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Husbandry Practice, Challenges and Prospect of Small Ruminant Production Performance in Dodota Woreda of Arsi Zone, Ethiopia

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Abstract: Ethiopia has a sheep population of 42.9 million heads and a goat population of 52.5 million heads. Despite their vast numbers, small ruminant production is underdeveloped due to obstacles such as a lack of water, a high prevalence of illnesses and parasites, a lack of genetic development, and a lack of market access and information. The objective of this study was to identify constraints and opportunities, as well as potential interferences with small ruminant production performance. The study area included Direkiltu and Amigna Debeso from a Goat Dominated site, Dodota Alem and Tedacha Guracha from a Sheep Dominated site, and Dilfaker from a Mixed Flock site. 36 households (a total of 180 households) were chosen at random from each kebeles to participate in the diagnostic survey. Using the SPSS statistical package, the collected data was organized, summarized, and analyzed (SPSS, 2017 Version 25.0). The findings are based on a survey of 180 households and focus group discussions. The main reasons for raising small ruminants in Dodota Woreda were for revenue, savings/assurance, meat, and social and cultural activities. The most prevalent feed sources were natural grassland, crop residue, indigenous browsing, crop aftermath, and house leftovers. Because most of the cultivated fields are covered with food crops, especially during the rainy season, most farmers (98.9%) used free grazing in the dry season, while 50 percent used tethering grazing systems in the wet season to prevent animals from harming crops. Throughout the year, all small ruminants were confined at night to protect them from rain, predators, and theft. With an index of 0.330, 0.203, 0.142, and 0.114, respectively, the key issues for small ruminant production in the area were feed and grazing land shortages, water shortages, drought, and disease. Documentation of different feed resources and strategic feeding management, water development, credentials of diseases and their control approaches through appropriate policy and information delivery are areas of essential involvements in order to assist farmers in building their flock and developing productivity.

Keywords: Dodota, Ethiopia, Productive, Small Ruminant

1. Introduction

Ethiopia has a population of approximately 42.9 million sheep and 52.5 million goats [14]. They are important components of the livestock subsector and provide cash income, milk, meat, wool, manure, and risk mitigation during crop failures, as well as many other socioeconomic and cultural functions [40, 21, 5, 23, 34]. They also provide property security, monetary saving and investment, and many other socioeconomic and cultural functions. Furthermore, the growing international demand for meat in general, as well as the high demand for sheep and goat meat in the Middle East, provide an additional impetus for the country's sheep and goat production [27]. Producers of sheep and goats have been able to sell more animals at higher prices as a result of this [31]. In many countries, their products make a significant contribution to the national and household economies.

Due to obstacles such as a lack of water, a high frequency of diseases, parasites, a lack of genetic development, and a lack of market access and information, small ruminant production

is not well established despite their enormous numbers [2, 1, 17]. Other researchers have argued that the primary constraints to small ruminant production are a lack of feed, insufficient veterinary services, and a lack of money [16, 39, 18]. In addition, improving the genetics of small ruminants could help close the production gap [24]. However, information on small ruminant production performance in the research area is scarce and poorly documented. As a result, the study was carried out to identify constraints and opportunities, as well as potential interferences, for increased small ruminant production in the study area.

2. Materials and Methods

2.1. Description of the Study Area

The research was carried out in Dodota Woreda, Oromia National Regional State, in the country's Great Rift Valley. Woreda (Dera) is located 125 kilometers from Addis Ababa. It covers 512 square kilometers and lies between 8° 11' and 8° 26' north latitude and 39° 2' and 39° 29' east longitude. The seasonal migration of the Inter-Tropical Convergence Zone (ITCZ), which follows the position of the sun relative to the earth and the related atmospheric circulation, has a strong influence on the woreda. Traditional and agro-ecological zones are the most widely used climatic zone classification schemes. Various species of acacia trees, bushes, woodlands, forests, and shrubs make up the majority of the vegetative cover in the area.

2.2. Sampling and Sample Size Determination

In the study area, a stratified sampling strategy was used to select Kebeles that may represent the mass of small ruminant distributions. As a result, the study areas were divided into sheep dominant sites (SDS), goat dominant sites (GDS), and sheep-goat mixed flock sites (MFS) based on flock distribution. The households were chosen based on the following criteria: minimum flock size of the sites (two animals for SDS, three animals for MFS, and three animals for GDS), at least one year of experience farming small ruminants, and willingness to participate in the study.

The sample size was calculated using the following formula, as recommended by [7]: N=0.25/SE2 Where N is the required sample size, SE is the standard error of 5%, and 95 percent confidence is the level of confidence. As a result, a total of 100 respondents were included; however, the study sample size was raised by 1.8 times to boost precision, and 180 homes from Woreda were proportionally selected from five Kebeles. Using secondary information collected from the Woreda livestock and fishery office, the selected Kebeles were based on the potentiality of the goat, sheep, and combination of two productions, as well as proximity to roads. As a result, the research area included Direkiltu and Amigna Debeso from GDS, Dodota Alem and Tedacha Guracha from SDS, and Dilfaker from MFS kebeles. Each kebeles' 36 households (a total of 180 families) were chosen at random to participate in the diagnostic survey.

2.3. Data Collection

We used both primary and secondary data. Personal interviews and a well-defined, structured questionnaire were used to collect primary data. The following variables were collected using a structured questionnaire: reasons for retaining small ruminants, feeds and feeding systems, constraints and prospects for small ruminants, housing, castration, and culling systems.

Secondary data was gathered from published papers, journals, books, statistical reports, and the livestock and fishery offices. The Woreda was also visited in order to have a better grasp of agriculture in general and small ruminant production in particular. Data was collected with the researcher by development agents (DAs) and supervisors who worked in the Woreda and spoke the local language. For 1-2 hours, focus group discussions (FGD) involving 7-12 people were led by trained leaders, and key informants were also used in the study kebeles. Both are used to get a full picture of the issues discussed in the structured interview and to see if the patterns discovered in the households were confirmed.

2.4. Data Analysis

Using the SPSS statistical tool, the acquired data was processed, summarized, and analyzed (SPSS, 2017 Version 25.0). Descriptive statistics and ranking were used for data with frequencies. Index = sum of [(3 x number of household rank first) + (2 x number of household rank second) + (1 x number of household rank third)] for a specific cause divided by the sum of [(3 x number of household rank first) + (2 x number of household rank second) + (1 x number of household rank third)] for all causes in flock density, as suggested by [24].

3. Results and Discussion

3.1. Household Characteristics

Males headed the majority (85.0 percent) of the small ruminant owning households in the research area, while females headed only a small proportion (15.0 percent). Female-headed homes may experience divorce or the death of their husbands. Across the three flock densities assessed, 34.4 percent of households were unable to read or write. Despite the fact that the majority of the households polled were literate, 43.9 percent of those polled did not have children who had completed basic school. According to key informants interviewed, lower levels of success in higher education may be attributable to a lack of knowledge of the value of creating works for society, but education has a substantial impact on the adoption of new technologies and the improvement of small ruminant management systems. The respondents' average age and family size were 44.0 years and 6.26 people, respectively. The current finding's total individual family size per household was higher than the 5.7 persons reported for the region by [13].

3.2. Husbandry Practice

3.2.1. Purpose of Keeping

Small ruminants were kept in the research area for various purposes (Table 1). Small ruminants were kept by the majority of households primarily as a source of revenue. Small ruminants are raised for revenue in various sections of the country, similar to this finding [3, 20, 26, 41, 30, 35]. Cereal crops were the predominant cash crop, according to group discussion members and key informants in the area. However, several issues such as irregular rainfall limit the economic success of most farmers. Crop yields fluctuate in most cases, and farmers use small ruminants as a kind of savings and insurance during these times. The proceeds from the sale of small ruminants were used to pay for school fees, food and clothing, farm improvements, fertilizers, improved seeds, medication, taxes, social activities, and replacement stock.

Table 1. *Households' ranking for the purpose of keeping small ruminants.*

Purpose	Ranked			
	1st	2nd	3rd	Index
Sale for income	129	48	3	0.430
Meat	1	26	30	0.127
Milk	1	23	25	0.065
Manure	0	18	41	0.067
Social and cultural function	7	21	26	0.077
Considered as drought tolerant	3	10	26	0.048
Saving/assurance	39	34	29	0.187

3.2.2. Flock Structure

The age delivery of sheep and goats was presented in (Figures 1 and 2). The delivery by age nearly follows a similar trend for both small ruminants. Breeding females represent a larger proportion while male lambs and kids were the second largest age groups in the flocks; and the uncastrated and castrates represent the lowest proportion in the flock for both species. From the sheep flock, 37%, 30%, 27%, 6.0%, and 0.0% were represented by ewes greater than six months, female lamb less than six months, male lamb less than six months, uncastrated ram greater than six months, and castrate rams of one year, respectively. Similarly, there were 36%, 33%, 25%, 6.0%, and 0.0% were represented by does greater than six months, female kid less than six months, male kid less than six months, uncastrated bucks greater than six months, and castrate bucks of one year, respectively.

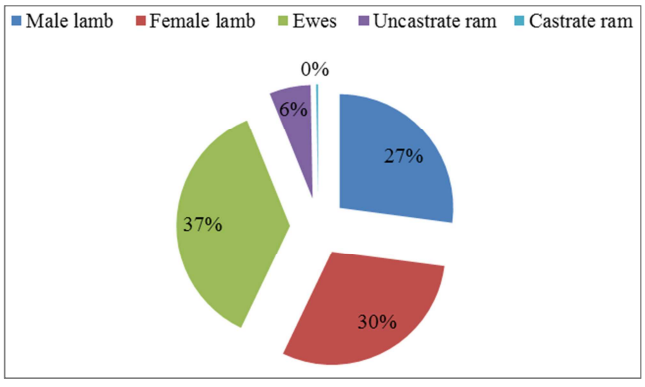

Figure 1. *Flock structure of sheep.*

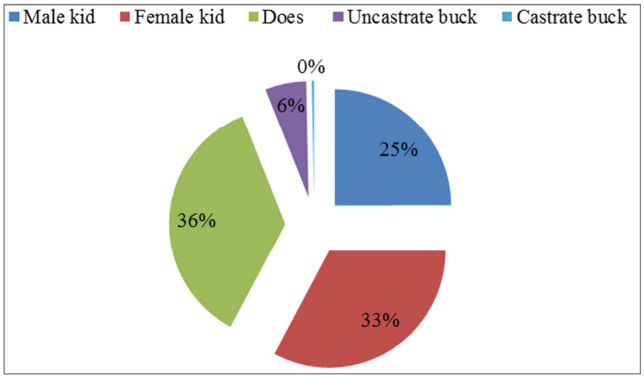

Figure 2. *Flock structure of goats.*

In the current study, females of all age groups covered the highest proportion this might be due to males were either sold for income purpose or slaughtered for meat consumption at home while females are kept for breeding and milk production purposes. The higher proportion of breeding females in the flock of current finding was in an agreement with the report of [28] in the central rift valley of Ethiopia, [22] in the central zone of Tigray and [39] in the eastern Tigray.

3.3. Feed Resource, Feeding Systems and Their Utilization

The major common feed resources available for the small ruminants in the study area were varied across the seasons as shown in (Figures 3 and 4).

Natural pasture, crop residue, and indigenous browse were the common feed source for small ruminants in the study area. The utilization of natural pasture was higher in rainy seasons (June, July, August, and September) due to sufficient moisture amount in the rain season. Grazing aftermath was mainly utilized during October to January at the time of crop harvesting seasons. The aftermath was an important source of small ruminants feed; it starts in September and declines at the end of March. During the short rainy season, its importance declines as farmers start plowing their croplands to prepare for the next cropping season.

The majority of the non-conventional feed resources for the small ruminants are kitchen leftover and *Atela* which were almost available in all seasons. According to group discussion and key informant's interviews, private grazing land was common and communal grazing land was not available for small ruminants in the area. When the farmers move to crop field for weeding they take their animals and feed them. The months of February, March, and April are periods of highest feed scarcity in the study area. This was caused by the shortage of rainfall in the low lands, drought, and lack of experiences to collect and preserve feed for the dry season feeding. Another important challenge in small ruminant production in the area is the conversion of grazing lands into cultivated lands at the expense of grazing areas for livestock production due to the increased human population.

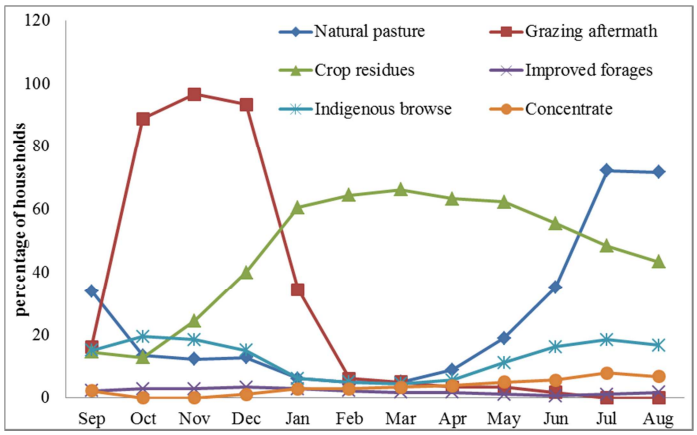

Figure 3. *Common grazing feed resource available at different seasons.*

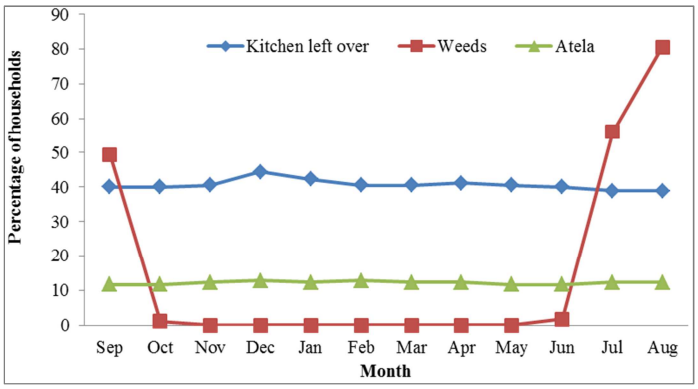

Figure 4. *Common non-conventional feeds resources available in different seasons.*

The different feed resources in the current study were similar to the report of [36] in the Goma district of Jimma zone and [5] in western Tigray. Similarly, [18] also, reported that natural pasture with certain browse species, crop residue, improved forage, and house leftover were the main feed resources for small ruminants in Misha Woreda, Hadiya Zone, Southern Ethiopia. Weeds were common feed sources for small ruminants during wet seasons and this was in agreement with the reports of [39] in the eastern Tigray.

3.4. Grazing Systems

The grazing systems used for small ruminants across the three studied small ruminant density are shown in (Figure 5). In the study area, grazing small ruminants with other livestock is a common practice, due to the labor shortage. The current study indicated that, 16.67% graze sheep alone, 11.13% graze goat alone, and 17.13% graze sheep and goat together. The current finding was lower than 63.0% of the respondents kept sheep only and 28.3% together with a goat, which was reported by [25] in the Gamogofa Zone. Similarly, [19] in the Degehabur Zone, Eastern Ethiopia, reported 93.3% of households to grazed small ruminants together which was higher than the current finding.

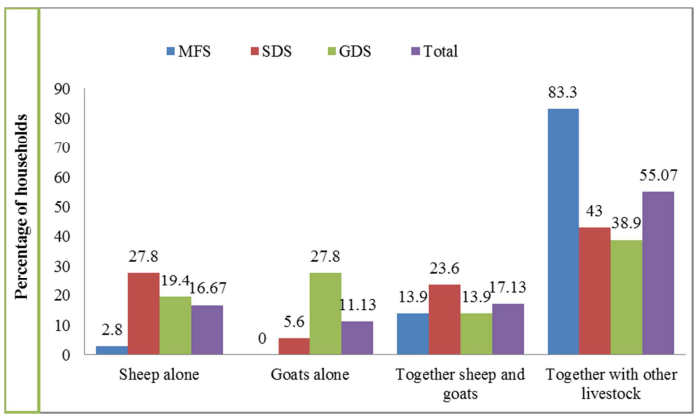

Figure 5. *Grazing systems used for small ruminants in the study area.*

In the dry season, the majority of the respondents (98.9%) practiced free grazing (Table 2). In the wet season, when the major feed resource was pasture grazing, about 50% of the respondents use tethering grazing, while 0.60% was free grazing systems. As key informants, the main reasons for tethering small ruminant during the wet season was to prevent crop damage, followed by optimum usage of labor while during the dry season to prevent predators and theft. The current finding was lower than 70.1% of the households used free grazing during the wet season as reported by [25] in the Gamogofa Zone.

Table 2. *Grazing practice of small ruminants in different seasons.*

Variable	Small ruminant density groups							
	MFS		SDS		GDS		Total	
	N	%	N	%	N	%	N	%
Grazing in the dry season								
Free grazing	36	100	72	100	70	97.2	178	98.9
Tethered grazing	0	0.0	0	0.0	2	2.80	2	1.10
Grazing in the wet season								
Free grazing	1	2.80	0	0.0	0	0.0	1	0.60
Tethered grazing	33	91.70	29	40.28	28	38.9	90	50
Cut and carry	2	5.50	35	48.61	30	41.7	67	37.2
Transhumance	0	0.0	8	11.11	14	19.4	22	12.2

MFS=Mixed flock site; SDS=Sheep dominate site; GDS=Goats dominate site.

Table 3. *The water source of small ruminant at different seasons.*

Variables	Small ruminant density groups							
	MFS		SDS		GDS		Total	
	N	%	N	%	N	%	N	%
Dry season								
River	0	0	0	0	5	6.94	5	2.80
Pond	1	2.80	13	18.1	42	58.3	56	31.1
Tap	35	97.2	59	81.9	25	34.7	119	66.1
Wet season								
River	1	2.80	1	1.40	19	26.4	21	11.7
Pond	20	55.6	31	43.1	19	26.4	70	38.9
Tap	3	8.30	14	19.4	3	4.2	20	11.1
Rainwater harvesting	12	33.3	26	36.1	31	43	69	38.3
Small rain season								
River	0	0	0	0	5	6.90	5	2.80
Pond	18	50	34	47.2	40	55.6	92	51.1
Tap	9	25	28	38.9	20	27.8	57	31.7
Rainwater harvesting	9	25	10	13.9	7	9.70	26	14.4

MFS=Mixed flock site; SDS=Sheep dominate site; GDS=Goats dominate site.

3.5. Water Source

The main sources of water for small ruminants in the study area were tap water (66.1%), pond water (38.9%), and pond water (51.1%) at dry, wet, and small rain seasons, respectively (Table 3). During the wet season, pond water (38.9%) was the main water source followed by rainwater harvesting (38.3%). Whereas, during the small rain season pond water (51.1%) was the main source of water followed by tap (31.7%). The current finding of water sources for small ruminants was similar to the report of [11] in the Sodo Zuria district. Similarly, [30] reported rivers, deep wells, rainwater, and ponds were the main water sources for small ruminants in the Wolayita Zone.

3.6. Watering Frequency

The watering frequency in the study area varied among seasons (Figure 6). In the study area, sheep were watered once a day by 61.1%, 50.7%, and 86.1% of the households in dry, wet and small rain seasons, respectively. The majority of sheep during the dry season were watered once a day (61.1%), followed by once in two days (32.6%) and once in three days (4.90%). The present finding was an agreement with the report of [39] in the eastern Tigray who reported sheep were watered mainly once a day but in areas with water shortage watered in two days in the dry season. On the contrary to the current study, watering sheep was reported to be two to three times a day during the dry season in the Wolayita Zone [30].

The watering frequency in the study area was different from season to season. In the study area, a goat was watered once a day by 57.9%, 60.3%, and 84.1% of the households in the dry, wet and small rain seasons, respectively (Figure 7) above. The majority (57.9%) of households watered goats in the dry season once a day, while 37.3% once in two days and 4.0% once in three days. The present finding of watering goats once a day followed by once in two days during the dry

season was an agreement with the report of [39] in the eastern Tigray. Similarly, [12] in the Asossa district stated that during the dry season, the majority of farmers provide water for their goats once a day.

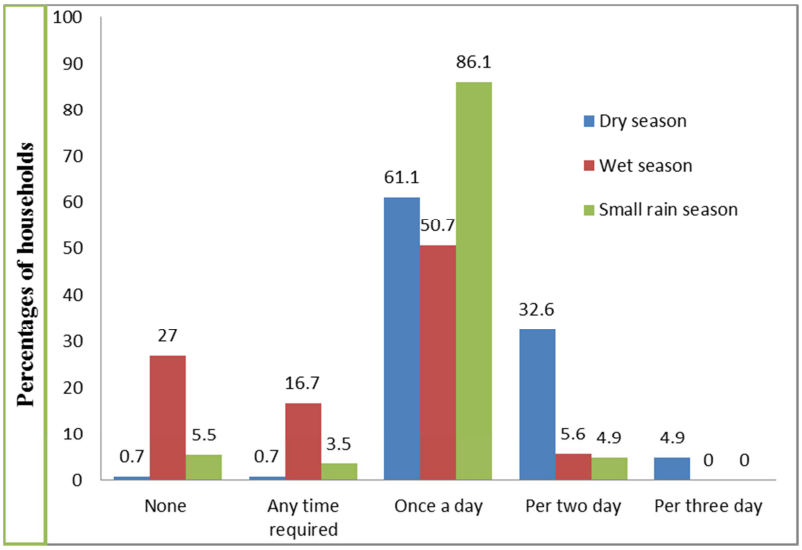

Figure 6. *Watering frequency of sheep.*

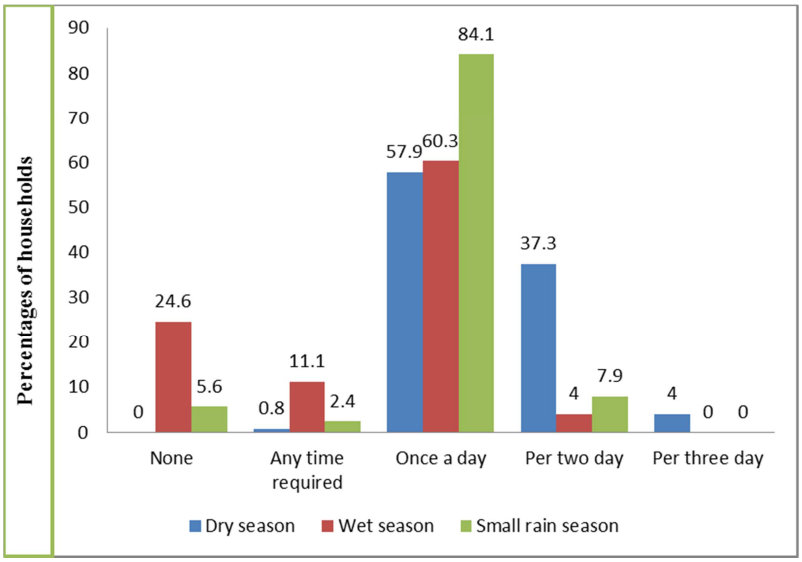

Figure 7. *Watering frequency of goats.*

3.7. Housing Systems

All farmers in the study area were housed at night throughout the year to protect them from rain, predators, and theft (Table 4). The higher proportions of respondents (90.0%) were housed their sheep and goat in a separate house from the main family. The majority of households used to construct houses from grass-sheet (82.8%), stone/bricks (84.4%), and earth/mud (100.0%), roof, wall, and floor, respectively. The current finding of all farmers housed their small ruminant was an agreement with the report of [8] in the Bale zone and [32] in the Amhara Region, Ethiopia. The current finding of a higher proportion of respondents housed their small ruminants in the separate house was in line with the report of [19] in the Degehabur Zone and [39] in the eastern Tigray. The current study result of floor materials; which was 100% made from earth/mud was similar to the report of [9] in the Bale Zone.

3.8. Castration Practice

In the study area, 95.6% of the interviewed households did not practice castration of small ruminants (Table 5). The reason behind this is, the households in the area mainly depend on small ruminants as a source of cash and they sale male animals at an earlier age. The percentage of households who practiced castration of their male sheep and goat were 87.5% to fetch more prices and 12.5% to avoid mating their flock with this male. The common methods used for castrating of the small ruminants in the study area were burdizo and local methods. According to the group

discussions, modern castration was done by animal health experts at animal health stations or veterinary clinics, while local castration was practiced using locally available materials like metal and woods to crash vas deference of the testes. The current study of castration reason to receive a higher price and to avoid mating was an agreement with the report of [4] in the Selale area and [38] in the Chencha and Mirab Abaya districts. The castration methods in the current study were reported by [41] in the Konso and Meta-Robi districts.

Table 4. *The housing of the small ruminants across flock type in the study area.*

Variables	Small ruminant density groups			
	MFS	SDS	GDS	Total
	N (%)	N (%)	N (%)	N (%)
Confine place				
Adjoin house (in the house)	3 (8.30)	8 (11.10)	7 (9.70)	18 (10)
Separated constructed house	33 (91.7)	64 (88.9)	65 (90.3)	162 (90)
Roof material				
Corrugated iron	1 (2.80)	13 (18)	5 (6.9)	19 (10.6)
Grass sheet	34 (94.4)	54 (75)	61 (84.7)	149 (82.8)
Wood	0 (0.0)	2 (2.80)	0 (0.0)	2 (1.10)
Stone/Bricks	0 (0.0)	0 (0.0)	1 (1.40)	1 (0.50)
Other	1 (2.80)	3 (4.20)	5 (6.90)	9 (5.0)
Wall material				
Wood	14 (38.9)	10 (13.9)	1 (1.40)	25 (13.9)
Stone/Bricks	21 (58.3)	61 (84.7)	70 (97.2)	152 (84.4)
Earth/mud	1 (2.78)	1 (1.39)	1 (1.40)	3 (1.70)
Floor material				
Earth/mud	36 (100)	72 (100)	72 (100)	180 (100)

MFS=Mixed flock site; SDS=Sheep dominate site; GDS=Goats dominate site.

Table 5. *Castration practice of small ruminants.*

Variables	Small ruminant density groups			
	MFS	SDS	GDS	Total
	N (%)	N (%)	N (%)	N (%)
Do you castrate				
Yes	2 (5.60)	5 (6.90)	1 (1.4)	8 (4.40)
No	34 (94.4)	67 (93.1)	71 (98.6)	172 (95.6)
Reason for castration				
Fetch more price	1 (50)	5 (100)	1 (100)	7 (87.5)
Avoid mating	1 (50)	0 (0.00)	0 (0.00)	1 (12.5)
Castration methods				
Local	0 (0.00)	4 (80)	0 (0.00)	4 (50)
Burdizo	2 (100)	1 (20)	1 (100)	4 (50)

MFS=Mixed flock site; SDS=Sheep dominate site; GDS=Goats dominate site.

3.9. Culling Practice

The study showed that 77.8% of the interviewed households did not practice the culling of small ruminants from the flocks (Table 6). From those who practice culling, the common reasons for culling practices listed by the interviewed households were: sickness (70.0%), reproductive failure (12.22%), old age (7.78%), and physical defects (5.0%). The current study, culling practiced due to sickness, reproductive failure, old age, and physical defects were in line with the report of [32] in the Amahara region; [12] in the Asossa district and Amare (2018) in Ethiopia.

Table 6. *Culling practice and methods of selling male small ruminants (%).*

Variables	Small ruminant density groups			
	MFS	SDS	GDS	Total
Culling flocks				
Yes	6 (16.7)	14 (19.4)	20 (27.8)	40 (22.2)
No	30 (83.3)	58 (80.6)	52 (72.2)	140 (77.8)
Reason for culling				
Old age	6 (16.67)	5 (6.94)	4 (5.56)	14 (7.78)
Sickness	18 (50)	46 (63.90)	57 (79.17)	126 (70)
Reproductive problem	12 (33.33)	16 (22.22)	0 (0.00)	22 (12.22)
Physical defect	0 (0.00)	0 (0.00)	7 (9.72)	9 (5.00)
Others	0 (0.00)	5 (6.94)	4 (5.56)	9 (5.00)

MFS=Mixed flock site; SDS=Sheep dominate site; GDS=Goats dominate site.

3.10. Challenges and Prospects of Small Ruminant Production

3.10.1. Challenges of Small Ruminant Production

The major small ruminant production constraints in the study area were presented in (Table 7). According to the interviewed households; there were different constraints that hampering the productivity of small ruminants. Feed and grazing land shortage, water shortage, drought, and disease were the most significant constraint of small ruminant production in order of importance with an index of 0.330, 0.203, 0.142, and 0.114, respectively. The abundant production loss caused by feed and grazing land shortage, water shortage might be related with the climatic condition of the study area. The erratic nature of the rainfall further deteriorates the feeding availability and aggravates the spreading of disease and parasites. In the current study, feed shortage, water shortage, drought, predator, and inadequate extension service was in agreement with other findings who reported by many authors;[8] in the Bale zone,[33] in eastern Ethiopia, [5] in western Tigray and [39] in the eastern Tigray.

Table 7. *Major constraints that hinder the production of small ruminants.*

Parameters	Ranked			
	1st	2nd	3rd	Index
Disease	17	20	33	0.114
Feed and grazing land shortage	70	63	25	0.330
Water shortage	43	33	16	0.203
Labor shortage	1	0	2	0.005
Drought in the area	33	20	16	0.142
Predator	14	22	24	0.101
Lack of breeding male	0	3	12	0.016
Lack of extension and support	2	18	48	0.083
Lack of technologies and innovation	0	1	4	0.006

3.10.2. Prospects of Small Ruminant Production

According to key informants and group discussions, the main reasons for small ruminant rearing were low start-up cost, an increase in meat demand, and minimal labor requirements. Also, high demand for small ruminants in the local market as a result of population increase, urbanization, and an increase in income can be considered as an opportunity for small ruminant producers. Moreover, their high turnover rate, easy to be managed by children and women are advantages to being integrated with crop production. Landless youth and farmers, aged people, and other members of society can participate in fattening activities that make them benefited as a result of high market demand and higher prices. There was a high consumption of meat during festivals and weddings, so a smaller amount volume of the animal was taken out of Dodota. The current finding of increasing their price and demand for live small ruminants and meat in local markets due to a rising population and increase in income of consumers and their uses as the source of income was an agreement with the report of [15] in the Tahtay Adyabo district.

3.10.3. Expansion of Small Ruminants Production

Some of the respondents in the study area planned to expand their sheep and goat flock size associated with the prevailing challenges were in (Table 8). The major reasons for expansion were; a short generation interval, easy to manage and keep, appropriate for slaughter and home consumption in the order of importance with an index of 0.441, 0.294, and 0.141, respectively. The current finding was in line with [36] in Goma district and [10] in Ghana who the majority of small ruminant producers showed willing to increase their flock sizes.

Table 8. *Plan to expand small ruminant flock size and production for future.*

Reason for expanding	Ranked			
	1st	2nd	3rd	Index
High market demand	5	11	32	0.094
Incentive market price	1	3	13	0.030
Easy to manage and keep	23	62	22	0.294
A short generation interval	87	28	6	0.441
Appropriate for slaughter and home consumption	6	18	49	0.141

4. Conclusion and Recommendation

Small ruminants were kept in Dodota Woreda for a variety of purposes, including income, savings/assurance, meat, and social and cultural functions. Natural pasture, agricultural residue, indigenous browsing, crop aftermath, and house leftover were the main feed sources in the study region. The main issues in the area for small ruminant production were a lack of feed and grazing land, as well as a lack of water, drought, and diseases. Documentation of different feed resources and strategic feeding management,

water development, credentials of diseases and their control approaches through appropriate policy and information delivery are areas of essential involvements in order to assist farmers in building their flock and developing productivity.

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