Breeding Practices of Indigenous Goat Type in South West Shewa Zone, Oromia, Ethiopia

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Abstract

This study was conducted in South West Shewa zone, to identify breeding practices in Tole and Becho districts. Data were collected through questionnaire and, focal group discussion. A total of 180 households were selected for interview. Data collected via questionnaire were summarized with descriptive statistics and analyzed using SPSS, V.21. Chi–square test was employed for categorical data. Indices were calculated to provide ranking. The primary reason of keeping goat in the study area was cash income and meat in both districts. The most sources of breeding buck in the area were their own flock. The overall mean age at sexual maturity for indigenous female goat was 7.20 ± 0.13 months and for male 7.10 ± 0.14 months; age at first kidding 13.5 ± 0.12 months, average reproductive life time of doe 7.86 ± 0.12-year, average kidding interval 7.14 ± 0.05 months. The most preferred selection trait of goat in study area were size/appearance, and color. The primary kidding season in study area was summer, followed by autumn. Generally, goats play a significant role for farmers as source of income generation and home consumption throughout the year. Uncontrolled mating regarding use of buck which born in their flock encouraged mating with his relatives and might resulted in loss of performance due to inbreeding depression. Therefore, awareness creation for farmers about inbreeding and arranging good mating system like buck sharing with neighboring flocks and rotation among need to be implemented.

Keywords: Breeding Practices; Preferred Trait; Uncontrolled Mating; Inbreeding; Breeding Buck; Selection

Introduction

Ethiopia has the largest livestock population in Africa and is a homeland of large number of goat populations (32.7 million) which are kept in different agro-ecological zones of highlands, sub-humid, semi-arid and arid environments (Getinet, 2016) [1]. Goats in the highlands are widely distributed in the mixed crop-livestock production systems with very small flock size (Tesfaye, 2004) [2]. Almost all goat population is managed by resource poor smallholder farmers and pastoralists under traditional and extensive production systems (Solomon, 2014) [3].

According to CSA (2018/2019), the number of goats reported in the country is estimated about 32.7 million and with respect to breed, almost all of the goats are indigenous which account for 99.97 %. While, a genetic study that used microsatellite markers showed only eight distinctively different types of goats in Ethiopia (Tesfaye, 2004) [2]. However, the current molecular study on the domestic goats by Getinet (2016) [1] does not support the former classifications of the indigenous goat populations. After detailed analysis of the goat population based on production systems, agro-ecologies, goat families, admixture and phylogenetic network analyses classified the 12 Ethiopian goat populations in to six goat types.

Goats are the common small ruminant animal species that sustain the livelihoods of smallholder farmers, pastoralists and agro-pastoralists. Small ruminants play an important role in all types of production system due to their low initial capital investment, ability to produce multiple products (meat, milk, skin, manure etc.) at low input costs, high rates of reproduction (multiple births are common), and high turnover rates due to the short time they take to attain maturity (Getahun 2008) [4]. According to Kahi and Nitter (2004) [5], breeding objective can be defined as the traits to be improved, the cost of production and the revenue from product sales related to a genetic change in each trait. Breed and trait preferences are useful to make better informed decisions in developing interventions to improve the contribution of the goat to livelihoods of their keepers (Kosgey 2004) [6].

So far, in South West Shewa zones there were no compiled reliable information about the breeding practices, selection criteria and reproductive performance of indigenous goats. Therefore, this study was timely and crucial to assess and document important information on, the best trait preferred by farmers and indicate the constraints of the major breeding practices, selection criteria and reproductive performance of indigenous goats in the study area. Thus, the research findings of this study can be used to design breed improvement programs and breeding practices, selection criteria and reproductive performance of indigenous goats in the study areas.

Materials and Methods

Description of the study Area

The study was conducted in South west Shewa, which is one from 24 zones of Oromia region in Ethiopia. According to the data from the South West Shewa Zone Agricultural Office the Zone, lies between 8^0 37'33" North latitude and 38^0 14' 7" East longitudes with an elevation ranging 1600-3576 meters above sea level. The wide range of agro-ecology (highland, midland and lowland) found in the zone. The mean annual temperature of the zone ranges between 10 °C and 35 °C and the mean annual rain fall ranges 900-1900mm. The climate of the area is characterized by a long rainy season (June-September) accounting for 75% of the annual rainfall having a peak falls in July and August (South West Shewa Zone Agriculture Office, 2019).

Tole district Part of the South west Shewa Zone, the district administrative city Bantu is found 77km far away from the zonal city Woliso and 80km far away from Addis Ababa. It is bordered on the south by Sedan sodo, on the west by Becho, on the north by Elu and Sebata Hawas and on the east by Karsa malima. According to the data from the district Agricultural Office the district, lies between 8°37' North latitude and 38°22' East longitude of with an elevation of 2234 meters above sea level (Tole District Agriculture Office, 2019).

Tole district has livestock populations of: Cattle 1, 01,848, Sheep 66,010, Goats 32,894, Horses 9,200, Mules 1,200, Donkeys 16,232, Poultry 52,552 and Beehives 5,390. The main agricultural practice in the area mixed agriculture (crops and livestock production) The important crop production in the Tole district were Maize, teff, chickpea, barley, bean, pea, and wheat (Tole District Agriculture Office, 2019).

Becho district Part of the South West Shewa Zone, the district administrative city Tulu bolo is found 29 km far away from the zonal city Woliso and 85km far away from Addis Ababa. It is bordered on the south by sedan Sodo on the west by Woliso, on the north Dawo, and on the east Elu and Tole. According to the data from the woreda Rural Development Office, the woreda, lies between 8°40' N latitude and 38°13' E longitude with an elevation of 2193 meters or 7195 feet above sea level (Becho District Agriculture Office, 2019).

Livestock populations of Becho district were: Cattle 96,755, Sheep 59409, Goats 33,894, Horses 4200, Mules 3200, Donkeys 15,232, Poultry 42,552 and Beehives 3,390 The main agricultural practice in the area cereal crops production and animal farming (Becho District Agriculture Office, 2019). The main crop production in Becho woreda were teff, chickpea, barley, bean, pea, wheat, and sorghum (Figure 1).
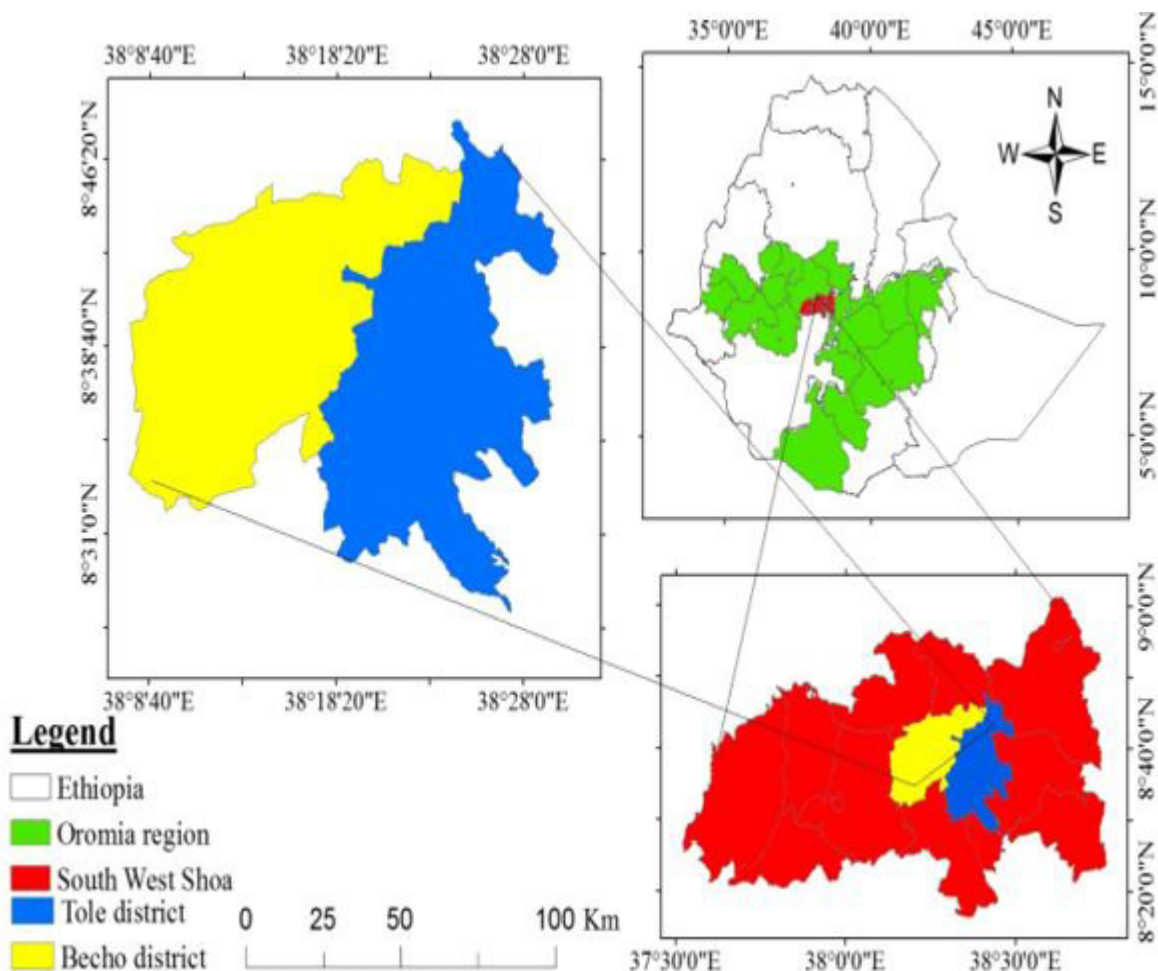

Figure 1: Map of the study areas

Sampling Techniques and Data Collection Procedures

Sampling Techniques: The study districts (Tole and Becho) are found in South west Shewa administrative zones. Three kebeles were selected in each woreda purposively based on their goat production potential. A total of 180 households (30 households from each kebeles) were selected randomly for interview within the selected kebeles by using Cochran (1963) formula.

$n = z^2*pq/ e^2$

Where: n= the number of sample size

z= confidence level (95%)

e= acceptable error margin (0.05)

p= proportion of sampled population (0.14), q= 1-p

Data collection

Structured Questionnaire: The questionnaire were prepared and translated in to local language, pre–tested and re-framed in such a way that interviewing households would respond without difficulty and biasness and then administered on study households selected from district assistance of development agents, supervisor and other worker in district. The questionnaires covered information on key household characteristics, livestock possession, flock structure goats, Purpose of goats, selection criterial of goats, breeding practices goats and kidding pattern.

Focus Group Discussions: Focus group discussion was held with selected household in the study site, which contains 8- 12 members and the group was composed of women owner goats, Developmental agents, village leaders, village elders and socially respected individuals who are known to have better knowledge on present and past social and economic status of the study area. Discussion was focused on the history of breed, social law; major loss livestock, indigenous knowledge in managing breed, types of services in goat's husbandry, and goat population were discussed by the focus group in the study area.

Secondary Data Sources: Secondary Data Sources were carried out to collect necessary raw data during the current study

Data Management and Statistical Analysis

Data management: Data collected from each site were coded and entered into the computer (Excel 2007 and SPSS computer software) to facilitate for further analysis. Data collected through questionnaire, group discussion, linear body measurement and secondary data source data were entered into computer software and analyzed using (SPSS, V21, 2013).

Statistical Analysis

Qualitative data was analyzed using the descriptive statistic of (SPSS, V, 21, 2013) and quantitative data from survey was analyzed using compare mean of (SPSS, V, 21,2013) which Chi-square used to identify the significance of categorical data.

Index was calculated to provide overall ranking for qualitative data such as purpose of goat keeping, selection criteria of male and female, and season of birth occurrence, according the following formula: Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons(attributes).

Results and Discussions

Goat Flock Structure and Purpose of Keeping Goat

There was significance difference between the districts for young male and Castrated goats P (<0.001). The overall mean of the females goats more than one-year-old was 4.5±0.13 whereas, males goats of the same age were 2.7±0.504, young females goats (6months-1year) 2.55±0.106, young males goats (6months-1year) 1.6±0.064, kid 2.5±0.072 and castrated 1.5±0.106 of the population per household. The present study revealed that the flock structure of indigenous goats found in the study area was mainly based on maintaining large number of female goats. From the results of group discussion revealed the reason for lower proportion of males might be due to cultural practice of selling and slaughtering of male goats and need of keeping of high proportion of female goats, imply the production of larger number of kids for the increment of goat number and continuity of the production and use. The higher proportion of breeding females in the flock was in agreement with the report from Bati, Borena and Short eared Somali goat population (Hulunim, 2014) [7] and Tesfaye (2010), who reported for indigenous Arsi-Bale goat population.

The primary reason for keeping goat in study area was for sale (index = 0.34) followed by meat (index = 0.32), saving (index=0.22) and skin (index=0.12). Most of respondents in current study area were keeping their goat for sale (income generation) and for meat production especially during holyday and ceremonies. In agreement with current finding, of Gatew (2014) who reported that source of income is the principal objective why farmers keep Goat in Bati, Borena and Shinelle zones. Similar results were also obtained by Gizaw et al (2010) most important objectives are cash income, savings, and meat for household consumption. As well as Goats are of great importance as major sources of livelihood which was reported by Kosgey (2004) [6].

Variable	Districts			Test	
	Tole (Mean±SE)	Becho (Mean±SE)	Overall (Mean±SE)	F-value	P-value
Doe>year	3.7±0.13	5.2±0.14	4.5±0.13	5.017	0.026
Buck>year	1.86±0.09	3.0±0.10	2.6±0.50	1.082	0.3
Young female	2.4±0.12	2.7±0.09	2.6±0.10	1.352	0.246
Young male	1.3±0.05	1.9±0.08	1.6±0.06	13.082	0
Kid	2.3±0.07	2.7±0.07	2.5±0.07	0.188	0.665
Castrate	1.27±0.07	1.73±0.14	1.5±0.10	19.721	0

Purpose of Keeping goat Districts

	Tole	Becho	Overall
Meat	0.31	0.32	0.32
Sale	0.33	0.34	0.34
Skin	0.23	0.22	0.120
Saving	0.12	0.11	0.220

Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons (attributes)

Table 1: Goat Flock Structure and Purpose of keeping goat

Breeding Bucks source and Mating System

The sources of breeding buck in the area were their own flock (79.4%) and Neighbor (20. 6%). The farmers in the study areas were practiced uncontrolled mating. Uncontrolled mating and use their own born buck in the study areas might be the cause of inbreeding depression and decrease production and productivity of goat population. The implication of inbreeding depression is the ratio of breeding female goats to breeding buck is 2:1 per household (Table 1). The value obtained sources of breeding buck from their own flock was similar with the report of Alefe (2014) [8] the main source of the breeding buck was born in their flock. Several studies have shown that most goat keepers were used their own breeding bucks to mate their breeding does (Biruh, 2013; Demissie et al., 2014; Alubel, 2014; Hulunim, 2014) [7,9,10] which is in agreement with the present finding. However, the value obtained from their own flock in this finding was disagreement with the report of (Belete, 2009; Tesfaye, 2010; Dhaba et al., 2013; Ahmed et al., 2015) [11,12].

The average breeding buck service duration in the flocks were 2.2±0.09 years. After that it might be slaughter or sold or castrated from their flock. As (Netsanet et,.al 2016) [13] reported that the average service life of a buck in the flock Meta Robi was 2.3 years which was similar with the current result. The average services years of bucks in Dire Dawa (5.5 years) (Grum,2010) [14] and in Asayta (4.4±2.01 years) (Feki 2013) which was higher than the current result.

Variable	Districts						Test	
	Tole		Becho		Overall		X²	P-value
Buck source	N	%	N	%	N	%	0.85	0.36
Own	74	82.2	69	76.7	143	79.4		
Neighbors	16	17.8	21	23.3	37	20.6		
	Mean ±SE		Mean ±SE		Mean ±SE		F-value	
Buck service year	2.2±0.09		2.1±0.09		2.2±0.09		1.257	0.673
Control mating								
Yes								
No	90	100	90	100	180	100		

X²=chi-square, SE=standard Error, N=Number

Table 2: Buck source, Age service buck, and Control mating

Selection Criteria for Goat Breed

The primary selection criteria for breeding male goats in study area were size/appearance (index=0.27) followed by, Color (index=0.26), Growth rate (index=0.21), Libido (index=0.13) and character (index=0.11). This result implies that the preference trait for selection of breeding male goats in study area were size, color and growth, might be fetch of better market price, higher growth rate and gaining of body weight sooner. In accordance with current finding, different authors found that coat color type/pattern, body conformation, growth rate and libido are important selection criteria of breeding buck (Mahilet, 2012; Alubel, 2014; Hulunim, 2014; Ahmed et al., 2015; Tsigabu, 2015; Zergaw et al., 2016) [7,10,12,15].

Primary selection of breeding female goats in the current study area were appearance (index=0.2) followed by color (index=0.16), age at 1st kidding (index=0.15), Kid growth and Kidding interval (index=0.13), kidding survive (index=0.12), and twinning (index=0.11). This study implies that the preference trait for selection of breeding female goats in study area were appearance, color and age at 1st kidding were the most important trait; this might be the farmers expected large size goats kidding large kids, market demand and to increase the crop percentage of kids. The present finding was in agreement with the result of Mahilet (2012) who reported that appearance was considered as the first reasons for doe selection in East Hararghe zone of Ethiopia.

Variables	Districts											
	Tole				Becho				Overall			
Section Criteria	R_1	R_2	R_3	Index	R_1	R_2	R_3	Index	R_1	R_2	R_3	Index
Male												
Size /Appearance	24	17	22	0.25	35	20	17	0.29	44	37	39	0.27
Growth rate	17	24	26	0.18	24	24	18	0.23	41	48	44	0.21
Character	10	14	12	0.1	5	14	17	0.11	15	28	29	0.11
Color	23	25	20	0.26	23	23	14	0.25	46	48	34	0.26
Libido	15	13	10	0.14	10	11	16	0.12	25	24	26	0.13
Female												
Kidding interval	13	12	11	0.14	10	14	10	0.13	27	26	21	0.13
Kid survive	12	11	13	0.13	11	10	15	0.13	23	21	28	0.12
Size/appearance	14	13	21	0.17	35	5	5	0.22	48	18	26	0.20
Twining	15	10	16	0.07		10	16	0.15	15	20	32	0.11
Color	14	19	8	0.16	13	18	12	0.16	32	37	20	0.16
Kid growth	8	18	9	0.12	10	12	16	0.13	20	30	25	0.13
Age at 1st kidding	14	8	14	0.13	11	21	20	0.17	25	29	34	0.15

Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons (attributes). R_1=Rank1, R_2=Rank2, R_3=Rank2

Table 3: Selection Criteria for Goat Breed

Reproductive performance of Goats

There was significance difference between district in most of reproductive performance (age at first sexual maturity, age at first kidding, kidding interval and average number kid crop during life). The Overall Age at first sexual maturity for male was 7.1±0.08 months and for female 7.2±0.07. Age at 1st sexual maturity was depending on the sexual maturity and body condition of the goats that might be related with the management practices (feeding, housing, health, etc.) of owners of goats. This was in comparable with the result of Solomon (2014) [3] who reported 7.4 ±0 2 months for western lowland of Amhara region male goats.

Age at first kidding had shown significance difference between districts *P* (0.00). Based on the response of the farmers, the overall estimated mean age at first kidding was 13.5±0.10 months. Central Highland (13.6 months) which reported by Belay (2008) and Tesfaye (2009) who reported age at first kidding of local Metema goats was found to be 13.6 months which is in consistent with present finding. However, it was lower than the report of Belay (2008) reported for Abergelle goats that have the mean ages at first kidding of 14.9 months. The overall mean of kidding interval in the study area was 6.7±0.07 months. This result is comparable with Alefe (2014) [8] who reported that the kidding interval of Southern Ethiopia goats is 6.9 months and smaller than Jemal (2008) who reported the kidding interval of 7.87 months and Adugna and Aster (2007) reported that 8 months of KI for some indigenous goat breeds in Ethiopia. Therefore, to achieve optimum reproductive performances of goats in the study area prevailing feeding regime needs to be adequate enough throughout the year.

Variables	Districts			Test	
	Tole (M±SE)	Becho (M±SE)	Overall (M±SE)	F	P
Age at first sexual maturity					
Male	6.9±0.09	7.3 ±0.08	7.1±0.08	42.75	0.004
Female	7.0±0.08	7.4±.07	7.2±0.07	0.082	0.00
Age at first kidding	13.3 ±0.9	13.8±0.11	13.5±0.10	0.45	0.0001
Kidding interval	6.5±0.06	6.9.0±0.08	6.7±0.07	1.2	0.001
Average Reproductive Lifespan of Doe	7.6±.115	7.8±.12	7.9±0.12	0.035	0.25
Average Number Kids Crop During Life	15.3±.348	17.6±0.32	16.5±0.33	0.029	0.00
Average Reproductive Lifespan of Buck	3.1±.072	3.0±0.08	3.04±0.08	0.644	0.534

SE=standard Error, N=Number, %=percentage

Table 4: Reproductive performance of indigenous goat

Pattern of birth, kidding season and weaning practices

There was significance difference between districts. The overall pattern of birth in the study area was 47.8%, 27.2%, and 25% single, single and twin and twin respectively. The significance difference might be due to breed, and proving sufficient feed (feeding systems). The result of current study approach to the result of Mahilet (2012) on Hararghe highland goats, where single birth was significantly higher across all districts and disagrees with Seade (2018) that reported most of births were single and twin (47.9%) and only single (41.7%) in south Gonder zone.

The primary kidding season in study area was summer (index=0.30), followed by autumn (index=0.29), spring (index=0.21) and winter (0.21). The higher index value obtained for summer and autumn implies that goats might be get sufficient amount of feed or high access of feed resource and in other during spring and winter (middle/December and January) there was high crop residues this might good opportunity for breeding and birth might be occurred in summer and autumn season. In agreement with the current finding, Alefe (2014) [8] reported in that highest, 55.5% births occurred during main rainy season during which forage availability was increased. Also, Mekasha (2007) reported breeding is naturally controlled to adjust maximum use of seasonal sexual activity or nutrition availability and ensures greatest likelihood to establish pregnancy, and optimal ovulation.

There was significance difference between the districts in average weaning practices *P* (0.0001). The result of current finding revealed that the farmers practice weaning kids at the age of 4-5 months (44.4%), >5 months (25%), and 3-4 months (30.6%). Most of respondents weaned their kids at the age of 4-5 and 3-4 months when it starts feeding forage well. This finding similar with Seade (2018) reported that the majority of farmers practiced weaning at the age of (4-5 months) in south Gonder. Relatively to the current finding Tsedeke (2007) reported weaning age of kids 4 months for in Alaba, Southern Ethiopia. In other case this finding disagrees Alefe (2014) [8] reported that the majority of respondents practiced early weaning (<3 months) in Ogaden [16,17].

Variable		Districts											
		Tole				Becho				Overall			
Scientific	LN	R_1	R_2	R_3	Index	R_1	R_2	R_3	Index	R_1	R_2	R_3	Index
Winter	*Bone*	18	9	25	0.18	28	10	23	0.22	46	19	48	0.21
Autumn	*Arfesa*	19	43	22	0.31	13	42	25	0.27	32	85	47	0.29
Summer	*Gena*	28	29	17	0.30	24	28	28	0.29	52	57	58	0.30
Spring	*Birra*	24	9	25	0.21	25	10	20	0.21	49	19	45	0.21
Birth occurrence		N (%)				N (%)						x^2	P-value
Single		66 (73.3)				20 (22.2)				86 (47.8)		69.6	<0.0001
Single and twin		24 (26.7)				25 (27.8)				49 (27.2)			
Twin						45 (50)				45 (25)			
Weaning practices													
4-5months		46 (51.1)				34 (37.7)				80 (44.4)		14.05	0.0001
3-4months		31 (34.4)				24 (26.70				55 (30.6)			
>5months		13 (14.4)				32 (35.6)				45 (25.0)			

Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons (attributes), LN=Local name, X^2=chi-square, N= number, %= percentage

Table 5: Pattern of birth, Birth occurrence and weaning practices

Conclusion

Generally, the present study revealed that the flock structure of indigenous goat found in the study area was mainly based on maintaining large number of female goats which might be due to cultural practice of selling and slaughtering of male goats and need of keeping of high proportion of female goats. The goats have vital role in current study for sale (income generation) and for meat production especially during holyday and ceremonies. Also, the present study was identified the mating system of goat in the study area. The preference trait for selection of breeding goats were size, color and growth for male and size, color and age at 1st kidding for female are the most important preference trait identified in the current study. Kidding seasons the higher index value obtained for summer and autumn. The results of this study recommended that design and implementation of community-based breeding program which tested in Ethiopia and resulted in substantial genetic and economic benefit is suggested considering the breeding objectives and selection criteria identified in this study.

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