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Management and Breeding Objectives of Maefur goat breed type in Erob district eastern Zone of Tigray, Northern Ethiopia

Weldeyesus Gebreyowhens[1,2*] and Rohotash Kumar[3]

[1]Tigray Agricultural Research Institute. P. O. Box 492, Mekelle Tigray Ethiopia.
[2]Mekelle Agricultural Research Center. P. O. Box. 258, Mekelle Tigray Ethiopia.
[3]Department of Animal, Rangeland, and Wildlife Science, College of Dry Land Agriculture and Natural Resources, School of Graduate Studies, Mekelle University, Ethiopia.

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A cross sectional survey was conducted to characterize production system and to identify breeding objectives of Maefur goat population in the eastern zone of Tigray, Northern Ethiopia. A pre-tested questionnaire was used for the personal interview with purposively selected 150 households. The data collected through personal household interview were analyzed using descriptive statistics. Indices were used to provide the ranking. The mean (±SD) family size of the household was 8.5±2.1. The average (±SD) livestock holdings of the sampled household for goat, chicken, sheep, bee colony, and cattle were 31.0±11.1, 12.2±4.2, 6.8±4.5, 3.7±3.7, and 3.0±1.5, respectively. Does are mainly reared for milk, breeding, meat and for manure production with an index value of 0.25, 0.24, 0.17 and 0.14, respectively. Average composition of goat flock was 50, 22, 15, 10, and 3% for does, gimmers, bucks and wethers, respectively with an average ration of intact male to female goat was 6.3:1. Male and female goat reached for sexual maturity at the average (±SD) age of 11.1± 1.5 and 12.7±2.1 months, respectively with an average (±SD) age of 21.1±2.0 months at first kidding of the female goat. The average (±SD) kidding interval was 7.1±0.6 months.

Key words: Maefur goat, breeding objectives, selection criteria, reproductive performance.

INTRODUCTION

Agriculture is the base for Ethiopian economy and livestock sub sector is an integral part of agriculture. Ethiopia has the largest livestock population in Africa and the livestock sector has been contributing in livelihood improvement smallholder farmers (CSA, 2017). The sub sector plays a significant role in reducing poverty, achieve better food security; contribute to national income growth; contribute to exports and foreign exchange earnings; and contribute to climate mitigation and adaptation (Shapiro et al., 2015). Indigenous goat

*Corresponding author E-mail: welde26@yahoo.com.

populations are important animal in subsistence agriculture because of unique ability to adapt and maintain themselves in harsh environments. The total population of goat in Ethiopia is estimated as 30.2 millions of which 99.7% are indigenous goat breeds (CSA, 2017). About 15.18% (4.5 million) of the total goat population of Ethiopia are found in the regional government of Tigray (CSA, 2017). Individual study reports indicated that there are four breed types named as Abergelle, Begait, common highland goat, and Maefur. FARM-Africa (1996) described the origin and historical distribution of the indigenous goat population of Ethiopia that emphasized on documentation of the goat breeds. The description of goat production systems in Ethiopia emphasized on the contribution of the indigenous goat to the total household revenue (Solomon et al., 2010). The estimated contribution of goat population for economic growth and transformation in Ethiopia accounts for 16.8% of the total contribution of ruminant livestock meat outputs, which plays a great role as source of foreign currency (Ameha, 2008). Indigenous goat populations contribute to improve the livelihood of the rural area through providing milk and meat (as a source of food) and a source of income from the sole of goat. The amount of the domestic consumption of meat contributed from goat accounts for 1.13 million goats slaughtered 62 thousand metric tons (Adane and Girma, 2008). However, the traditional way of goat management is challenged by total reduction of the goat flock by mortality of kids and adult goat. The current study revealed that mortality accounts for 26% of the total reduction of the goat flock under smallholder farmers. Hence, identification of the breeding objectives, characterization of the production system and documentation of goat breeds are important for any type of development or improvement work (Alefe, 2014). Maefur goat populations adapted to mountainous topographical feature of "Ayga" and "Asimba" Erob district Eastern zone of Tigray and is recognized as selective goat breed types for meat improvement with an average live body weight at adult age (2 years and above); 42.8 and 37.7 kg for male and female, respectively (Weldeyesus and Rohatash, 2017). The estimated total number of the Maefur goat population is 49 266 a potential indigenous goat breeds types that have not been utilized for sustainable breed improvement with limited attempts to characterization for sustainable utilization and designing management intervention under smallholder farmer. Identifying of farmers' management practices that influence the survivability of kids in small-scale communal goat production systems leads to an appropriate extension message to meet the needs of sheep and goat farmers (Tatek, 2016). The objective of the study were to characterize the production system and identify trait preference of smallholder farmers, to identify breeding objectives, management practices and selection criteria for breeding male and female goat and to assess factors affecting the production of the ecotype goats breeds of Maefur in the study area.

MATERIALS AND METHODS

Description of the study area

The study was carried out in Erob district (14° 10'-14° 25'N and 39° 40'-39° 50'E) found in Eastern zone of Tigray 47 km North east of Adigrat (Figure 1). Erob district was selected based on potential availability of Maefur goat breed as the information obtained from DAGRIS (2004). The annual temperature of the study area ranges from 25 to 30°C and 12 to 16°C, respectively. Altitude ranges between 1200 and 3000 m above sea level with mean annual rainfall ranges from 250 to 300 mm during the rainy months of June and August (Tesfay et al., 2011). It has notable topographic features including the Assimba and Ayga mountains. The study area has diversified topographical features including peak mountainous, up and down hill and plain areas with the proportion area coverage of 84, 14, and 1%, respectively. The study area has three agro-ecological classifications of highland, midland, and lowland with proportional area coverage of 15, (12750 ha), 75 (63750 ha), and 10% (8500 ha), respectively (Tesfay et al., 2011).

Sampling procedure and data collection

Qualitative and quantitative data were collected through personal household interviewing with randomly selected 150 goat owners. The targeted peasant association was selected based on the secondary data obtained from livestock and extension experts of the study area. The designed questionnaire was used to gather data on general characteristics of the respondents (position in the household, age, gender, and family size), livestock holding, and goat flock composition, purpose of keeping goat, feeding, breeding practices, perceived important goat diseases, and reproductive characteristics of the indigenous Maefur goat population (Figure 2).

Data analysis

SPSS computer software (version 16.0) (2007) was used as database and all the collected data were this computer software. The information was presented mainly in the form of descriptive tabular summaries and graph. Microsoft excel was used to estimate an index in preference to rank based on the principle of weighted average (Kosgey, 2004 and Alefe, 2014).

Index = Sum of (4 for tick + 3 for rank 1 + 2 for rank 2+1 for rank 3) for each reason, criteria or preference divided by sum of (4 for tick + 3 for rank 1 + 2 for rank 2+1 for rank 3) for all reason, criteria or preference.

RESULTS AND DISCUSSION

General household characteristics

One hundred and fifty households (150) participated in survey research work as respondent in personal household interview (Table 1). The respondents were household head, son of the household head, daughter of household head and other relatives. Male and female-headed households represented about 83.3 and 10% of the overall proportion (93.3%) of respondents.

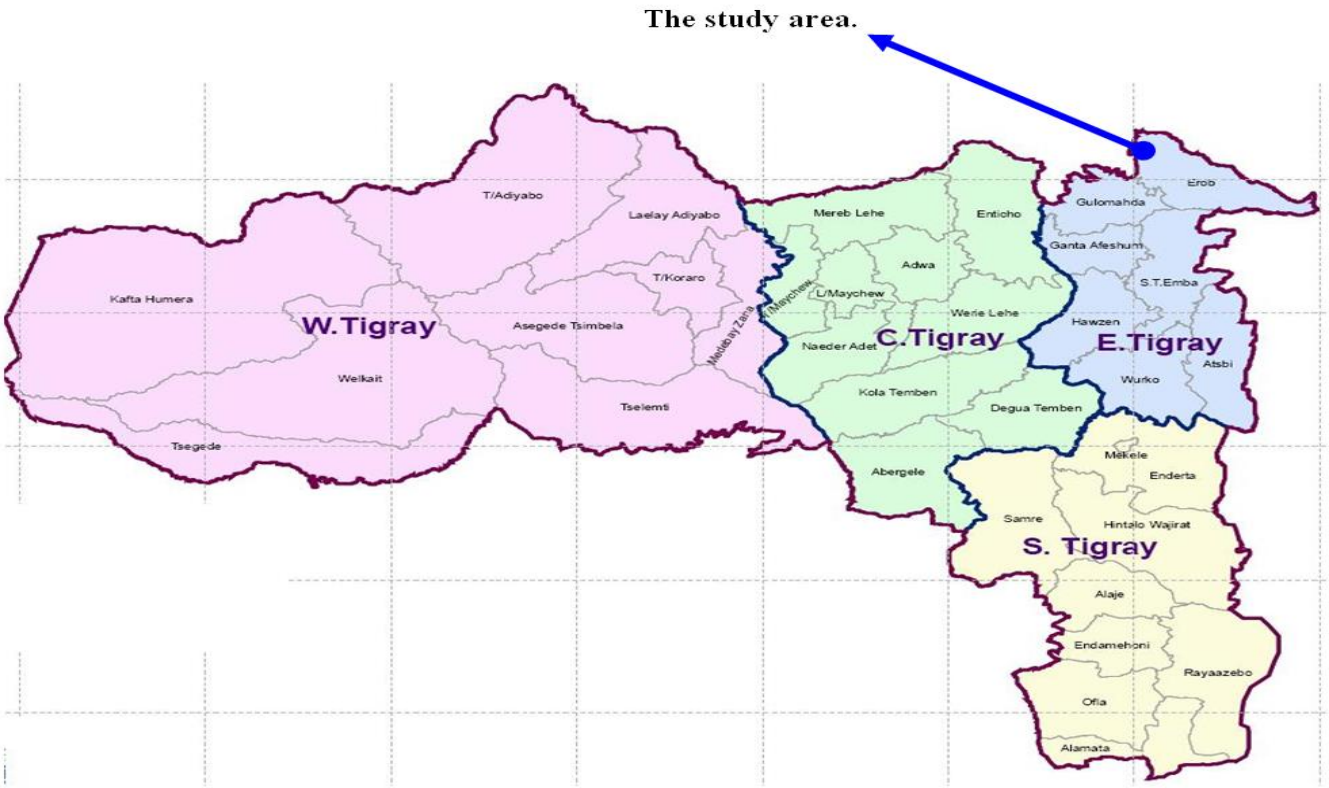

Figure 1. Map of the study area Source: http://www.tigraionline.com/tigrayGIF.gif

Figure 2. Personal interview with household in the study area.

To validate this finding, relevant literature is available.

Among the similar study report, Bosenu et al. (2014) discussed that 73.3% of the interviewed households were male-headed households. The current study compared this information with the proportion of male and female-headed households in the district. The proportion of male

Table 1. Characteristics of respondents included in the interview.

Descriptor	Variables	Number respondents	Percentage
Position in household	Household head	140	93.3
	Relative	2	1.3
	Son	1	0.7
	Daughter	7	4.7
	Subtotal	150	100.0
Gender of respondent	Male	126	84.0
	Female	24	16.0
	Subtotal	150	100.0
Age of the respondent	<31	6	4.0
	31-40	24	16.0
	41-50	71	47.3
	51-60	33	22.0
	61-70	11	7.3
	>70	5	3.3
	Subtotal	150	100.0

Table 2. Mean± (SD) family size of the households in the study area.

Gender	Age category	Mean	Maximum	Minimum
Male	<15 years	2.5±0.8	5	1
	>15 years	2.3±0.9	5	1
Female	<15 years	2.0±1.1	5	1
	>15 years	1.7±0.7	4	1
Total family size		8.5±2.1	13	4

and female-headed households from the total number of 6900 households found in the district was 58.4 and 41.6%, respectively. The mean ± (SD) composition of the households for male less than 15 years and greater than 15 years old age were 2.5±0.8 (1 to 5) and 2±1.1 (1 to 5), respectively (Table 2). The mean ± (SD) composition of the households for female in these age were 2.3±0.9 (ranging 1 to 5) and 1.7±0.7 (ranging from 1 to 4), respectively. The overall mean family size of the households was 8.5±2.1 (ranging from 4 to 13).

Characterization of the goat production systems

Majority (98%) of the respondents indicated that agro pastoral production system was the dominant livestock production system in which human and cattle settled with limited land holding for cereal cultivation. Goat flocks are kept to move towards the potential communal grazing land of Sengede for specific period possible with herders' ready stay around the resource area for a week. There is a broad question: why is goat dominant in the pastoral and agro pastoral production system? Regarding this question the main driven force is searching for water for animals and the communal rangeland (Solomon et al., 2010; Wilson, 1991). In most pastoral system, goat spends more efforts searching for feed and water which is mostly associated with mobility towards the resource area (Tsedeke, 2007).

Livestock holding and their relative importance for households

The average (±SD) livestock holdings of the sampled household for goat, chicken, sheep, bee colony, and cattle were 31.0±11.1, 12.2±4.2, 6.8±4.5, 3.7±3.7, and 3.0±1.5, respectively (Table 3). The current study observed that the average holding of goat in the sampled households was relatively higher than the average

Table 1. Livestock species and livestock holding of the sampled households.

Livestock species	TLV for overall sampled HH	Percent composition	Mean (±SD) livestock holding per HH
Goat	4643	54	31.0±11.1
Chicken	1836	21	12.2±4.2
Sheep	1015	12	6.8±4.5
Bee colony	554	6	3.7±3.7
Cattle	443	5	3.0±1.5
Donkey	175	2	1.2±0.6
Total	8,666	100	57.8±16.9

TLV = Total number of livestock of the sampled households.

Table 2. Ranked livestock species according to their importance.

S/N	Livestock species	Number of respondents	Ranks			Index
			1	2	3	
1	Cattle	143	134	6	3	0.23
2	Sheep	144	139	4	1	0.23
3	Goat	149	148	1	0	0.24
4	Chicken	145	1	139	5	0.16
5	Donkey	117	0	2	115	0.06
6	Bee colony	137	0	0	137	0.07

Table 3. Ranking on the basis of Doe and Buck rearing purpose.

Purpose	Doe				Buck			
	1st	2nd	3rd	Index	1st	2nd	3rd	Index
Meat	28	116	0	0.17	140	8	1	0.27
Milk	149	1	0	0.25	-	-	-	-
Breeding	140	6	1	0.24	119	14	2	0.24
Manure	0	110	32	0.14	1	29	99	0.10
Skin	0	24	116	0.09	0	4	133	0.09
Ceremony	-	-	-	-	0	2	125	0.08
Income	0	2.0	104	0.06	20	118	9	0.19

holding of other livestock species. There are reviewed literatures, which indicate there might be a shifting of livestock holding because of the changing environmental conditions (Solomon et al., 2010).

The current study found that goat, sheep, and cattle were considered as most important livestock species with an index value of 0.24, 0.23, and 0.23, respectively (Table 4). Goat in the study area adapted to the mountainous topographical feature, were able to survive, reproduce, and provide milk, meat, and was source of income to smallholder farmers. This is the reason why goats were ranked first by households because of their ability of utilizing various browse plant species and to stand and, climb to browse from shrubs. Similar findings were obtained for the above reason in Amhara region of Metema woreda (Tesfaye, 2009).

According to the respondents' point of view, households have developed their own weighting preference on the desirable traits over the specified livestock species.

Breeding objective of the indigenous Maefur goat population

Respondent`s ranking of the production objectives of buck and doe are presented in Table 5. The main purpose of keeping bucks was for meat, breeding, income generation, and manure production with an index value of 0.27, 0.24, 0.19, and 0.10, respectively while the

Table 4. Ownership of the goat flock in the study area.

Who own the goat?	Number of the respondents	Percentage of the respondents (%)
Household head	82	54.7
Head/spouse together	65	43.3
Daughters	1	0.7
Household head and Daughters	2	1.3
Total	150	100.0

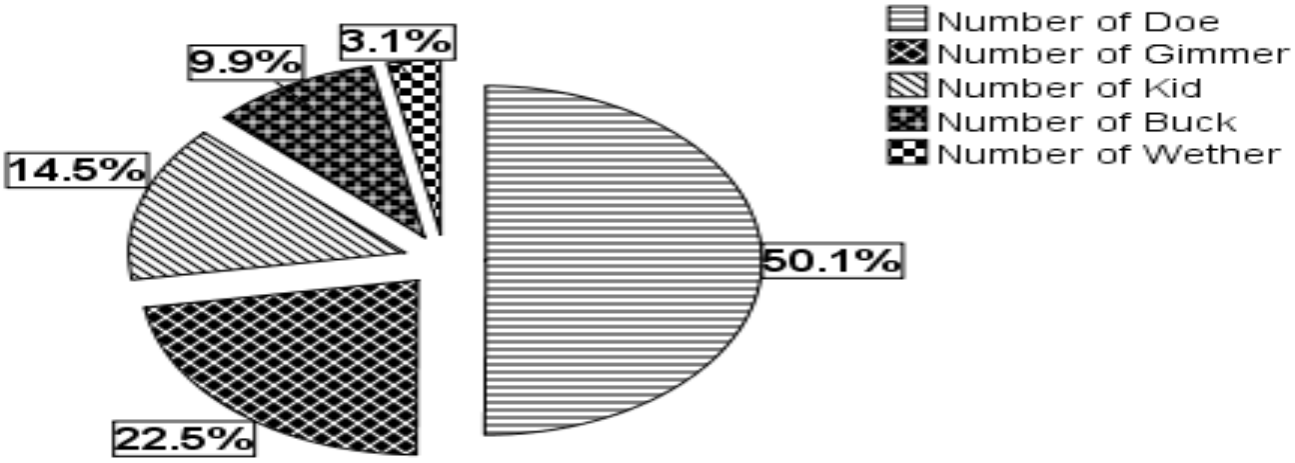

Figure 3. The overall mean goat flock composition of the household.

does were mainly for milk, breeding, meat, and source of manure with an index value of 0.25, 0.24, 0.17, and 0.14, respectively. The respondents realized that they first prioritized bucks during festival when there is a need to prepare food from meat and retained one buck for breeding. If they produced access bucks, they sold them for the immediate source of income. Similar findings on identifying the breeding objectives of goat under pastoral and agro pastoral production are system discussed by Adugna and Aster (2007), Solomon et al. (2010) and Tesfaye (2009) in different part of Ethiopia. There is also similar report on breeding objectives of goat under mixed crop-livestock production system reported by Lamba (2015) in Loma District, southern Ethiopia in lowland, midland, and highland agro ecologies.

Goat flock ownership

According to the respondents point of view, the whole member of the family could have a sense of goat flock ownership for common wealth (Table 6). However, on behave of the whole family within the households, the ownership was under the household head (husband) and head/spouse jointly with the respondents' proportion of 54 and 43.3%, respectively.

This finding of the current study is in parallel to the previous research work done by Tesfaye (2009) who reported that large proportion of goat flock were owned by husband while wife owned 29.0% of the goat flock in Metema Woreda, Amhara region, Ethiopia.

Goat flock composition

The approach for describing this information used age class categories of the flock and the reproductive physiological status of the male goat like intact male (buck) and castrated male (wether). The age categories used in this study is equivalent to the goat age categories of CSA (2017). The flock composition summarized as kids (male and female) are under 6 months age, gimmers with the age range of 6 months to 1 year, buck with age of 1- 2 years, does with the age of 2 and above years and castrated with 2 and above years (Figure 3). Accordingly, the overall average composition of goat flock for kids, gimmers, bucks, does, and wethers was 15, 22, 10, 50, and 3%, respectively. This report of the current finding is in parallel to the research report of Belete (2009) who studied flock composition of the household which used similar age categories of goat in Goma district of Jimma zone of Western Ethiopia. The current study found that

Figure 4. Rangeland as source of indigenous browse plant species for goat flock feed source.

Table 5. Supplementary feed for goat flock in the study area.

Feed resource	Dry season		Wet season	
	Number of respondents	Relative %	Number of respondents	Relative %
Cactus	141	41	46	29
Hay	85	24	**8**	**5**
Crop residue	112	32	10	6
Wheat bran	9	3	2	1
No need to supplement	-	-	92	58

the average proportion of the does to bucks in the study area was 6.3:1. The finding of the current study is more similar with the study report of Tsedeke (2007) who found the proportion of the does and bucks as 6.6:1 to 6.8:1. However, the general recommendation on the proportion of doe and buck suggested by Wilson and Durkin (1988) is 25:1. The current study revealed that smallholder farmers retained enough number of bucks for breeding purpose.

Feed resource for goat flock

According to the observational study point of view, indigenous goats are free grazing around the mountainous rangeland (Figure 4). This observation coincided with other observational studies in different part of Ethiopia as they indicate goats are browsers that spent more time during the daytime searching for edible green feeds from different plant species (Girma et al., 2013).

The respondents indicated that supplementary feeds (mostly roughage) like cactus (41%), crop residue mostly maize Stover (32%) and hay (24%) are required during prolonged drought (dry season) for providing supplementary feed for goat flock (Table 7). Majority (58%) of the respondents indicated no need of supplementation during the wet season but about 29% of the respondents replied that there was a need of supplementation of cactus for goat flock if there is a shortage of feed during the wet season (Table 7). This finding of the current study is in agreement with those of previous finding of Tesfaye (2009) who reported that the source of feed for goat in Metema district Amhara region, Ethiopia is main from rangeland (pasture land).

Table 6. Access to veterinary services and distance to nearest vet.

Descriptors	Variables	Number responders	Percentage
Access to veterinary services	Government only	122	81.3
	Government and private shop	28	18.7
Total		150	100
Distance to nearest veterinary services	<1 km	2	1.3
	1-5 km	27	18.0
	6-10 km	115	76.7
	>10 km	6	4.0
Total		150	100

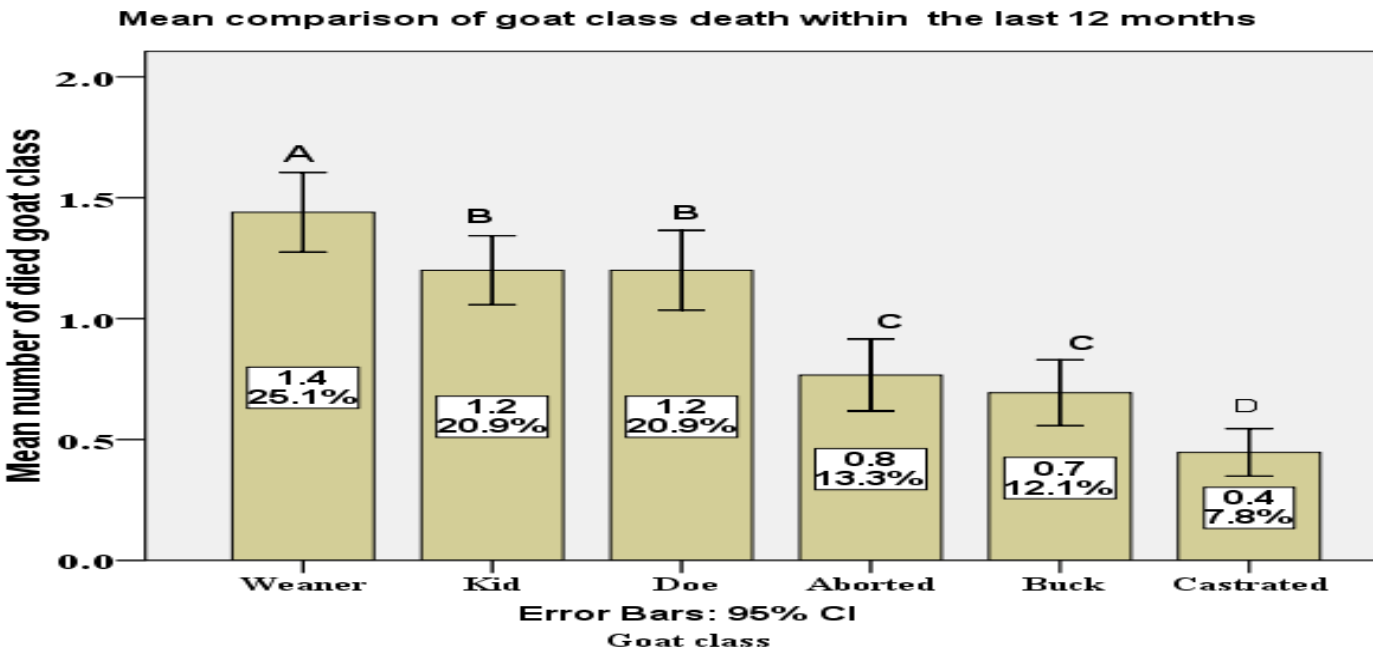

Figure 5. Mean number of goat class died within household flock.

Flock health management and factor for death of goat

Access to veterinary service

Even though the district has a regular control mechanism for disease and parasite, there is still a problem of poor health management of the goat flock under smallholder framers. As the study area is with up and down hill topographical features, giving animal health management services is very tedious. It needs more transportation facilities to keep diseased animals from lost. Most of the respondents discussed about animal health they got from government only (81.3%) or government and private veterinarians (18.7%) within the distant range of 6-10 km (76.7%) while 18% of the respondents could access goat veterinary services within a range of 1-5 km (Table 8).

Occurrence of goat death in the study area

The mean ±(SD) for death of aborted, kid, weaned, doe, buck and castrated in the last 12 months per households were 0.8±0.9, 1.2±0.9, 1.4±1.0, 1.2±1.0, 0.7±0.8 and 0.4±0.6, respectively (Figure 5)

The study revealed that higher proportions weaned kids (25.1%) are lost from the flock than any other goat class due to occurrence of death. The study is confident enough to provide this information at the level of 95% of confidence Interval.

Factor for goat death

The main factors for goat death are listed in Table 9. The

Table 7. Factor for death of goat class in the last 12 month in study site.

Factor for death	Number	Rank			Index
		1	2	3	
Predator	137	72	62	10	0.27
Disease	138	110	28	8	0.28
Injury	23	0	2	22	0.04
Nutritional deficiency	45	0	6	40	0.07
Parasite	134	9	63	54	0.22
Toxicity	72	9	14	51	0.12

Table 8. Major goat disease and their symptoms in the study site.

Common name	Local name	Symptom	N	Occurrence (%)
Diarrhea	Tsitsah	Thin diarrhea in legs	74	49
Mange mites	Hafew	Sore in the skin	144	96
Pasteurellosis	Kirid (Meita)	Dullness	150	100
Coenerosis	Zarti	Move circling	86	57
Respiratory problem	Sael	Frequent nasal discharge cavity	13	9
Toxicity	Bloating	Dullness, increased rumen size	30	20
Snake Sting	Swelling	Swelling in the mouth part and anus	9	6

respondents indicated that goat died due to disease, infestation of parasite and incidence of predator (mainly tiger) with an index value of 0.28, 0.27, and 0.22, respectively. The death of goat flock was aggravated by feed toxicity and nutritional deficiency of the goat flock with an index value of 0.12 and 0.07, respectively. The main factors for goat death reported in the current study are common cause of goat death in different part of Ethiopia reported by Fikru and Gebeyew (2015) and Solomon et al. (2011).

Goat disease surveillance

The most common diseases in the study area were addressed from the description of symptoms noted down during the field survey study. The most noticeable goat disease that occurred in the study area was Pasteurelosis (kirid or meita) indicated by 100% of the respondents. Mange mites (Hafew), Coenerosis (Zarti), Diarrhea (Tsehtsah) and feed toxicity were the major goat disease reported by about 96, 57, 49 and 20% of the respondents, respectively (Table 10). Snake stings and respiratory problem (Sael) were reported by 9 and 6% of the respondents. The smallholder households described diseases using local names. Veterinary names of the diseases were established based on farmers' description of the symptoms. These major diseases of goat are the common goat disease in Ethiopia (Solomon et al., 2011. Almost all (100%) of the respondents did not use traditional control method for the mentioned goat prevalent disease. Modern control method for the major goat disease was done when a need arose (99.3%) by goat flock owners.

Internal and external parasite of goat and their control method

The most common internal parasite of goat in the study area hosted inside the gastro intestinal track was nematodes mostly the large parasitic tapeworm species of *Taenia* local name Habie. The control activities for this gastro intestine nematode was done when the need arise indicated by about 98.0% of the respondents. Out of 150 respondents, almost all (99%) the respondents reported that dipping and spraying were the most important and widely used modern control for external parasite. About 43 and 14% of the respondents reported that they control the external parasite of the goat population through traditional methods and using tablets, respectively. The most common type of external parasite was tick, lice, and their control activities done routinely by about 54% and done when need arise by about 46.0% of the sampled household.

Goat flock dynamics

Mean total exit from goat flock

Among the goat class, adult male with mean ± (SD) total

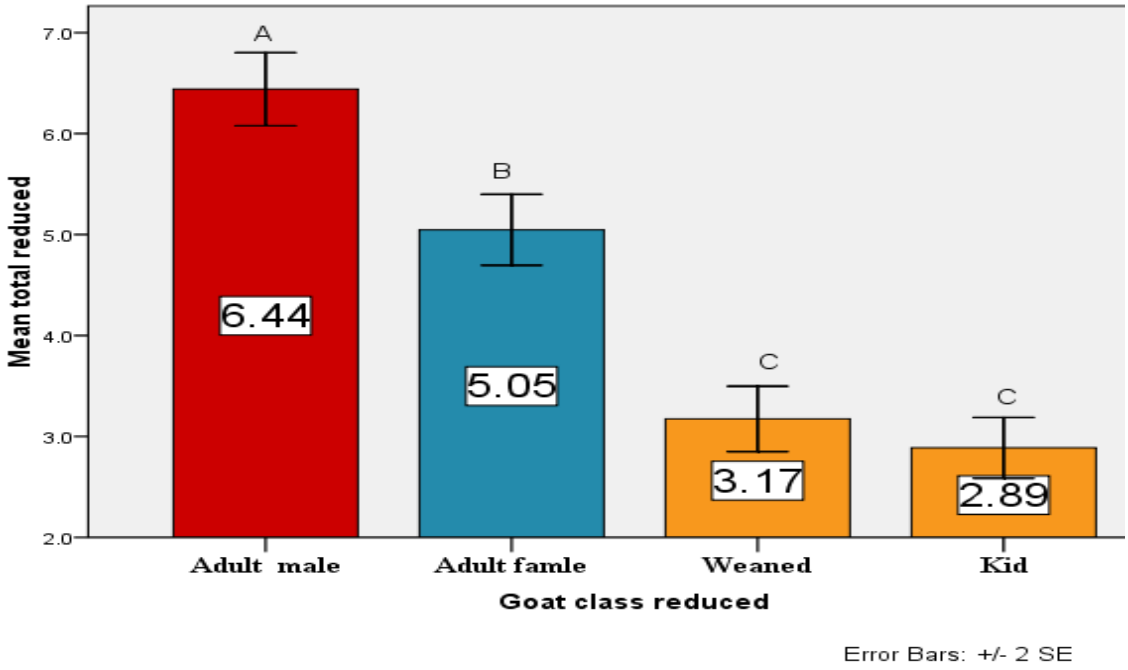

Figure 6. Mean total exit of the goat class from the goat flock.

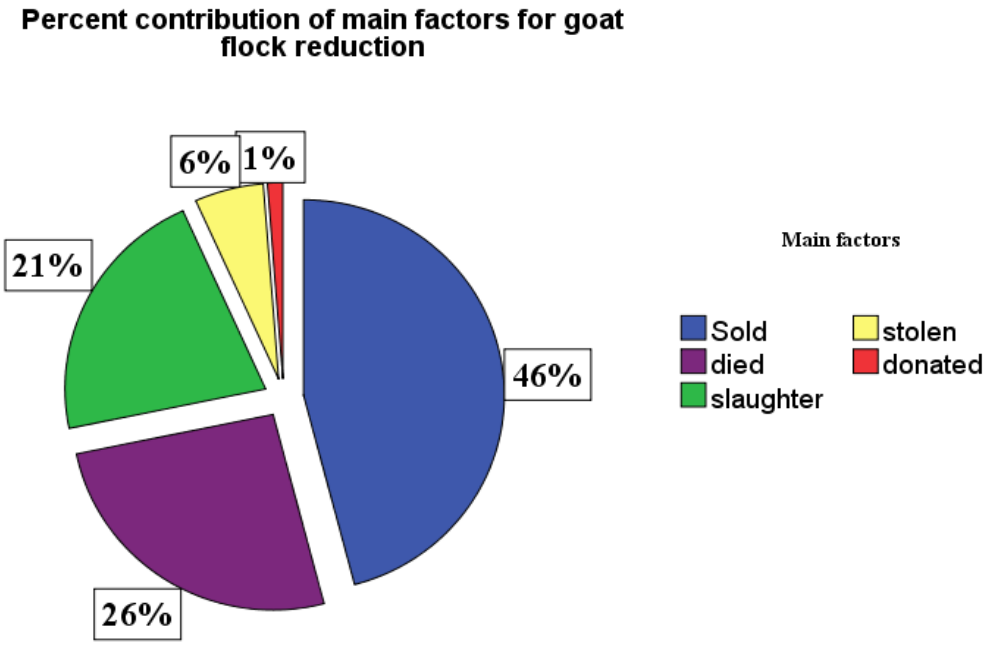

Figure 7. Factors of exit from the goat flock per households.

exit from the goat flock (6.4±2.2) were highly reduced (A) followed by adult female (B), weaned (C) and kids (C) with mean± (SD) total reduction of 5.1±2.2, 3.2±2.0 and 2.9±1.9, respectively (Figure 6).

Figure 7 illustrates the main factor for total reduction of goat flock per household and the relative contribution of the main factor to the mean total reduction. Goat sold contributed about 46% to the total reduction in goat flock size in the study area. This result is higher than from the findings of Tsedeke (2007) reported as 29.4%.

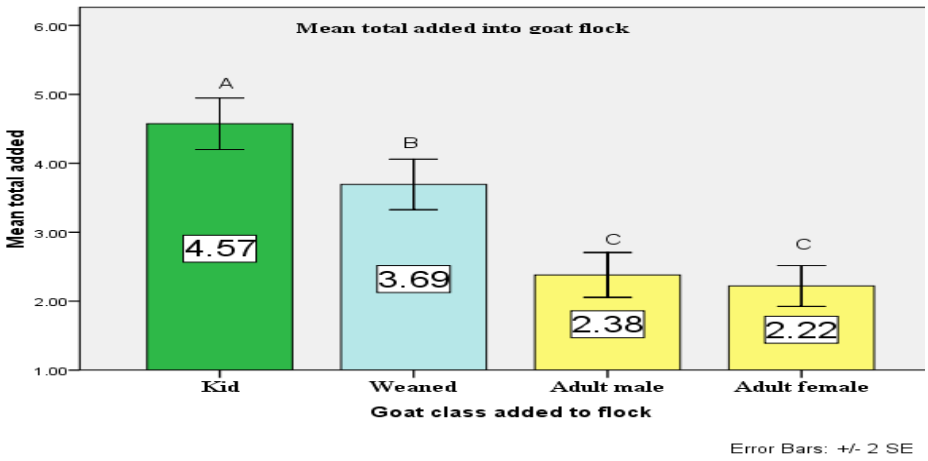

Figure 8. Mean total entry of the goat class from the goat flock.

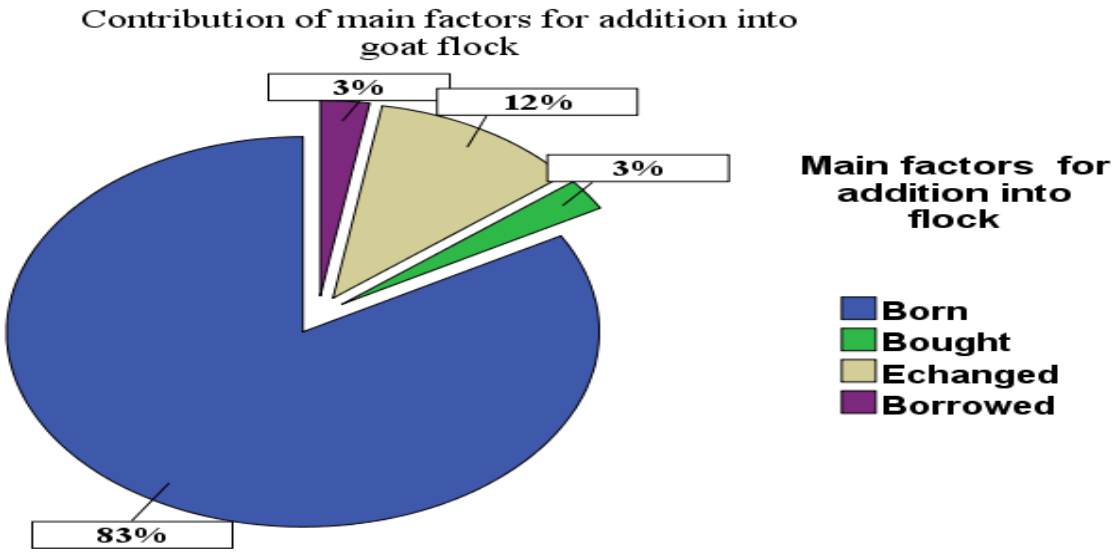

Figure 9. Contribution of the main factors of addition into the goat flock per households.

The current study found that goat death (mortality) contributed about 26% to the total reduction of goat flock but Tsedeke (2007) reported that mortality is accounted for 49.2% from the total reduction of goat flock size. Slaughtering also contributed 21% to the total reduction of goat flock in the study area. Commercial off-take and mortality rate might be the major cause for goat flock decline under traditional management system (Solomon et al., 2011). Figure 7 shows small proportion of goat lost from flock through theft (6%) and donation (1%).

Mean total entry to goat flock

Figure 8 shows that the mean total entry into the goat flock of the households was higher for kids followed by weaned. The mean± (SD) total entered to the goat flock for adult male, adult female, weaned and kids were 2.4±2.0, 2.2±1.8, 3.7±2.2, and 4.6±2.3, respectively. The average entry of adult male and female into the goat flock of the households was similar. With the increased number of kid and weaned, goat flock within household are able to compensate the decreasing number of flock under traditional management system. This is one mechanism for flock productivity evaluation in general.

Figure 9 illustrates that the contribution of each factors for entry into goat flock. The current study found that born contributed about 83% to build the goat flock in the study area. This finding is in line to the finding of Tsedeke (2007).

Table 9. Production and reproduction performance of Maefur goat.

Variables		Number of respondents	Minimum	Maximum	Mean	SD
Milk yield /head/ day in liter		150	0.3	1.4	0.5	0.2
Lactation length (month)		150	4.0	6.0	4.1	0.2
Age at first kidding (month)		150	14.0	26.0	21.2	2.1
Kidding interval (month)		150	5.7	13.5	7.2	0.7
Age at sexual maturity (month)	Male	150	7.0	18.0	11.1	1.5
	Female	150	9.0	18.0	12.7	2.1
Marketable age (month)	Male	150	6.0	24.0	10.7	1.8
	Female	150	7.0	24.0	11.5	1.6

The overall trend of the goat flock of the sampled household

The overall mean± (SD) total reduction from goat flock per the households in the study area was 17.5±4.4 whereas the overall mean± (SD) total added was 12.9±2.3. The overall mean± (SD) total reduced goat flock in the last 12 months was higher than the overall mean± (SD) total added. The average net off take of the goat flock under the agro pastoral and pastoral production system was 4.9. Based on this evidence the important breed in the study site decreased both in composition and in total number of the goat flock.

Productive performance of Maefur goat

Milk production and lactation length

According to the respondent point of view, goat milk in the study area is very important source of food. Goat milk is not processed in the pastoral and agro pastoral livestock production system (FARM-Africa, 1996). The estimated milk yield and lactation length are presented in Table 11. Selling goat milk is a cultural taboo in the study area. Average milk yield of the goat under study was 0.5±0.2 (SD) L per head per day; ranges from 0.3 to 1.4 L per head per day. The average lactation length was 4.01±0.7 (SD) months; ranges from 4 to 6 months. This finding is somewhat higher from goat in Ethiopia reported by Alefe (2014) as 3.6 months. The overall average milk yield per lactation length was 60.1 L per head. The overall average milk production per head is similar with other milk production of goat in pastoral and agro pastoral livestock production system (Alefe, 2014).

Marketable age male and female goat

The average marketable age for Maefur he male and female is presented in Table 11. The mean marketable age of the goat in the study site was 10.7±1.8 (SD) and 11.5±1.6 (SD) for male and female goat, respectively. This result is similar with the average marketable age of male and female goat as 11.01 and 11.69 months for male and female goats, respectively in other part of Ethiopia (Alefe, 2014).

Reproductive performance

Age at puberty

The age at puberty for male and female goat is presented in Table 11. According to the respondent, the age at puberty is defined as the age at which male produced viable sperm for successful mating and female produced fertile eggs and gets pregnancy. The average age at puberty for male and female was 11.1±1.5 (SD) and 12.7±2.1 (SD) months, respectively. This result is higher than from age at first puberty of Begait goat reported as 6 months and 7 months, respectively by Gebrekiros et al., (2016) and Tsedeke (2007).

Age at first kidding

The average (mean ±SD) age at first kidding in the study area was 21.1±2.0 month ranges from 19.1±2.2 and 23.3±2.0 months. Tesfaye (2009) reported that the age at first kidding varied between 7 and 24 months for Metema goat, Amhara region. The age at first kidding under traditional management system is largely depends on the management and availability of feed. Late age at first kidding might be the result of fail to conceive after mating led to large age at first kidding.

Kidding interval

The average kidding interval of the indigenous goat in the study area was 7.1±0.6 months (ranges from 8.2±0.8 to 6.2±0.7 months). The current result is in line to the previous report for goat breed of Ethiopia reported by Tesfaye (2009) as 8.4 ±1.4 months. However, it is lower than from kidding interval of Abergelle and central

Table 10. Ranking prolificacy of Maefur goat breed in the study site.

Prolificacy	N	Rank			Index
		1	2	3	
Singleton	150	149	1	0	0.43
Twin	149	1	149	0	0.37
Triplets	95	0	0	96	0.20

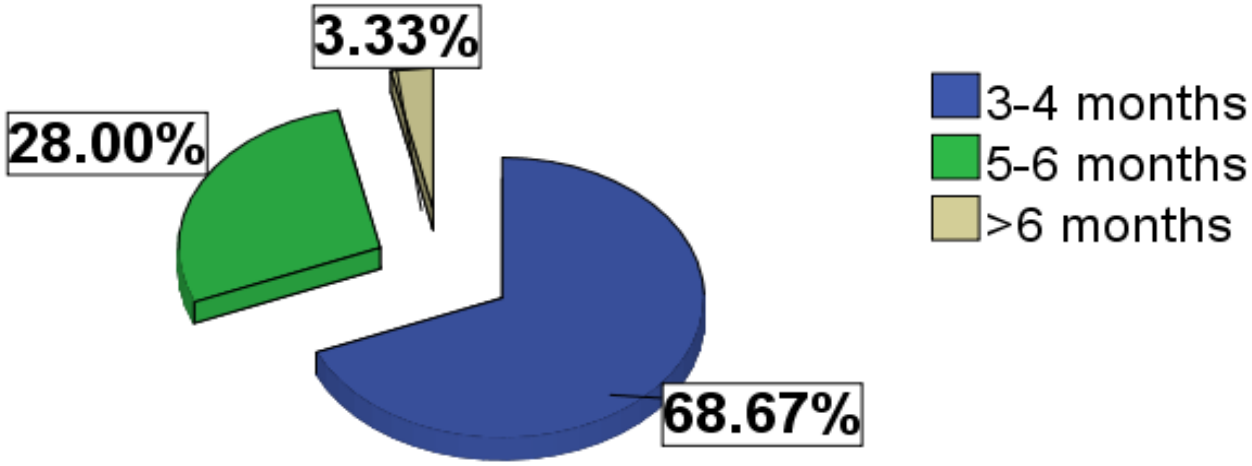

Figure 10. Average weaning age of the kids of Maefur goat breed.

highland goats reported as 11.31±2.2 and 10.3 ±1.42 months, respectively (Belay, 2008; Tesfaye, 2009).

Liter size

The most common type of litter size was singleton with an index of 0.43 followed by twins with an index value 0.37 in the study area (Table 12). Maefur goat breed gives birth to triplets with an index value of 0.20. The average litter size for most of the goat breed of Ethiopia is reported as a singleton (Tsedeke, 2007; Solomon et al., 2011; Endashew, 2007 and Adugna and Aster, 2007).

Average weaning age

Majority of the respondents (68.7%) indicated that kids weaned when they reached at 3-4 months age interval on average but sometimes weaned between 5-6 months (28%) age interval (Figure 10). This result is in agreement with the report of Tesfaye (2009) who found mean weaning age for both male and female as 4.1 months for Metema goat of Amhara region evaluated on farm with protein supplementation. However, kids weaned rarely at greater than 6 months (3.3%). Therefore, kids grow well to reach the age for meat consumption.

Status of Maefur goat population

Majority (68%) of the respondets indicated that the status of Maefur goat population was decreasedfrom time to time (Figure 11). According to the respondent's point of view, the main reason for decreased trend of goat population was the rare availability (53%) of goat breed. The other factor for the decreased goat population were decreased interest of households (3%) that means they did not add goat into their goat population and the breed become rare (7%) due to prolonged drought in the area. The reasons for increased number of goat population were increased interest of the households (19%) through addition of goat into their population and breed becomes available (17%) for household rapid recovery in reproduction performance.

Breeding management

Selection of breeding Buck and Doe and traits preferred of the smallholder

The selection criteria for breeding bucks involved size,

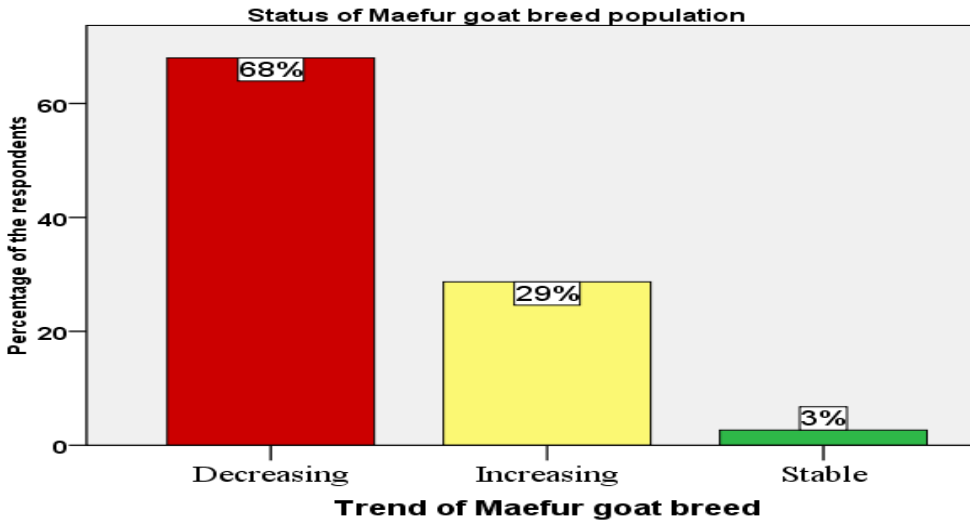

Figure 11. Trend of Maefur goat breed population in the study site (their number per household).

Table 11. Selection criteria for breeding Buck and Doe.

Selection criteria	Male (Buck)					Female (Doe)				
	N	Rank			Index	N	Rank			Index
		1	2	3			1	2	3	
Size	150	47	83	19	0.29	150	18	90	37	0.27
Conformation	150	25	75	46	0.27	150	11	76	62	0.26
Color	37	0	1	31	0.06	25	0	4	18	0.04
Temperament	73	0	4	38	0.11	80	2	13	47	0.12
Performance	138	98	17	17	0.28	150	134	8	7	0.31

N= Number of respondents.

conformation, color, temperament, and performance (Table 13). Size, performance, and body conformation were the most important selection criteria for breeding bucks with index values of 0.29, 0.28, and 0.27, respectively. However, Belete (2009) reported that conformation is first prioritized followed by performance for selection of buck. Size of the buck is the collective observation on his body length; heart girth and height at wither. Based on the index value, the owner used large body size as primary selection criteria. Buck with wide conformation and optimum body condition was selected for breeding purpose. Temperament (index value 0.11) and color except black (index value 0.06) were supportive selection criteria for bucks.

The households first prioritized the production traits of their goat flock and then the physical appearance for selection of breeding bucks. The selection criteria for doe (breeding female) included milk yield and breeding performance, size, and conformation, temperament, and body color. The most important selection criteria for breeding doe are performance, size, and conformation with index values of 0.31, 0.27, and 0.26, respectively (Table 13). The responders indicated that those criteria are the primary factors for female breeding characteristics. According to the respondents, temperament and body color with index values of 0.12 and 0.04, respectively were useful criteria for selection of breeding female.

Culling unwanted goat from reproduction

The reasons for culling male and female goat are listed in Table 14. The respondents indicated that farmers practiced culling unwanted male and female from goat due to various reasons. The major reasons for culling male goat include reproductive (fertility) problem and old age with an index value of 0.35 and 0.34, respectively. The major reasons for culling female goat include reproductive (fertility) problem, old age, and unwanted

Table 12. Reason for culling bucks and Does.

Reason for culling	Male (Bucks)					Female (Does)				
	N	Rank			Index	N	Rank			Index
		1	2	3			1	2	3	
Old age	140	49	19	80	0.34	149	27	37	82	0.27
Sickness	51	0	38	16	0.12	44	2	28	19	0.08
Reproductive problem	128	94	19	20	0.35	149	129	14	5	0.33
Unwanted physical characteristics	24	15	67	24	0.12	132	8	75	47	0.25
Black color	12	2	1	13	0.03	-	-	-	-	-
Physical defect	12	1	10	8	0.03	32	12	7	15	0.06

Table 13. Kidding and breeding season for Maefur goat flock in the study site.

Kidding season	N	Ranks			Index	Breeding season	N	Ranks			Index
		1	2	3				1	2	3	
May	110	10	40	50	0.12	March	21	16	3	9	0.03
June	120	50	45	25	0.14	April	59	27	15	11	0.08
July	120	50	40	30	0.14	May	150	20	33	84	0.18
Sep	54	28	14	14	0.07	June	150	8	104	27	0.19
Oct	140	37	31	79	0.16	July	132	87	2	38	0.18
Nov	136	8	103	30	0.15	Nov	120	87	10	23	0.17
Dec	132	82	7	47	0.16	Dec	110	80	10	20	0.16

physical characteristics with index values of 0.33, 0.27, and 0.25, respectively. The level and degree for culling reasons might be varying across different places. This finding of the current study is in line to the previous findings of (Belete, 2009) who reported that higher percentages of goats were culled due to fertility problem (90.9%) and unwanted physical characteristics (81.8%).

Kidding and breeding season of the goat

Major kidding season occurred in the dry season of Octobers, November, and December with index values of 0.16, 0.15, and 0.16, respectively. The minor breeding season occurred in May, June and July with index values of 0.12, 0.14, and 0.14, respectively. Rare breeding season occurred in August and September and January with index values of 0.04 and 0.07, and 0.01, respectively. The natural environment governs at what time of mating/kidding occurred with respect to the availability of feed (Solomon et al., 2011).

Two possible breeding seasons of the goat flocks were identified. As to the index value of 0.03 and 0.08, some goat flock started at early March and April, respectively (Table 15). As the rainy season intensified, goat population adjusted their breeding season. The occurrence of breeding season intensified between May, June and July with an index 0.18, 0.19, and 0.18, respectively. Therefore, the major breeding seasons for goat flock in the study site are between May and July. The second breeding season was between November and December with index values of 0.17 and 0.16, respectively. However, Tsedeke (2007) reported that the major breeding seasons for goat flock in Alaba, southern Ethiopia are between November and January whereas the minor breeding season are April and June. The owner of the flock in the current study area justified that the occurrence of the breeding season mainly depends on the availability of feed, which determines the body condition of breeding animals. The breeding season might be collapsed by the prolonged dry season.

Origin of the breed

About (43.3%) of respondents reported that they obtained their goat flock from parents through inheritance and bought from neighbor farmers whereas 29.3% of the respondents reported that the origin of the goat flock was from parents transferred from generation to generation through inheritance. Small proportion (14.7%) of the respondents reported that their goat breed originated from own flock since long time ago. Majority (80.7%) of the respondents reported that the indigenous goat is moderately tractable whereas 19.3% of respondents indicated that the breed is docile.

Table 14. Ranked goat production constraint in the study site.

Constraints	Number of respondents	Ranks			IIndex
		1	2	3	
Disease and parasite	130	138	5	6	0.29
Feed shortage	98	10	40	18	0.16
Water shortage	26	10	40	18	0.07
Labor shortage	10	0	8	13	0.02
Drought	130	9	72	58	0.23
Predator	130	9	59	60	0.22
Inadequate technology	13	0	0	19	0.02

Constraints of goat production

The major limiting factors for constraints of goat production in the study area are presented in Table 16. The incidence of disease and parasite with an index value of 0.29 was the major limiting factor for goat production under traditional management system.

The problem of prolonged drought with an index value of 0.23 aggravated the incidence of disease and parasite causing major constraints for goat production. According to the respondents' point of view, the problems of predators were the third major constraint with an index value of 0.22. This finding of the current study is comparability similar to the previous findings reported by Tsedeke (2007) and Solomon et al. (2011) who studied similar constraints for poor fertility of the goat production across the pastoral and agro pastoral production system in Ethiopia.

Conclusion

The study area is a mountainous topographical feature (84%) involving Assimba and Ayga notable mountains. The large proportion (75%) of the total area coverage of the study area is under midland agro ecology. Goat holding of households was higher as compared to holding of other livestock species. Indigenous goat production is ranked as the first most important livestock species. The indigenous goat populations are identified with common name of Maefur. The main purposes of goat production were for meat, breeding, milk, manure, and source of income. The indigenous goats are managed under free grazing utilized browse plant species from the rangeland. Smallholder farmers practiced selection of breeding male and female goat using body size, conformation, body performance, color, and temperament as selection criteria. The main reason for culling unwanted male and female goat from reproduction were reproductive (fertility) problem, old age, bade phenotypic characteristics, black color and disease. The most noticeable goat disease occurred in the study area were Pasteurelosis (kirid:meita), Mange mites (Hafew), Coenerosis (Zarti), Diarrhea (Tsehtsah) and feed toxicity. Smallholder farmers had veterinary access to their goat flock mainly from government support. However, death of goat was mainly the cause of goat flock reduction under smallholder farmer. The study observed the main factors for goat death in the study area were infestation of parasite, disease incidence, drought, and the problem of predator. Death of weaned lambs was among the main loss of goat under smallholder farmers. Hence, smallholder farmers should have to improve the management practice of kids before and after weaning. The study identified two breeding season (May to July and November to December) and two kidding season (May to July and October to December). In general, the current study showed that there is a possibility to have three kidding in two years with great emphasized on the availability of feed and proper husbandry and management of the goat flock under traditional management system. Thus, careful goat health management helps to control the negative impact of the above goat death factor on the reproductive performance of the goat breed under traditional management system. In general, improving goat health management, feed supplementation during the dry season, breed improvement through selection and sustainable utilization of the indigenous goat are the most management interventions for improving the productivity of goat flock under smallholder farmers.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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