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Socioeconomic status of small ruminant rearers in selected provinces in Sierra Leone

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Abstract

This study focused on assessing the socio-economic characteristics of small ruminant farmers and identifying key challenges impairing the growth of the small ruminant local industry in selected provinces in Sierra Leone. The research adopted a cross-sectional design to generated primary information from 438 respondents in six selected districts using a well-structured pre-tested questionnaire. The data was analyzed using the statistical tool SPSS (version 23.0), the relationship between assessed variables and location were tested using Pearson's Chi-square test. The findings of the study revealed that majority of the respondents were men (60.5%), married (83.8%), had no formal education (79.2%), and above 50 years old (62.8%). Small ruminants were predominantly owned by men, but women and children (47.5%) were mainly responsible for routine management practices. The primary reasons for keeping small ruminants include cultural practices (78.5%), household income (71.5%), food (66.3%), and religious practices (64.6%). Farmers preferred rearing small ruminants over other livestock due to high market demand (31.1%), disease tolerance (20.5%), adaptation (16.0%), and prolificacy (13.2%). Income generated from the sales of small ruminants was mostly used to purchase food (68.0%), for educational purposes (64.2%), and crop farming (51.6%). The major challenges for farmers were diseases/parasites (100.0%), inadequate animal health services (80.8%), animal theft (63.7%), and mortality (62.1%). According to 81.7%, 77.2%, 73.1%, and 71.2% of the farmers, peste des petits ruminants, skin infection, foot rot, and reproductive diseases were regarded as the main diseases of small ruminants. To enhance productivity of small ruminants in the study areas, continuous education, improved biosecurity, and robust measures by the government and community are required to overcome these challenges.

Keywords: Diseases/parasites; Income Household; Production constraint; Rearing Reason; Small Ruminant Ownership

1. Introduction

In Sierra Leone, the livestock sector particularly small ruminants plays a crucial role in economic development, provision of livelihoods as well as food and nutritional security. The sector contributes significantly to the protein intake of households, accounting for 21%, and contribute 5.7% to the national GDP (1). The majority of the livestock are owned and kept by rural farmers due to their significant contributions such as income, fulfilling social obligations, food security, livelihood diversifications, and input to crop production (2). Sierra Leone has an estimated livestock population of 17,623,308, of which 8.9% and 5.5% are goats and sheep (3). More than 75% of the households involved in livestock production raise either sheep and/or goats. The most practice system is the mixed crop-livestock systems with 85% of the households involved in it (4). This system is characterized by minimal input with corresponding low output, unimproved breeds, inadequate husbandry practices, and no/limited external support. In spite of these limitations, small ruminant productivity continues to make positive impact among smallholder farmers. However, there is an insufficient information on the socio-economic status of small ruminant farmers in Sierra Leone limiting our understanding on productivity and factors impairing sustainable production. Therefore, our goals in this study were to assess the socioeconomic status of farmers and to identify critical challenges that could be attributed to the poor performance of small ruminants in the study areas.

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2. Methods and material

2.1. Description of survey areas

Sierra Leone is located on the west coast of Africa with a geographical land area of 72,000 square kilometres with an altitude reaching 500 meters in the highlands (5,6). Sierra Leone lies between latitudes 6°55 and 10°00 N and longitudes 10°16 and 13°18 W with a tropical monsoon climate. The country borders the Atlantic Ocean, the Republic of Guinea and Liberia. Administratively, Sierra Leone is divided into five provinces with 16 districts and 149 chiefdoms with a population of 7,541,641, with the majority (59.0%) residing in rural areas (7). 44.2% of the population has never been to school, 31.4% of the working-age group is economically unviable while 43.0% are either polygamously or monogamously married (8). Agricultural households account for 57.9% of all households where 85.4% are engaged in arable farming and 73.6% and 33.6% practice livestock and fish farming, respectively (8). Crop farming and animal husbandry remain the main sources of livelihoods in the study areas. Goats, sheep, chickens, ducks, pigs and cattle are the most important livestock rear. Goat and sheep rearing is mainly characterized by small flock size, feed shortages due to climatic variability, and inadequate veterinary services leading to high disease/parasitic infestations.

2.2. Study design and sampling technique

The study was conducted between January and December 2021 in the eastern, northern and southern provinces of Sierra Leone. The Northern Province which lie on longitudes 9°1460.00N and the latitudes -11°4459.99W is the largest province compared to the South (longitude 8°00000N and latitude -12°1460.00W) and East (longitude 8°1460.00N and latitude -11°000.00W). These provinces are nationally and international linked with one another (Guinea and Liberia to the east, Guinea to the north and Liberia to the south) making animal movement easier. These provinces are Muslims dominated with Mende, Temne and Fullah being the main ethnic groups. Researchers used a tiered research design to generate primary data from small ruminant farmers to provide insight into their current socio-economic status. The provinces were purposively chosen due to the lack of information on the socio-economic status goat and sheep farmers, high participation animal rearing, and access to study areas.

2.3. Data collection

Quantitative and qualitative data were collected from respondents using a pre-tested semi-structured household questionnaire. The questionnaire which consisted of closed and open-ended questions, was designed with input from the research team and animal health workers in the selected areas. To ensure proper administering of the questionnaire, enumerators were selected per province and trained. The objective for the selection was to increase farmers' participation and eliminate language barrier. The semi-structured household interview focused on the following key elements: demographic attributes, ownership and routine management practices, reasons for rearing, role of income generated from goats and sheep, preference of goats and sheep over other livestock, and major challenges.

2.4. Questionnaire administration and survey size

Before questionnaire administration, the researchers undertook an assessment tour to gain a preliminary understanding of: 1. the general socio-economic status of small ruminant farmers and the current challenges standing in the way of sustainable productivity in the sector. During this tour, key stakeholders like community heads and farmers were educated about the potential benefits of the research at community level and the livestock industry in general. Following stakeholders' approval, a face-to-face interview was proposed and conducted. Overall, 438 questionnaires were filled in all three provinces. For each province, two districts were purposively selected with each having 73 respondents hence, 146 respondents per province.

2.5. Data management and analysis

Data collected were checked for possible errors, coded and entered into a Microsoft Excel spreadsheet and imported into IBM's software package for social scientists (SPSS, version 23.0). Descriptive statistics including frequency counts and cross-tabulations were used to describe samples. Spearman's chi-square test was used to assess the relationships between the selected variables and the survey locations (provinces). P values of 0.05 were considered statistically significant. Notes and observations made during the interview were translated into statements as additional information in understanding the socio-economic status of the respondents.

3. Results and discussion

Table 1 shows the demographic characteristics of small ruminant farmers in the study areas. From the demographic analysis, 60.5% of the households were male-headed compared to 39.5% which were female-headed. The large number of male-headed households could be attributed to cultural norms and religious beliefs giving leadership predominance to men over women. This could serve as an obstacle to household decision-making as well as transferring modern technologies to women. Being household head across most many African settings like Sierra Leone also demands taking control over household assets thus limiting their counterparts from being productive viable and self-reliant. The results of the study showed that more than two-thirds (83.8%) of the respondents were married, 9.1% were single parents, and 7.1% were single. These findings demonstrate the link between small ruminant production and marital status in the study areas. The high involvement of married couples in rearing small ruminants is due to the multiple benefits they offer to address household burdens.

Table 1 Socio-economic attributes of respondents

Gender headed household	**Percentage**
Men	39.5
Women	60.5
Respondents' marital status	
Single parents	9.1
Single	7.1
Married	83.8
Respondents' educational level	
Basic	17.8
Tertiary	3.0
None	79.2
Respondents' age (years)	
18 – 50	37.2
Above 50	62.8

According to table 1, 79.2% of farmers had no formal education, while 17.8% had basic education, and only 3.0% had tertiary education. The results indicate that lack of formal education among farmers is a serious concern as only 20.8% reported having being to school. This may lead to slow or ineffective adoption of technology, which could limit their production potential, access to important information, and opportunities for competition. Further, the table reveals that 62.8% of the farmers were over the age of 45, while only 37.2% were in their active working years. Our investigation suggests that goat and sheep rearing is mainly done by older people who may not have the energy to perform these activities effectively. The low participation of young people in animal rearing may be due to the availability of alternative economic activities.

Findings on small ruminants' ownership and management responsibility in the study areas are presented in Figure 1. According to the results, 49.5% of the herd visited was owned by men, 19.4% by women, and 31.1% co-owned. The gender differences in goat and sheep ownership suggest that men are more involved in small ruminant ownership than women. This could be due to cultural norms, social status, earning power, and educational status. Previous studies have also reported similar ownership patterns, with men being the primary owners of small ruminants (9, 10). In contrast, studies in Kenya, South Africa, and The Gambia have reported that females own more small ruminants than males (11, 12, and 13). However, there is an increasing participation of women in small ruminant production though they encounter numerous challenges. The low participation of women in small ruminant production in this study may be due to limited decision-making power, low-income earning power, limited education and technical skills, limited participation and information on marketing system, cultural factors, and inadequate access to production resources such as land, breeding animals, and feed. Similar socioeconomic factors have also been found to be the main factors affecting livestock ownership among women in studies conducted in India and Pakistan by 14, 15).

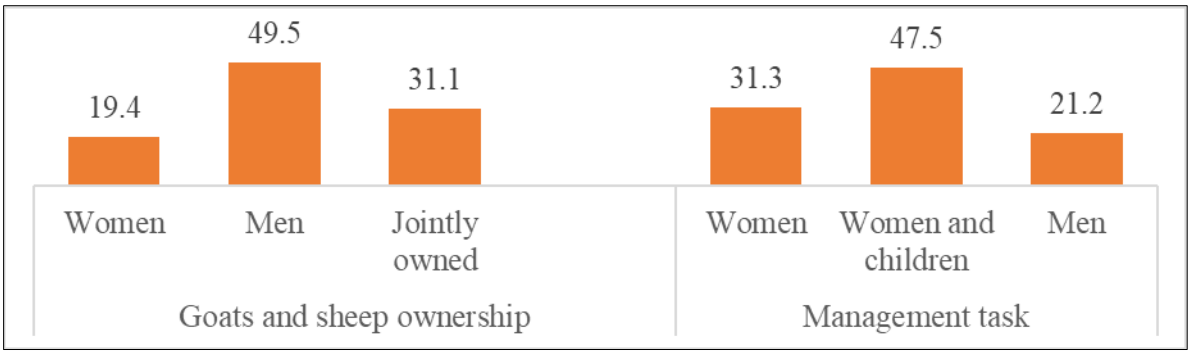

Figure 1 *S*mall ruminant ownership and management tasks by gender in the study area

Gender-related management practices are important for households, both occasionally and as routine tasks. These practices are typically shared responsibilities among family members, with women and children bearing the greatest responsibility. According to figure 1, women and children carry out 47.5% of the management practices, compared to 31.3% by women alone, while men involvement accounted for 21.2% of all the management practices assessed. However, the degree of involvement varies depending on the household and province due to gender and age factors. Farmers interviewed revealed that periodic tasks, such as constructing shelters, selling animals, and treatment, are typically performed by men. Regular activities such as cleaning housing and animals, tethering, confinement, feeding, and watering are mostly done by women and children. These findings are consistent with those of (16) and (11).

Figure 2 summarizes the most common livelihood activities of farmers in the study areas, categorized into two main groups: agriculture-related and non-agriculture-related activities. Agriculture-related activities were the most popular form of livelihood in the study areas, accounting for 80.1% (351 out of 438) of the total, compared to non-agricultural activities, which accounted for only 19.9% (87 out of 438). Among those engaged in agriculture, the majority were from the South (34.2%), followed by the North (27.6%) and East (18.3%). The results show that agriculture is the most important form of livelihood activity across the study areas, particularly in the South and North. According to literature, households with higher education levels tend to prefer other types of work than those with little or no education (14).

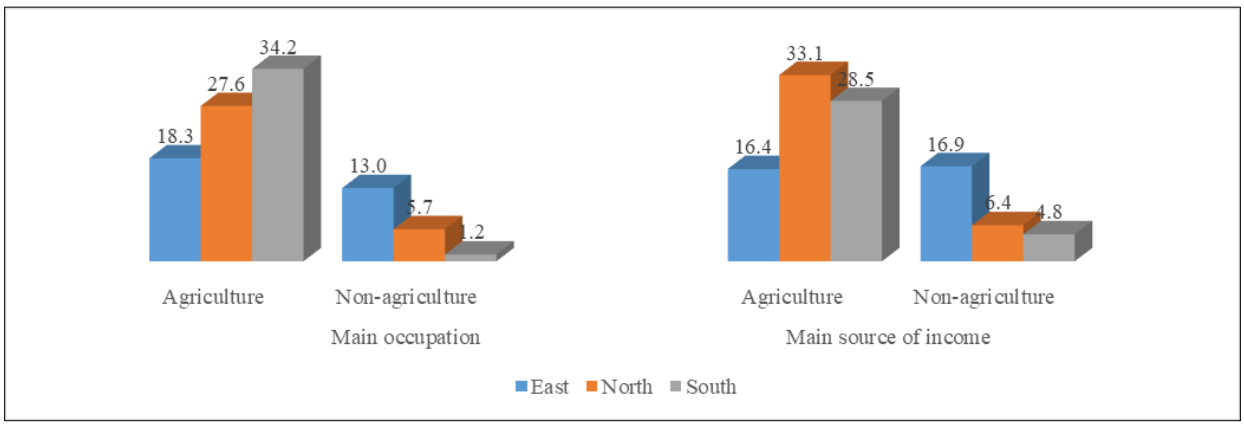

Figure 2 Respondents' occupation in the study area

Livestock, especially small ruminants, play a sustainable role to ensuring community development in multiple ways. They directly and indirectly contribute to achieving household food and nutrition security, income, livelihoods, and socio-cultural practices. This influence has led more people to engage in livestock production. The recent study showed that 78.1% (342/438) of the farmers considered agriculture as their primary income source activity. The remaining 21.9% (96/438) identified other activities as their primary source of income. The sources of income among farmers varied considerably based on herd size, type of species rear and proximity to market environment. Compared to the East (16.4%) and South (28.5%), the North (34.2%) recorded the highest number of farmers reporting small ruminants as their main source of income. On the contrary, the eastern province recorded the highest proportion of those who reported other activities as their major sources of income (16.9%), followed by the North (6.4%) and South (4.8%). These variations in income sources in the study areas are attributed to other economically related activities such as

mining, business, and formal employment. This study correlates with previous findings by (17) where similar results were recorded.

The main reasons described by farmers for keeping small ruminants in the study areas showed a significant statistical association among the provinces assessed (table 2). Overall, 78.5% of the farmers highlighted cultural practices as the primary reason for keeping small ruminants followed by household income (71.5%), food (66.3%), religious functions (64.6%), and manure (16.7%). In the south, cultural practice (91.1%) and food (90.4%) were mentioned as the main reasons for keeping small ruminants compared to the north [cultural practice (79.5%) and food (70.0%)] and the east [cultural practice (59.6%) and food and (34.9%)].

Table 2 Reasons for keeping goats and sheep in the study area

Reason	East	North	South	Overall	p-Value
Cultural practice	59.6	79.5	91.1	78.5	0.000
Income	51.4	83.6	79.5	71.5	0.000
Food	34.9	70.0	90.4	66.3	0.000
Religious function	80.8	78.1	34.9	64.6	0.000
Manure	11.0	22.6	16.4	16.7	0.028

The majority of farmers, accounting for 80.8%, cited religious purposes as the main reason for keeping small ruminants. This indicates that small ruminant production is a practice steeped in tradition. In Islamic rituals and non-Islamic ceremonies, some farmers use their own animals thus preventing them from buying. Livestock production, according to research conducted by (18), contributes up to 68% of household income in developing countries. In the Northern region, the highest preference was given to income (83.6%), while in the South, cultural practices (91.1%) were the most important factor, which is consistent with the findings of (19). Other studies have also highlighted similar reasons for rearing small ruminants. For instance, Abd-Allah et al. (20) reported that cultural, economic, food, and manure reasons were important factors for keeping small ruminants.

Table 3 provides information on how small ruminant production helps households meet their financial obligations, which varies significantly across different study areas. According to the respondents, selling goats and sheep helped them tackle their main problems such as purchasing food (68.0%), providing education (64.2%), and farming (51.6%). Despites being a critical component to fight against hunger, small ruminants are disposed of to enable farmers afford sending their children to school. The start of the cropping season was also reported as a small ruminant sales period as farmers needed to purchase inputs and hire labor. Additionally, other household issues such as repairing the dwelling house, business capital, paying fines/taxes, medical bills, and purchasing clothing and household utensils were also addressed with income earned from small ruminant sales. These results strongly agree with the findings of (19, 21).

Table 3 Functions of income earned from sales of goats and sheep at the household level

Expenditure	East	North	South	Overall response	P Value
Purchase food	45.9	78.1	80.1	68.0	0.000
Medical bills	23.3	17.8	11.6	17.6	0.033
Education	33.6	88.4	70.5	64.2	0.000
Support crop farming	16.4	45.2	93.2	51.6	0.000
Dwelling house	5.5	60.3	47.9	37.9	0.000
Clothing/household utensils	55.5	24.7	9.6	29.9	0.000
Business capital	10.3	68.6	18.5	25.1	0.000
Pay fine/tax	2.1	44.0	32.9	20.82	0.000

In comparison to the North and South, more farmers in the East spent their income on clothing, household utensils, and medical bills. On the other hand, in the North, more farmers used small ruminants to educate, do business, repair dwelling houses, and to apy fine/tax than in the East and South. In the South, however, more farmers utilized their income to provide food and support crop farming in comparison to the East and North. These highlight the significance of keeping small ruminants and the need to improve on the sector for better productivity and economic prosperity.

Figure 3 entailed the different types of livestock species rear in the study areas. Among the various farmers interviewed, 52.7% kept both goats and sheep, 32.9% and 14.4% kept goats and sheep only, and 6.2 kept cattle.

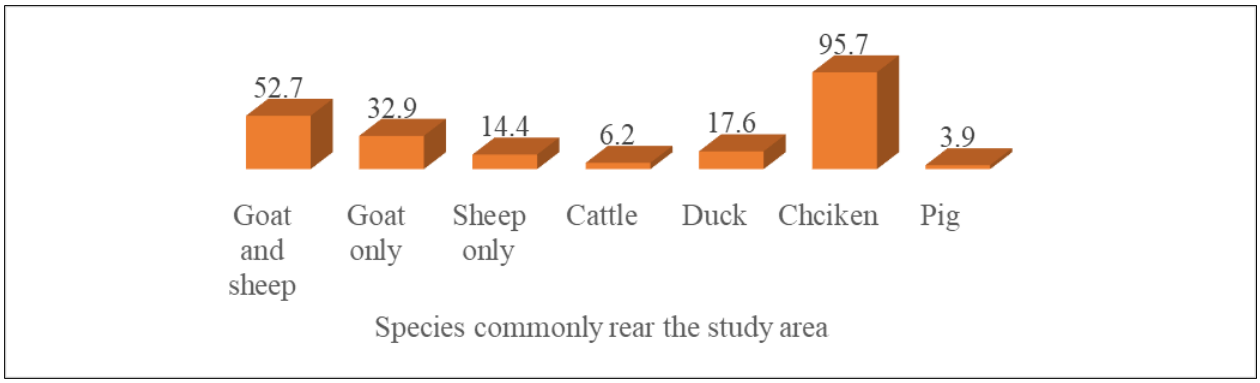

Figure 3 Different species of livestock rear in the study area

According to our findings, 95.7% of the respondents kept chickens, 17.6% kept ducks, and 3.9% kept pigs. It was observed some farmers either rear or multiple species due to certain perceived benefits and challenges they encounter which are consistent with the findings made by (22). However, keeping one species at a time was considered safer due to less risk, ease of management, and less damage to the environment. This finding is consistent with the study conducted by (23) in Benin.

The study found that the average herd size was 8.4, with goats accounting for 9.3 (ranging from 2 to 97) and sheep representing 7.7 (ranging from 1 to 41). This difference in average herd size between goats and sheep may be due to a higher preference for goats over sheep. The majority of both goat and sheep herds were composed of females (49.2% and 57.1%, respectively) compared to males (17.1% and 9.4%, respectively). When it came to growing animals, female goats were in the majority (21.6%) followed by male goats (17.5%). However, male sheep were more populated (19.2%) than female sheep (14.3%).

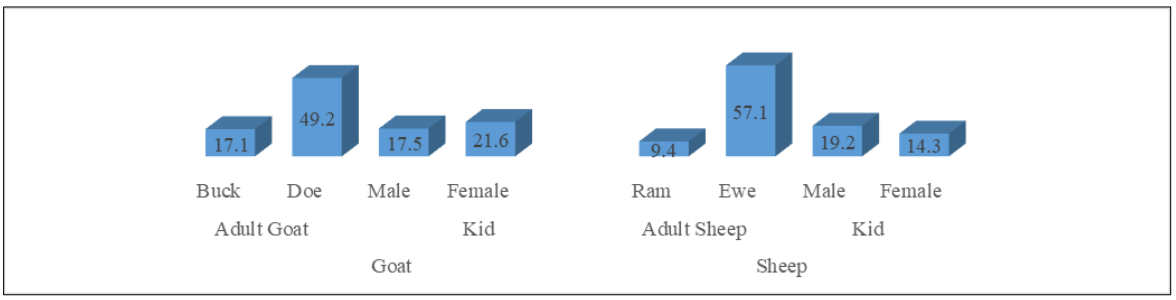

Figure 4 Herd composition for both species

The results of this study followed similar patterns to those of Conteh et al. and Sime et al. (19, 24) in Sierra Leone and Ethiopia respectively. Male animals can easily be disposed of for economic and non-economic purposes while female animals are most times retained in the herd for breeding purposes. The differences observed in young animals may have been caused by different management practices and environmental factors as well as mortality caused by diseases.

Small ruminants are being given a high priority over other livestock due to their inherent traits that integrate well into the current production system, especially the traditional free-range. During a survey, farmers highlighted unique characteristics which small ruminants had over other livestock such as cattle and swine. From their experience. prolificacy emerged as the most profound reason for rearing small ruminants, representing 39.5% of the farmers.

Adaptation was the second main reason, accounting for 22.6% of the farmers. Other reasons included disease resilience (15.1%), high market demand (10.5%), short reproductive cycle (8.9%), and general acceptance (3.4%).

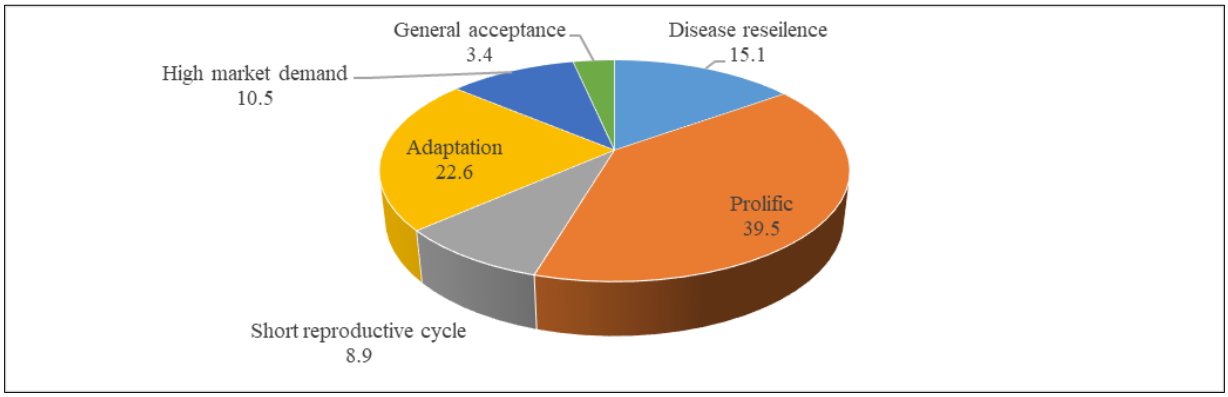

Figure 5 Preference of goats and sheep over other livestock in the study area

Goats and sheep give birth twice a year, but goats are more likely to have multiple births like twining, triplets, and quadruplets than sheep. Moreover, the survival rate of goats could be higher compared to sheep. Small ruminants are highly adaptable to different environmental conditions due to their robust disease-resistance ability. The traditional free-range system of rearing small ruminants requires minimal input in terms of labor, feeding, knowledge, and housing, making it accessible to different categories of people. The most critical economic factor in small ruminant production is access to an improved and easily accessible market for producers. A good market facility is a vital mechanism for economic transformation, providing a pathway out of poverty (25), and positively impacting food security (26). Small ruminant products have no market barriers for consumption, except for specific uses such as rituals.

Figure 6 provides an understanding of how rural communities obtained breeding stock especially, when improved breeding system is lacking. The results of our study highlighted five main sources farmers acquire animals for breeding purposes. More than half (57.5%) of the respondents said that they obtained their parent stock through self-breeding. Other sources included other local herders (18.9%), inheritance/gift (10.1%), relatives/friends (9.4%), and market (4.1%). The results implies that parent stocks are locally acquired in the study areas, signifying the importance of introducing an improved animal breeding program not just in the study area but the country at large. These findings support studies conducted by Bolowe et al. and Conteh et al. (27, 17) in Botswana and Sierra Leone, where farmers also identified similar sources for their breeding animals. However, the various sources of breeding animals could pose potential threats to farmers due to the possibility of disease transmission and the risk of purchasing low-productive breeds, which may appear cheaper.

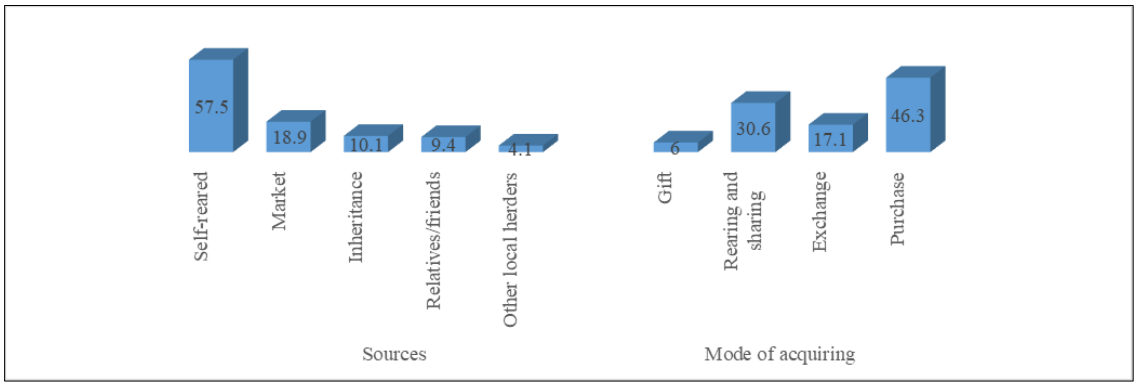

Figure 6 Sources and mode of acquiring breeding stock

Figure 6 also shows the various mode farmers acquire animals for breeding purposes. Among these different modes listed, purchasing was the most common method (46.3%), followed by rearing and sharing (30.6%), exchange (17.1%), and gift (6.0%). This means that raising goats and sheep in these areas requires some costs associated with it, as purchasing is the most frequently reported mode of acquiring breeding stock. However, this factor may limit individuals who intend to engage in small ruminant production.

Small ruminant production in Sierra Leone is subject to several hindrances that influence sustainable productivity. To gain an understanding of these interruptions, the study carefully examined the constraints faced by small ruminant producers in the study areas. Figure 7 shows that theft was the most significant constraint reported by all farmers (100.0%). Animal theft is a major setback for small ruminant rearing, particularly when it is practiced in the traditional free-range system. The impact posed by thieving in the study areas includes low participation in animal rearing, reduction in household income, and protein intake. Additionally, animal theft may also limit the investment process. Other constraints identified in the study were health problems (88.4%), mortality (76.7%), and husbandry practices (63.9%). Other constraints, such as negative community attitudes (28.1%), inadequate education (14.2%), and predation (11.1%), were also listed. Although all provinces identified similar constraints, the degree to which they occurred differed. In the East, the primary constraints were health problems (91.8%) and mortality (90.4%). In the North, husbandry practices (81.5%) and health problems (74.7%) were the primary constraints, while health problems and mortality were the main issues in the South, representing 98.6% and 75.3%, respectively. Although some animals die naturally, the majority of deaths are caused by diseases/parasites, accidents, predators, or harsh environmental conditions. These constraints have been earlier on reported by various studies elsewhere. For example, Offor et al. (28) in Nigeria found veterinary services as a major constraint, Armson et al. (29) in Ethiopia found disease and poor market structure as the major constraints, Lawal-Adebowale and Alarima (30) in Nigeria found animal theft as the major constraint, Tesfaye (31) in Ethiopia found feed shortage as the major constraint, and Singh (32) in India found lack of extension services as a major constraint.

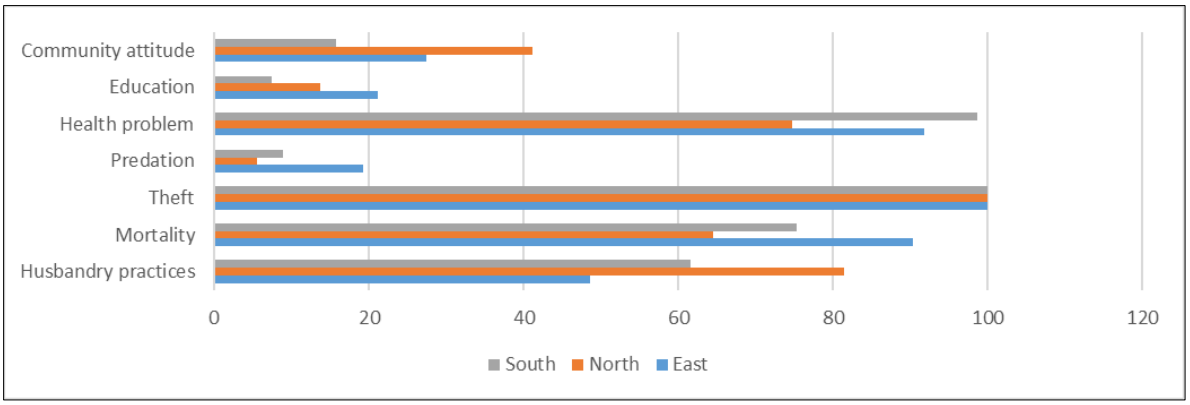

Figure 7 Constraints limiting small ruminant productivity in the study area

The veterinary service in the country is yet to achieve its intended purpose and due to this most farmers have not understood how crucial it is in livestock production. Areas where veterinary services operates, it faces challenges such as lack of willing to pay for veterinary drugs or practice routine immunization. Some farmers are still bent on using non-veterinary medicine whose efficacy remain unknown. Additionally, community attitudes such as killing, poisoning, and physical harm was also a big challenge in the study area. These attitudes may result from environmental disturbances, such as grazing of crops, blaring, and pollution, which can lead to conflict (31). Low educational level was another constraint particularly in the North, which accounts for 41.1% of the farmers. Farmers need adequate knowledge and skills to maximize production and reduce production costs as well as to be able to mitigate some challenges. A sound extension service program can help improve their knowledge, skills, and attitudes. In addition to the aforementioned constraints, predators such as wild animals (snakes) and domestic pets (dogs) attacking and harming and killing their animals also emerged as a challenge.

According to Sime et al. (24), diseases and parasites are major obstacles to small ruminant production. These issues cause significant losses in the study areas, as outlined in table 4. Farmers report that the primary disease affecting their animals is peste des petits ruminants, which was identified by 81.7% of participants. Skin infections (77.2%), foot rot (73.1%), and reproductive diseases (71.2%) were also noted as major problems. Other diseases, including pneumonia (42.5%), worms (30.4%), bloat (25.6%), lymphadenitis (16.4%), and Orf (12.3%), were identified as well. These findings are consistent with the results of a study by (17). Also in Ethiopia, Armson et al. (31) parasites, Orf, PPR, and pneumonia as major animal health challenges limiting small ruminant production.

Table 4 Common diseases and parasites of goats and sheep in the study area

Diseases/Parasites	East	North	South	Overall responses	P Value
Skin infection	92.5	71.9	82.9	77.2	0.000
PPR	77.4	67.8	100.0	81.7	0.000
Foot Rot	63.7	79.5	76.0	73.1	0.006
Reproductive Disease	64.4	59.6	89.7	71.2	0.000
Bloat	26.0	39.0	11.6	25.6	0.000
Worm	51.4	26.7	13.0	30.4	0.000
Orf	11.6	15.1	10.3	12.3	0.439
Pneumonia	49.3	30.8	47.3	42.5	0.002
Lymphadenitis	18.5	9.6	21.2	16.4	0.019

The results of this study showed that small ruminant production is facing serious threats from diseases and parasites. The analysis revealed a significant association between geographical locations and the occurrence of diseases and parasites, except for Orf. Other studies have also identified similar diseases and parasites such as mange, reproductive diseases, foot rot, PPRV, feeding diseases, pneumonia, and worms as major constraints to small ruminant production. The study found that some provinces reported the occurrence of certain diseases and parasites more frequently than others. For example, in the East, skin infection, worm infestation, and pneumonia were more prevalent compared to the North and South. Foot rot, bloat, and Orf were more of a problem in the North, while PPR, reproductive diseases, pneumonia, and lymphadenitis were reportedly higher in the South. The differences in occurrence could be associated with ecological factors, management practices, and animal healthcare services. Improving veterinary services and infrastructures, as well as farmers' knowledge and awareness of animal diseases, can help to prevent further spread.

4. Conclusion

Small ruminant production plays a significant role in improving the livelihoods and social practices of both livestock and non-livestock farmers in the study areas. It also serves as a primary source of income and animal protein. The study reveals that small ruminant production in the study areas is largely dominated by men and married couples, and has a high illiteracy rate among farmers, with less participation of youths. To improve food security, the government and other developmental partners need to increase women's participation in small ruminant production by improving their technical skills, providing access to loans, and establishing women's livestock programs as major contributors. Although small ruminants' ownership was dominated by men, women and children were largely responsible for management activities. Recognizing the critical roles of women in household food security and their immense role in small ruminant production by minimizing economic and social disparities will promote ownership rights and decision-making. Agriculture remains the main occupation and source of income for the people in the study areas. Income from the sales of small ruminants is used to purchase food, support educational activities and crop farming, highlighting the need to improve the sector. However, the development of the sub-sector is affected by disease/parasitic infestation, inadequate veterinary services, and high mortality rates. The study recommends providing farmers with improved knowledge and practices on animal husbandry practices and biosecurity measures through an efficient extension service. The most important economic diseases and parasites reported were PPR, skin infections, foot rot, and reproductive infections. The scope of veterinary services needs to be improved and expanded to address animal health challenges as well as improve farmers' knowledge of biosecurity and disease management practices. The formulation of local policies at the rural level can help stop the incidents of theft and other animal cruelty.

Compliance with ethical standards

Disclosure of conflict of interest

All the authors declare that there are no external influences, sponsorships, or affiliations with organizations or entities that could an undue impact on this study.

Statement of informed consent

All participated participants were accordingly informed prior to and during data collection. Therefore, consent was obtained from all individual participants and confidentiality was strictly followed by all authors.

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Author's short biography

Dr, Abdul Rahman Sesay: Dr Abdul Rahman Sesay is an Associate Professor and the current Dean of the School of Postgraduate Studies at Njala University. Dr Sesay holds a PhD, Master's, and BSc degrees in Biological Sciences, Animal Reproductive Physiology, and Animal Breeding and Reproduction from the University of Sierra Leone (Njala University College), Guangxi Agricultural University, China, and South China Agricultural University, respectively. He has previously served as Dean of the School of Agriculture and Food Sciences (2018 to 2021) and Head of the Animal Science Department (2013 to 2017), and was a Senior Lecturer from 2004 to 2011. His research interests include, but are not limited to, improving livestock productivity and conserving animal genetic resources, and he has numerous publications in these areas.	
Abdulai Mahmood Conteh: In 2016, Abdulai Mahmood Conteh graduated from Njala University with a Bachelor of Science with honors in Animal Science. Following his undergraduate studies, Conteh worked as a Project Research Assistant in a Serology and Molecular Laboratory, where he gained hands-on experience and developed a deep appreciation for laboratory work, as well as a broad understanding of Laboratory Quality Management Systems. After completing his Master of Science in the same discipline at Njala University in 2021, Conteh continued his professional career as a laboratory technician at Njala University, a university globally recognized and based in Sierra Leone. In this role, he conducted diagnoses of viral hemorrhagic fevers and other emerging pathogens, managed laboratory equipment, developed standard operating protocols, collected clinical samples, taught basic laboratory instrumentation and analysis at undergraduate level, and ensured that all experiments adhered to rigorous standards of accuracy and safety. Conteh's meticulous attention to detail and his ability to troubleshoot complex issues quickly made him a valuable asset to the institution. In 2022, his expertise and dedication earned him a promotion to Senior Laboratory Technician. In this capacity, he led a team of technicians and played a crucial role in several high-profile research projects, contributing significantly to the university's success and enhancing its reputation as a leader in laboratory analysis. Conteh's research interests include livestock health and production, viral hemorrhagic fevers other emerging pathogens of animal origin. Throughout his career, Conteh has been recognized for his exceptional work ethic and technical proficiency. He has authored several research articles published in peer-reviewed journals, making significant contributions to advancements in diagnostic technology and therapeutic development within the field of Animal Science.	
Dr Sanpha KAllon: Dr. Sanpha Kallon, born in 1963, was raised in Magburaka, Kholifa Rowalla Chiefdom, Tonkolili District, Northern Sierra Leone. He earned a B.Sc. in Agricultural Education in 1988, an MSc in Animal Science in 2005, and a Ph.D. in Animal Nutrition and Feed Science in 2013, all from Njala University, Sierra Leone, and South China Agricultural University, Guangzhou, China, respectively. His areas of specialization include animal nutrition (ration formulation), livestock production, and animal health.