil presents a low technology use and weak disease control practices (SANTOS, 2017). Sheep farming in Sergipe is characterized by the production of Santa Inês animals with high zootechnical value (ALMEIDA, 2007), while the sheep meat market is characterized by a high degree of informality in the various links of the production chain, leading to difficulties in obtaining official data on the sector (OLIVEIRA, 2014). Sergipe is the Northeastern State with the lowest number of animals, 157,560 sheep, and the highest concentrations are found in the municipalities of Tobias Barreto (15,649), Poço Verde (10,521), and Poço Redondo (9,415) (IBGE, 2018).

Despite the growing market demand, the State of Sergipe has only one federally certified slaughterhouse, located in the municipality of Propriá, contributing to the predominance of an informal meat trade in the open-air markets of the municipalities (D'ALENCAR et al., 2009). Data from the Federal Inspection Service of the Ministry of Agriculture, Livestock and Supply (MAPA) found that an annual average of only 920 sheep have been slaughtered under federal inspection since 2015. Often, the lots destined for slaughter were of inferior genetic quality, uneven, and with low carcass yield (MELO et al., 2003).

Goat farming in the Northeast of Brazil tends to be part of family or subsistence farming, and to serve local trade (FARIAS et al., 2019). The State of Sergipe has 20,837 goats, located mainly in the municipalities of Tobias Barreto (1,847), Canindé de São Francisco (1,753), and Poço Redondo (1,640). The production rate of goat milk is approximately 266,000 liters for every 610 goats milked per year, generating mean production of 436 liters per animal (IBGE, 2018). It was also observed that only 63.5% (169,000 liters) of the total milk produced is sold, with a mean price of R \$ 1.63/liter of milk (IBGE,

2017a). Regarding the quality of milk produced in the State, 52% of the samples collected in the main producing regions did not reach standards recommended by good hygiene practices in milking (SILVA et al., 2015a). Research in the primary goat milk area in Sergipe, located in the sub-region of Alto Sertão, found that goats are milked in the fold on 52.38 of the properties. The authors also observed that 66.6% of farmers do not keep milk refrigerated and/or frozen, selling the product in its fresh form in 61.9% of cases (Santos et al., 2014).

The goat and sheep production chain requires greater investments for better diagnosis, participative organization, and socialization of guidelines and results through a good rural extension program with sheep and goats, in order to contribute to improvement in meat management and marketing, as well as milk and its derivatives (MELO et al., 2003). An in-depth good diagnosis of the production chain will contribute to the planning of governmental policies for sheep and goat farming in the State, focusing mainly on permanent technical assistance, financing of activities, and implementation of strategies to improve health and control emerging diseases (GUILHERME et al., 2017). The diagnosis of practices used on the properties would make it possible to determine the main obstacles to the growth of activity (SILVA et al., 2015b). From these results, good management practices can be applied to obtain quality products and derivatives and, consequently, maximize profits from the different activities developed in sheep and goats.

The objective of the current work was to identify and characterize the production of goats and sheep in the Leste, Agreste, and Sertão mesoregions of the State of Sergipe. The work is justified by the scarcity and quality of information on the productive system of sheep from Sergipe.

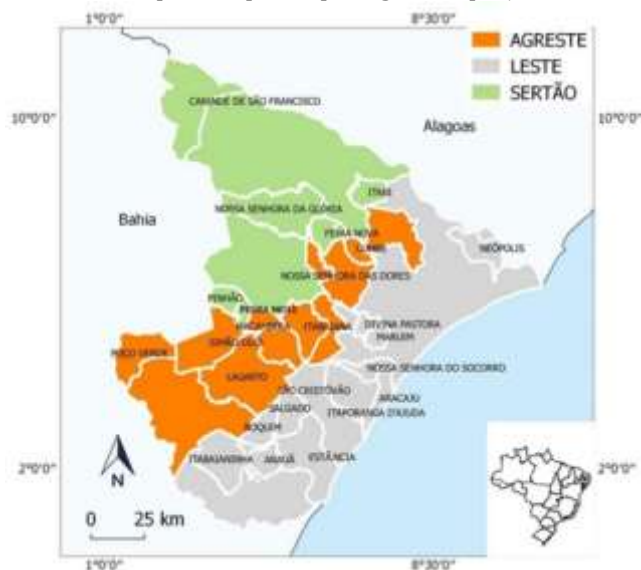
MATERIAL AND METHODS

The work was carried out in the State of Sergipe (latitude 9°31'49" and 11°34'05" and longitude 36°26'40" and 38°15'00"), located in the Brazilian Northeast, with a territorial area of 21,918,454 Km², composed of 75 municipalities distributed in three edaphoclimatic mesoregions: Leste, Agreste, and Sertão (IBGE, 2017b). The climate is typically tropical hot and humid in the coastal strip, with a decreasing precipitation index towards the interior of the State, characterized by a sub-humid climate in an intermediate strip and semi-arid climate in the Sertão (SEMARH, 2020). The variability of precipitation is not uniform, with the rainiest period concentrated in the first half of the year. The annual average precipitation can reach more than 1800 mm in

the Leste mesoregion, between 700 mm to 1400 mm in the Agreste, and up to 500 mm in the Sertão (PEREIRA et al., 2011).

For data collection, a structured questionnaire was used, previously prepared and approved by the Bioethics Commission of the Faculdade Pio Décimo, Aracaju-SE, under protocol number 06/2011 of April 16, 2011. The project took place from March 2011 to December 2014, in which 101 herds (41 of goats and 60 of sheep) were visited, distributed in 25 municipalities in the Leste (33), Agreste (36), and Sertão (32) mesoregions (Figure 1), comprising an area of 9,076.26 km², corresponding to 41.4% of the total area of the State.

Figure 1. Map of the state of Sergipe divided by mesoregions (Sertão, Agreste, and Leste) highlighting the 25 municipalities participating in the project.



The properties visited were selected according to indications from the Sergipe Association of Breeders of

Goats and Sheep (ASCCO), in addition to farmers indicated by third parties. Due to the impossibility of better distribution of the State's farmers the sample was of the probabilistic type for convenience as recommended by Thrusfield (2007), as well as through the acceptance, availability, and ease of access to rural properties.

On each visit a questionnaire was applied to the farmer or person responsible containing objective closed questions, regarding the general characteristics of the property (size, presence of other domestic animals), herd (breeding system, number of animals, breed), facilities (type of sheepfold, food storage, water source, distribution of feed and water troughs, use of manure pit), sanitary management (cleaning and disinfection of facilities, disposal of placental remains and miscarriage products, grazing with other breeders, use of sterile needles and syringes, periodic castration, quarantine of animals, separation of healthy and sick animals, examinations when purchasing animals, vaccination, deworming), nutritional (type of feeding, mineral supplementation), reproductive (type of cover, breeding season, loan of breeder, occurrence of reproductive disorders), and socioeconomic aspects of the breeder (periodic technical assistance, participation in agricultural fairs, technical training, participation in associations or cooperatives, time in the activity, purpose of rearing, level of education). The information obtained was tabulated in a database using Excel® software and analyzed using descriptive statistics, based on the absolute and relative frequency of each variable.

RESULTS AND DISCUSSION

Table 1 summarizes the information obtained on the characteristics of the properties and nutritional management during the application of the questionnaire.

Table 1. Characteristics and nutritional management of goat and sheep properties in the mesoregions of Leste, Agreste, and Sertão of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	n	Frequency %
Size of property				
Less than 30 hectares	24	58.5	8	13.3
Between 30 and 100 hectares	14	34.1	17	28.3
More than 100 hectares	3	7.3	35	58.3
Number of animals in the herd				
Up to 50	19	46.3	24	40
Between 50 and 100	14	34.2	15	25
Between 100 and 150	08	19.5	12	20
Above 150	0	0	9	15
Type of feed				
Concentrate	5	12.2	2	3.3
Concentrate and pasture	9	22.0	22	36.7
Pasture	16	39.0	31	51.7
Pasture and hay	1	2.4	2	3.3
Pasture and silage	9	22.0	3	5.0
Pasture and palm	1	2.4	0	0
Mineral supplement	33	80.5	50	83.3

In the State of Sergipe, more than half the goat properties analyzed were smaller than 30ha (58.5%; 24/41). The properties that reared sheep had a larger territorial dimension, with 58.3% (35/60) of them having an area larger than 100ha. This finding can be explained by the practice of simultaneous breeding of cattle by the majority of sheep farmers surveyed. Goat farming in northeastern Brazil is characterized by production based on family or subsistence farming, for domestic consumption and serving the local informal trade (PINHEIRO et al., 2000). Due to the lower socioeconomic level of the breeders, it is natural that the territorial dimensions of the properties are small, as can be seen in the Cariri da Paraíba region (RIET-CORREA et al., 2013; SILVA et al., 2013), the semiarid zone of the state of Pernambuco (DINIZ et al., 2014; RODRIGUES; COELHO; COELHO, 2016), and in Bahia (QUINZERO et al., 2011; PORTO; SALUM, ALVES, 2013), not exceeding 100 ha per family unit.

With regard to the number of goats and sheep, this may be directly related to the area of the property. In the State of Sergipe, it was observed that the number of animals per property, in the vast majority of cases, was considered small, with up to 50 heads (46.3% and 24.0%) or varying between 50 and 100 animals (34.2 % and 25.0%), in goat and sheep herds, respectively (Table 1). The results corroborate with other regions of the Northeast, such as in the municipality of Sumé, region of Western Cariri in the state of Paraíba, where 49/60 (81.6%) of goat milk producers had herds with up to 50 heads (SILVA et al., 2013), and in 26 properties intended for sheep breeding in the State of Alagoas, where 38.46% of the farmers had 50 animals on the property, while 26.92% reported that they had between 50 and 100 heads (PINHEIRO JÚNIOR et al., 2010).

With respect to the type of feed, 51.7% (31) of the sheep farmers stated that the animals fed exclusively on pasture and 36.7% (22) provided some type of concentrate associated with grazing. Regarding the feed source of goat herds, 39.0% (16) of the properties use pasture, while 22.0% (9) use a combination of concentrate and roughage (Table 1). The predominance of grazing is essentially related to the low purchasing power of the farmer, making it impossible to supply concentrate to the animals in a constant and balanced manner. According to Diniz et al. (2014), even breeders who have the financial capacity to supply some protein source, only make it available irregularly, with the supply prioritized for some categories of the herd, so that production is maintained during the dry season.

In order to improve the production efficiency of small ruminants in the Northeast of Brazil, it is essential to use feeding strategies that suit the conditions of each property, with forage and conservation techniques that are available in the region, such as leucaena, gliricidia, forage palm, maniçoba, algarobeira cassava, and pigeon

pea, among others (SILVA et al., 2010). Interestingly, forage palm and hay use are still little explored as strategic resources for the period of feed scarcity. In addition, there was no report on the part of respondents about the use of legumes in the form of a protein bank, as an alternative means of reducing spending on the purchase of external feed supplies. The limited use of forage conservation techniques increases the consumption of commercial concentrate and production costs (SILVA et al., 2013). According to the observations of Farias et al. (2019), this is a reality observed in the sheep industry in the Northeast, as a significant portion of breeders still do not adopt forage conservation practices.

Supplementation with minerals *ad libitum* was observed in 80.5% and 83.3% of the properties of goats and sheep, respectively (Table 1). In order to achieve greater feed efficiency and cost reduction, it is recommended that mineral supplementation be carried out only in the rainy periods, since during the dry season the limiting resources for production are the insufficient availability of energy and protein sources (RIET-CORREA, 2004).

With respect to the variety of breeds, the majority of sheep herds were composed of animals with a defined breed standard and/or crossbreeds of the Santa Inês breed (83.3%; 50/60). The representativeness of the Santa Inês breed in most of the properties is probably due to the fact that Sergipe has been considered a reference in the selection, genetic improvement, multiplication, and maintenance of the breed for more than 50 years (OLIVEIRA, 2014). In the goat species, there was a predominance of SRD animals (46.3%; 19/41), followed by the Saanen breed (31.8%; 13/41), and a lower percentage of the Anglo Nubian (7.3%; 3/41) and Boer breeds (7.3%; 3/41). Pardo Alpina (4.9%; 2/41) and Toggenburg (2.4%; 1/41) herds were also identified.

The presence of native goat breeds was not identified, such as: Moxotó, Canindé, Repartida, and Marota. Native herds are characterized by their greater potential for milk production and better carcass conformation associated with their better adaptation to the edaphoclimatic conditions of the semi-arid region (QUINZEIRO NETO et al., 2011). Although the breeders of the State of Sergipe have possibly heard of these breeds, they still do not recognize their productive potential and ease of adaptation to semi-arid conditions. It is believed that access to their genetic material and incentives for the acquisition of these herds are still little encouraged. According to Riet-Correa et al. (2013), the choice of exotic breeds should be made with discretion, as some are very sensitive to the climatic and geographical conditions of Northeast Brazil, in addition to being less adapted to conditions different from their natural habitat.

Table 2. Production systems for goat and sheep breeding in the Leste, Agreste, and Sertão mesoregions of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	N	Frequency %
Farming system				
Extensive	6	14.6	25	41.7
Intensive	8	19.5	3	5
Semi-intensive	27	65.9	32	53.3
Facilities				
Masonry wall with cement floor	10	24.4	6	10.0
Corral with dirt floor	6	14.6	27	45.0
Wooden sheepfold with slatted floor	14	34.2	21	35.0
None	11	26.8	06	10.0
Feed storage				
Open area	9	22.0	5	8.3
Closed area	31	75.6	47	78.4
Closed and open area	1	2.4	8	13.3
Water source				
Running	8	19.5	11	18.3
Standing	29	70.7	31	51.7
Standing and running	4	9.8	18	30.0
Feed and water troughs for young and adult animals	28	70.0	53	88.3
Use of manure pit	15	36.6	27	45.0

The goat and sheep rearing system was semi-intensive on 65.9% and 53.3% of the properties, respectively (Table 2), which is characterized in the region by the animals spending part of the day in the pasture and then being collected and taken to the fold in the late afternoon, with the provision of concentrate or bulky

supplementation in the trough (TEIXEIRA et al., 2015). This trend has been modified in recent years due to the long period of drought in the Northeast region, as breeders have been forced to switch to the semi-intensive system, in order to guarantee the maintenance of a viable activity (FARIAS et al., 2019).

Table 3. General characteristics of sanitary management in goat and sheep properties in the Leste, Agreste, and Sertão mesoregions of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	n	Frequency %
Cleaning of facilities				
Daily	14	34.1	9	15.0
Weekly	10	24.4	18	30.0
Monthly	10	24.4	13	21.7
Semiannual	0	0	7	11.7
Annual	2	4.9	2	3.3
Not cleaned	5	12.2	11	18.3
Disinfection of facilities				
Whitewashing	24	58.6	8	13.3
Chemical products	1	2.4	8	13.3
Fire broom	1	2.4	5	8.3
Whitewash and chemical products	1	2.4	1	1.7
Whitewash and fire broom	5	12.2	7	11.7
Not disinfected	9	22.0	31	51.7
Disposal of placental remains				
Deposit in distant pasture	39	95.2	44	73.4
Bury	1	2.4	14	23.3
Burn	1	2.4	02	3.3
Disposal of miscarriage product				
Deposit in distant pasture	35	85.4	48	80
Bury	5	12.2	11	18.3
Burn	1	2.4	01	1.7

Regarding the types of facilities for housing goats (capril), it was found that 34.2% (14) were of wood with slatted floors and 24.4% (10) masonry with cement

floors. Regarding the sheepfolds for housing the sheep, it was found that 45% (27) of the properties used a corral with a beaten earth floor and 35% (21) were wooden

with a slatted floor (Table 2). Although the majority of farmers in Sergipe contain some type of accommodation facility, regardless of the structure, it is worth noting that in addition to the need to provide comfort and animal welfare, it is important that cleaning and disinfection are carried out regularly. The type of floor may or may not facilitate cleaning and disinfection, and the beaten earth floor presents the greatest challenge in this respect (ALMEIDA et al., 2010). Suspended pens present great advantages, as the risks of spreading gastrointestinal parasites and other diseases are less, since there is a decrease in the animals' contact with the feces on the floor and with the humidity often found in beaten earth floors (SANTOS et al., 2014).

With respect to water supply, it was observed that in 70.7% (29) and 51.7% (31) of the properties with goats and sheep, respectively, the origin of the water supplied to the animals was from standing sources (weirs, cacimbas, dams). Feed and water troughs were shared between young and adult animals on 70.7% (29) and 86.7% (52) of the properties with goats and sheep (Table 2). As can be observed, the supply of captured rainwater prevails, where the animals collectively share the same pasture, without separating lots. This type of rearing demonstrates a greater exposure of animals to the health risk of contracting a waterborne disease (DINIZ et al., 2014).

Proper sanitization of the facilities is a major factor in the health management of the herd. Good results were observed in the Sergipe properties, verifying that 34.1% (14) and 24.4% (10) of the goat farmers cultivated the cleaning of the folds daily to weekly, respectively. Approximately 30% (18) of sheep farmers perform weekly cleaning and 21.7% (13) monthly cleaning. The

accumulation of waste, excretions, and secretions can transmit a series of diseases to animals (ALMEIDA et al., 2010). The recommended frequency for cleaning facilities is daily (RODIGUES; COELHO; COELHO, 2016; CRUZ et al., 2019). Less encouraging results were observed regarding the practice and form of disinfection. While 58.6% (24) of goat farmers reported that they apply lime (whitewash), 51.7% (31) of sheep farmers do not disinfect the facilities (Table 3). Disinfection aims to eliminate infectious agents that were not removed by the cleaning process (Almeida et al., 2010). It is recommended that a combination of at least two different forms of disinfection be carried out, in order to expand the spectrum of decontamination of the environment.

In 36.6% (15) and 45% (25) of goat and sheep farms, respectively, the feces collected from the fold after cleaning are kept in manure pits and out of direct reach of the animals. This percentage can still be considered small, as the accumulation of feces in inappropriate places favors the maintenance of the cycle of gastrointestinal parasites and the proliferation of flies in the environment (ALMEIDA et al., 2010; PINHEIRO JÚNIOR et al., 2010).

Regarding the appropriate destination of placental remains, 85.4% (35) and 73.4% (44) of goat and sheep farmers, respectively, responded that when placental remains are found, they are usually deposited in a distant pasture. The same practice is also used for miscarriage products by 85.4% of goat farmers and 80% of sheep farmers (Table 3). The lack of adequate disposal practices favors the consumption by animals of other species that eventually circulate the pasture areas, in addition to the health risks.

Table 4. Other sanitary practices adopted in the goat and sheep properties of the Leste, Agreste, and Sertão mesoregions of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	n	Frequency %
Pastured with other farmers	9	22.0	5	8.3
Use of sterile needles and syringes	24	58.5	27	45.0
Periodic trimming	33	80.5	42	70.0
Quarantine when buying animals	17	41.5	22	36.7
Separated healthy and sick animals	26	63.4	26	43.3
Exams on the acquisition of animals	2	4.9	8	13.3

As shown in Table 4, 22.0% (9/41) of the goat farmers responded that they move their herd to a pasture area of another farmer and only 8.3% (5/50) of the sheep farmers perform this practice. As previously discussed, the higher frequency of goat properties below 50 ha can compromise the availability of pasture when no plans have been made for forage in the driest periods of the year, often forcing the farmer to rent pasture. It is also observed that many breeders neglect the use of sterile needles and syringes for the application of vaccines and medicines to animals, observing percentages of 58.5% (24) and 45.0% (27) in goat and sheep properties, respectively. The use of contaminated needles and

syringes poses serious risks for the occurrence of abscesses, and above all, the transmission of diseases carried by the blood.

Good results were identified regarding the periodic trimming, obtaining rates of 80.5% and 70.0% in the goat and sheep properties, respectively (Table 4). Periodic trimming has the main objective of preventing hoof diseases, such as infectious pododermatitis, interdigital dermatitis, white line disease, double sole, and sole ulcer. These diseases have an impact on animal welfare due to lameness and economic losses arising from depreciation and early slaughter of animals

(CARVALHO et al., 2018). Although the majority of the farmers in the State carry out this activity, it is important to emphasize that the prevention of the occurrence of hoof problems is multifactorial, not limited exclusively to the practice of trimming, but also to the control of the humidity of the facilities and pastures, especially in regions with higher rainfall.

Quarantine was not performed at the time of animal acquisition in 58.5% (24) of goat farms and 63.3% (38)

of sheep farms. The indices were considered moderate in relation to the separation of healthy and sick animals, where 63.4% goats and 43.3% of sheep farmers reported that they do not perform this procedure. Only 4.9% and 13.3% of goat and sheep farmers, respectively, responded that they require some kind of health certificate when buying animals. The absence of a health document can allow the spread of important infectious agents, such as small ruminant lentiviruses, brucellosis, and tuberculosis (GOUVEIA et al., 2015).

Table 5. Vaccination and deworming of the herd in the goat and sheep properties of the mesoregions of the Leste, Agreste, and Sertão of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	n	Frequency %
Vaccination				
Rabies	12	29.3	26	43.3
Clostridium	16	39.0	22	36.7
Leptospirosis	13	31.7	12	20
Not performed	2	4.9	2	3.3
Deworming				
Once per year	5	12.2	7	11.7
Two to three times per year	14	34.1	25	41.7
Four times per year	20	48.8	26	43.3
Form of treatment				
No deworming	02	4.9	02	3.3
Curative	10	24.4	9	15.0
Preventative	28	68.3	38	63.4
Suppressive	01	2.4	03	5.0
Tactical	0	0	08	13.3

The prevention of diseases through vaccination was carried out on all goat and sheep properties, being mainly against rabies (29.3% and 43.3%), clostridium (39% and 36.7%), and leptospirosis (31.7% and 20%), respectively. It is recommended that vaccination against rabies and clostridiums only be performed in regions with a history of case occurrence, with annual doses and not only in the first months of life, in order to maintain the appropriate antibody titers. Regarding immunoprophylaxis for leptospirosis, commercially available vaccines are indicated for cattle. According to Higino; Azevedo (2014), little information is available on its effectiveness in goats and sheep, since the vaccination protocol for both species needs to be performed with vaccines that contain leptospiral serovars from the region. The only study available on the occurrence of animals seropositive for *Leptospira* sp. in the State of Sergipe was carried out by Rizzo et al. (2017b), who identified the occurrence of the *Icterohaemorrhagiae*, (85.75%), *Australis* (5.15%), *Pomona* (3.61%), *Sejroe* (3.09%), and *Pyrogenes* serogroups (2,58%) in goat herds.

The control of endoparasites based on the use of anthelmintics is generally practiced by four deworming applications throughout the year (48.8% and 43.3%) and preventively (68.3% and 63.3%) in goat and sheep herds, respectively (Table 5). The form of treatment adopted by the farmers is possibly still guided by the old

technical recommendations, which are based on treating the entire herd three to four times a year, once in the rainy season and two to three times in the dry season (CODEVASF, 2011). This type of treatment is disadvantageous, as it significantly reduces the population of nematodes in the pasture and not exposed to treatment (refuge) in the dry period, ensuring the survival of the population of parasites with resistance genes (RIET-CORREA; SIMÕES; RIET-CORREA, 2013). None of the properties reported selective treatment, currently recommended to delay the development of anthelmintic resistance, where only a portion of the herd is dewormed. Selective treatment often consists of adopting simple technologies, such as treating; only young and female animals in the peripartum, goats with greater milk production, in the presence of clinical signs, or in association with the FAMACHA® method (COSTA, SIMÕES, RIET-CORREA, 2011).

In the records on the frequency of clinical cases of verminosis, it is observed that the problem is present in almost 100% of the goat and sheep herds of Agreste and Sertão in Sergipe and a small portion of the breeders use the methods of integrated control of gastrointestinal parasites (SANTOS, 2007 and 2014; FARIAS et al., 2019). From the expressive number of cases, it is very likely that anthelmintic resistance is occurring in herds, however further research is necessary to prove this hypothesis.

Table 6. Presence of contact with domestic animals in goat and sheep farms in the Leste, Agreste, and Sertão mesoregions of the State of Sergipe, 2011-2014.

Property	Cats	Dogs	Cattle	Mixed rearing of goats and sheep
Goats	32 (78.0%)	33 (80.5%)	17 (41.5%)	24 (58.5%)
Sheep	46 (76.7%)	54 (90.0%)	51 (85.0%)	20 (33.3)

The presence of domestic dogs was observed in 80.5% and 90%, and the existence of cats was also mentioned by farmers, both in goat (78.0%) and sheep (76.7%) properties, respectively (Table 6). These animals can act as reservoirs of zoonotic infectious agents. The existence of dogs and cats in farms in Sergipe has already been determined as a significant factor associated with infection by *Toxoplasma gondii* (RIZZO et al., 2017a) and *Neospora caninum* (RIZZO et al., 2017c) in the sheep flocks in the State. Inadequate sanitary measures can lead to the access of dogs and cats to the viscera, placenta remains, and miscarriage products from infected animals, favoring, through contamination of water and food sources, the spread of two agents in the herd, the oocysts *Toxoplasma gondii* and *Neospora*

caninum. Farmers require more technical guidance on awareness of the risks that these two diseases pose to public health.

The joint rearing of small ruminants in the same pasture area was reported by 58.5% (24) of goat farmers and 33.3% (20) of sheep farmers. It was also verified that many of the farmers also kept cattle on their property, with values of 41.5% (17) and 85% (51). Precautions should be taken related to prophylactic methods of transmission of *Brucella* spp. between cattle, goats, and sheep that share the same area, as the occurrence of anti-*Brucella abortus* antibodies has been described in herds of small ruminants in Sergipe (RIZZO et al., 2019).

Table 7. General characteristics of reproductive management in the goat and sheep properties of the mesoregions of the Leste, Agreste, and Sertão of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	n	Frequency %
Type of breeding				
Artificial insemination	1	2.4	2	3.3
Natural breeding	33	80.5	53	88.3
Natural breeding and artificial insemination	7	17.1	5	8.3
Breeding period				
All year	24	58.5	43	71.3
Controlled	17	41.5	17	28.3
Use a breeder from another herd	16	39.0	11	18.3
Borrow a breeder	13	31.7	12	20.0
Presence of reproductive disorders				
No	28	68.3	26	43.3
Miscarriage	2	4.9	14	23.3
Infertility	10	24.4	19	31.7
Placenta retention	1	2.4	1	1.7

In relation to reproductive management (Table 7), natural breeding was the main reproductive technique used in 80.5% (33) and 88.3% (53) of the properties, while the exclusive use of artificial insemination was observed in only 2.4% (1) and 3.3% (2) of goat and sheep breeding, respectively. The use of reproductive biotechniques enables improvement of the herd through the introduction of genetic characteristics obtained from breeders in other regions and minimizes the transmission of venereal diseases (SANTOS et al., 2014). The practice of artificial insemination, for example, when using semen from different breeders, contributes positively to the elimination of the occurrence of inbreeding in the herd.

When asked about the loan of breeding males to other breeders, 31.7% (13) and 20% (12) of farmers replied that they carry out this practice. The use of breeding males that do not belong to the herd was also observed in 39% (16) and 18.3% (11) of goat and sheep farmers,

respectively. The exchange or loan of breeding males is unknown or undervalued by breeders, as the absence of control measures favors the spread of infectious agents by venereal transmission (CARDOSO et al., 2015).

When considering the activities as a source of income, it was possible to verify that the majority of sheep and goat farmers do not consider this activity as their main source of income, noting that goats (68.3%) and sheep (63.3%) were a secondary income activity. Rearing small ruminants in the state is widely carried out by small rural producers whose main source of family income is dairy cattle and agriculture (BRITO, 2006). Considering the time dedicated to the activity, 80.5% (33) and 63.3% (38) of the goat and sheep breeders, respectively, responded that they had been engaged in the activity for more than five years (Table 8). According to Almeida (2007), this factor may be related to the profitability, optimism for the market for genetically improved

animals, and family inheritance that is transferred between generations.

Table 8. Profile of farmers on the goat and sheep properties in mesoregions of the Leste, Agreste, and Sertão of the State of Sergipe, 2011-2014.

Variable	Goats		Sheep	
	n	Frequency %	n	Frequency %
Periodic technical assistance	25	61	30	50
Participation in agricultural exhibitions	19	46.3	13	21.7
Participation in associations and/or cooperatives	29	70.7	22	36.7
Technical training	26	63.4	24	60
Activity as main source of income	13	31.7	22	36.7
Length of time in this activity				
More than 5 years	33	80.5	38	63.3
Between 1 and 3 years	5	12.2	13	21.7
Between 3 and 5 years	3	7.3	9	15.0
Purpose of rearing				
Slaughter	10	24.4	48	80.0
Milk	18	44.0	0	0
Reproduction	3	7.2	07	11.7
Subsistence	10	24.4	05	8.3
Schooling				
Illiterate	2	4.9	7	11.7
Primary complete	5	12.2	7	11.7
Primary incomplete	13	31.7	16	26.7
Secondary complete	11	26.8	9	15
Secondary incomplete	2	4.9	3	5
Professional course	1	2.4	1	1.7
Higher complete	6	14.6	17	28.3
Higher incomplete	1	2.4	0	0

With respect to the reason for raising goats, dairy farming accounted for 44% (18), followed by the production of meat animals with 24.4% (10) and subsistence with 24.4% (10). In sheep breeding, what predominated was the production of animals for slaughter, representing 80% (48) of the properties, and secondly, 11.7% (7) replied that they rear sheep exclusively to breed livestock of high zootechnical standard for agricultural auctions and exhibitions. Participation in associations and agricultural exhibitions was confirmed in 70.7% (29) and 46.3% (19) of goat farms, respectively. Among sheep farms, 36.7% (22) participate in associations and 21.7% (13) take their animals to agricultural fairs (Table 8).

Considering technical assistance, 39% and 50% of the goat and sheep properties, respectively, did not receive technical assistance from any professional in the area. Gaining knowledge through participation in training courses and lectures was reported by 63.4% (26) of goat farmers and 60% (24) of sheep farmers (Table 7). The services of permanent technical assistance and routine training of the rural producer are directly linked to the success of the livestock activity, enabling the practice of basic measures to increase the zootechnical and economic results (SILVA et al., 2011). The level of education of the farmers was different in the two activities, with the sheep farms being managed mainly by farmers who had completed higher education (28.3%), while in the goat farmers, incomplete secondary level prevailed (31.7%). It is known that people with a higher

level of education have greater facility to assimilate information and accept new technologies, improving the productive and economic efficiency of the activity (RODRIGUES; COELHO; COELHO, 2016).

CONCLUSIONS

The results enable the conclusion that the predominant profile of goat and sheep farming in the State of Sergipe is characterized by the presence of small properties with low technology use, factors that hinder production, with respect to scale and quality, compatible with the demands of the consumer market.

ACKNOWLEDGEMENTS

To the Grupo de Iniciação Científica e Extensão em Buiatria (GICEB) of the Faculdade Pio Décimo, Aracaju, Sergipe.

REFERENCES

- ALMEIDA, B.M. Aspectos da sustentabilidade da ovinocultura e avaliação de uma metodologia profilática contra mastite clínica em ovelhas Santa Inês no agreste sergipano. 2007. 83f. Dissertação (Mestrado em Agroecossistemas) – Universidade Federal de Sergipe, São Cristóvão, 2007.
- ALMEIDA, A.C. et al. Perfil sanitário dos rebanhos caprinos e ovinos no Norte de Minas Gerais. *Comunicata Scientiae*, v.1, n.2, p.161-166, 2010.
- BRASIL. Ministério da Indústria, Comércio Exterior e Serviços. Comex Stat – Exportação e importação geral. Disponível em: <<http://comexstat.mdic.gov.br/pt/geral>> Acesso em: 05 mai. 2020.

BRITO, V.A. O espaço agrário da ovinocaprinocultura no sertão noroeste de Sergipe no período de 1980 a 2003.2006. 193f. Dissertação (Mestrado em Geografia) - Universidade Federal de Sergipe, São Cristóvão, 2006.

CARDOSO, M.V. et al. Caracterização da caprinocultura e ovinocultura no estado de São Paulo. Arquivos do Instituto Biológico, v.82, p.1-15, 2015.

CARVALHO, V.S. et al. Doenças podais em ovinos no estado da Bahia. Pesquisa Veterinária Brasileira, v.38, n.7, p.1250-1258, 2018.

CODEVASF. 2011. Companhia de Desenvolvimento dos Vales do São Francisco e do Parnaíba. Manual de criação de caprinos e ovinos. Brasília: CODEVASF, 2011.142p.

COSTA, V.M.M.; SIMÕES, S.V.D.; RIET-CORREA, F. Controle de parasitoses gastrintestinais em ovinos e caprinos na região semiárida do Nordeste do Brasil. Pesquisa Veterinária Brasileira, v.31, n.1, p.65-71, 2011.

CRUZ, G.R.B. et al. Aspectos sanitários na produção de caprinos e ovinos de produtores familiares no semiárido paraibano. Revista Conexão UEPG, v.15, n.2, p.129-134, 2019.

D'ALENCAR, C.E. et al. Caracterização do sistema de produção de ovinos Santa Inês no Estado de Sergipe. In: CONGRESSO BRASILEIRO DE MEDICINA VETERINÁRIA, 36., 2009, Porto Seguro. Anais... Bahia, 2009.

DINIZ, W.J.S. et al. Características gerais de produção de caprinos leiteiros em Paranatama, PE. Acta Veterinaria Brasilica, v.8, n.2, p.113-120, 2014.

FARIAS, A.E.M. et al. Characterization of goat production systems in five states of northeastern Brazil. Semina: Ciências Agrárias, v.40, n.6, p.3691-3708, 2019.

FAO. 2013. Organização das Nações Unidas para a Alimentação e a Agricultura. FaoStat. Disponível em: <<http://faostat3.fao.org/browse/Q/QA/E>>. Acesso em: 05 mai. 2020.

GUILHERME, R.F. et al. Characterization and typology of sheep and goat production systems in the State of Paraíba, a semi-arid region of northeastern Brazil. Semina: Ciências Agrárias, v.38, n.4, p.2163-2178, 2017.

GOUVEIA, A.M.G. et al. Zoo-sanitary aspects of goat husbandry in Southeastern Brazil. Semina: Ciências Agrárias, v.36, n.1, p.277-284, 2015.

HIGINO, S.S.S.; AZEVEDO, S.S. Leptospirose em pequenos ruminantes: situação epidemiológica atual no Brasil. Arquivos do Instituto Biológico, v.81, n.1, p.86-94, 2014.

IBGE 2018. Pesquisa Pecuária Municipal. Brasília: Instituto Brasileiro de Geografia e Estatística, 2018. Disponível em: <<https://sidra.ibge.gov.br/pesquisa/ppm/quadros/brasil/2018>>. Acesso em: 07 fev. 2020.

IBGE 2017a. Censo Agropecuário. Brasília: Instituto Brasileiro de Geografia e Estatística, 2017a. Disponível em: <<https://sidra.ibge.gov.br/pesquisa/censo-agropecuario/censo-agropecuario-2017>>. Acesso em: 06 fev. 2020.

IBGE 2017b. Estados. Sergipe. Instituto Brasileiro de Geografia e Estatística. Disponível em: <<https://cidades.ibge.gov.br/brasil/se/panorama>>. Acesso em: 02 fev. 2020.

MELO, C.B. et al. Perfil dos caprinos e ovinos abatidos em estabelecimentos com inspeção federal em Sergipe. In: SIMPÓSIO INTERNACIONAL SOBRE CAPRINOS E OVINOS DE CORTE, 2., 2003, João Pessoa. Anais... Paraíba, 2003.

OLIVEIRA, T.S. Dinâmica produtiva e inovativa no arranjo produtivo local de ovinocaprinocultura de Sergipe: o caso da Associação Sergipana dos Criadores de Caprinos e Ovinos - ASCCO. 2014. 128f. Dissertação (Mestrado em Desenvolvimento Regional e Gestão de Empreendimentos Locais) - Universidade Federal de Sergipe, São Cristóvão, 2014.

PEREIRA, E.R.R. et al. Variabilidade do número de dias chuvosos no estado de Sergipe - SE. Revista Brasileira de Tecnologia Aplicada nas Ciências Agrárias, v.4, n.1, p.45-65, 2011.

PINHEIRO, R.R. et al. Aspectos epidemiológicos da caprinocultura cearense. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, v.52, n.5, p.534-543, 2000.

PINHEIRO JÚNIOR, J.W. et al. Aspectos sociais, higiênico-sanitários e reprodutivos da ovinocultura de corte do Estado de Alagoas, Brasil. Revista Brasileira de Ciências Agrárias, v.5, n.4, p.600-605, 2010.

PORTO, L.L.M.A.; SALUM, W.B.; ALVES, C. Caracterização da ovinocaprinocultura de corte na região do centro norte baiano. Revista Brasileira de Gestão e Desenvolvimento Rural, v.9, n.1, p.281-296, 2013.

QUINZEIRO NETO, T. et al. Caracterização da caprino-ovinocultura de corte de produtores de Jussara e Valente, BA. Revista Caatinga, v.24, n.2, p.165-173, 2011.

RIET-CORREA, F. Suplementação mineral em pequenos ruminantes no semiárido. Ciência Veterinária nos Trópicos, v.7, n.2-3, p.112-130, 2004.

RIET-CORREA, B. et al. Sistemas produtivos de caprinocultura leiteira no semiárido paraibano: caracterização, principais limitantes e avaliação de estratégias de intervenção. Pesquisa Veterinária Brasileira, v.33, n.3, p.345-352, 2013.

RIET-CORREA, B.; SIMÕES, S.V.D.; RIET-CORREA, F. Sistemas produtivos de caprinocultura leiteira no semiárido nordestino: controle integrado das parasitoses gastrointestinais visando contornar a resistência anti-helmíntica. Pesquisa Veterinária Brasileira, v.33, n.7, p.901-908, 2013.

RIZZO, H. et al. Risk factors for *Toxoplasma gondii* infection in sheep in the northeastern region of Brazil. Brazilian Journal of Veterinary Research and Animal Science, v.54, n.2, p.139-146, 2017a.

RIZZO, H. et al. Frequency of and risk factors associated to *Leptospira* sp. seropositivity in goats in the state of Sergipe. Ciência Rural, v.47, n.7, p.1-7, 2017b.

RIZZO, H. et al. Pesquisa de anticorpos IgG para *Neospora caninum* e avaliação de fatores de risco em ovinos do Estado de Sergipe. Pesquisa Veterinária Brasileira, v.37, n.8, p.813-819, 2017c.

RIZZO, H. et al. Occurrence of anti-*Brucella abortus* agglutinins in small ruminants in Sergipe. Arquivos do Instituto Biológico, v.86, p.1-5, 2019.

RODRIGUES, B.R.; COELHO, M.C.S.C.; COELHO, M.I.S. Aspectos sanitários e de manejo em criações de caprinos leiteiros produzidos na comunidade de Caróá, Distrito de Rajada, Petrolina-PE. Revista Brasileira de Agropecuária Sustentável, v.6, n.2, p.9-18, 2016.

SANTOS, G.G.A. et al. Caracterização da caprinocultura na bacia leiteira sergipana. Scientia Plena, v.10, n.11, p. 1-11, 2014.

SANTOS, V.W.S. Estudo zoonosológico e fatores de risco associados à artrite encefalite caprina nos estados do Ceará, Rio Grande do Norte e Sergipe. 2014. 121f. Dissertação (Mestrado em Zootecnia) - Universidade Estadual Vale do Acaraú, Sobral, 2014.

SANTOS, V.W.S. Aspectos tecnológicos dos rebanhos ovinos e caracterização epidemiológica da língua azul nos estados do nordeste. 2014. 112f. Tese (Doutorado em Ciência Animal) - Universidade Federal Rural do Semi-Árido, Mossoró, 2017.

SILVA, N.V. et al. Alimentação de ovinos em regiões semiáridas do Brasil. *Acta Veterinaria Brasilica*, v.4, n.4, p.233-241, 2010.

SILVA, R.A.B. et al. Caracterização zoonosológica da ovinocultura e da caprinocultura na microrregião homogênea de Teresina, Piauí, Brasil. *Arquivos Instituto Biológico*, v.78, n.4, p. 593-598, 2011.

SILVA, E.M.N. et al. Diagnóstico dos sistemas de produção de leite de cabra no município de Sumé, cariri da Paraíba. *Agropecuária Científica no Semiárido*, v.9, n.2, p.61-65, 2013.

SILVA, G.M. et al. Avaliação da qualidade do leite de cabra in natura produzido no Estado de Sergipe. In: VI CONGRESSO PERNAMBUCANO DE MEDICINA VETERINÁRIA E VII SEMINÁRIO NORDESTINO DE CAPRINO-OVINOCULTURA, 18., Recife, 2015, Recife. *Anais...Recife: Ciência Veterinária nos Trópicos*, 2015. p.284-287

SILVA, I.C.S. et al. Caracterização zootécnica e econômica dos criadores de caprinos em área de assentamento rural no estado do Maranhão. *Revista Brasileira de Agropecuária Sustentável*, 5:1-11, 2015b.

SEMARH. Secretaria de Estado do Meio Ambiente e dos Recursos Hídricos. Caracterização Climática. Sergipe: SEMARH, 2020. Disponível em: <<http://www.semarh.se.gov.br>>. Acesso em 02 fev. 2020.

TEIXEIRA, W.C. et al. Perfil zoonosológico dos rebanhos caprinos e ovinos em três mesorregiões do estado do Maranhão, Brasil. *Acta Veterinaria Brasilica*, v.9, n.1, p.34-42, 2015.

THRUSFIELD, M.V. *Veterinary epidemiology*. 3ª ed. Oxford: Blackwell Science Ltd., 2007. 610p.