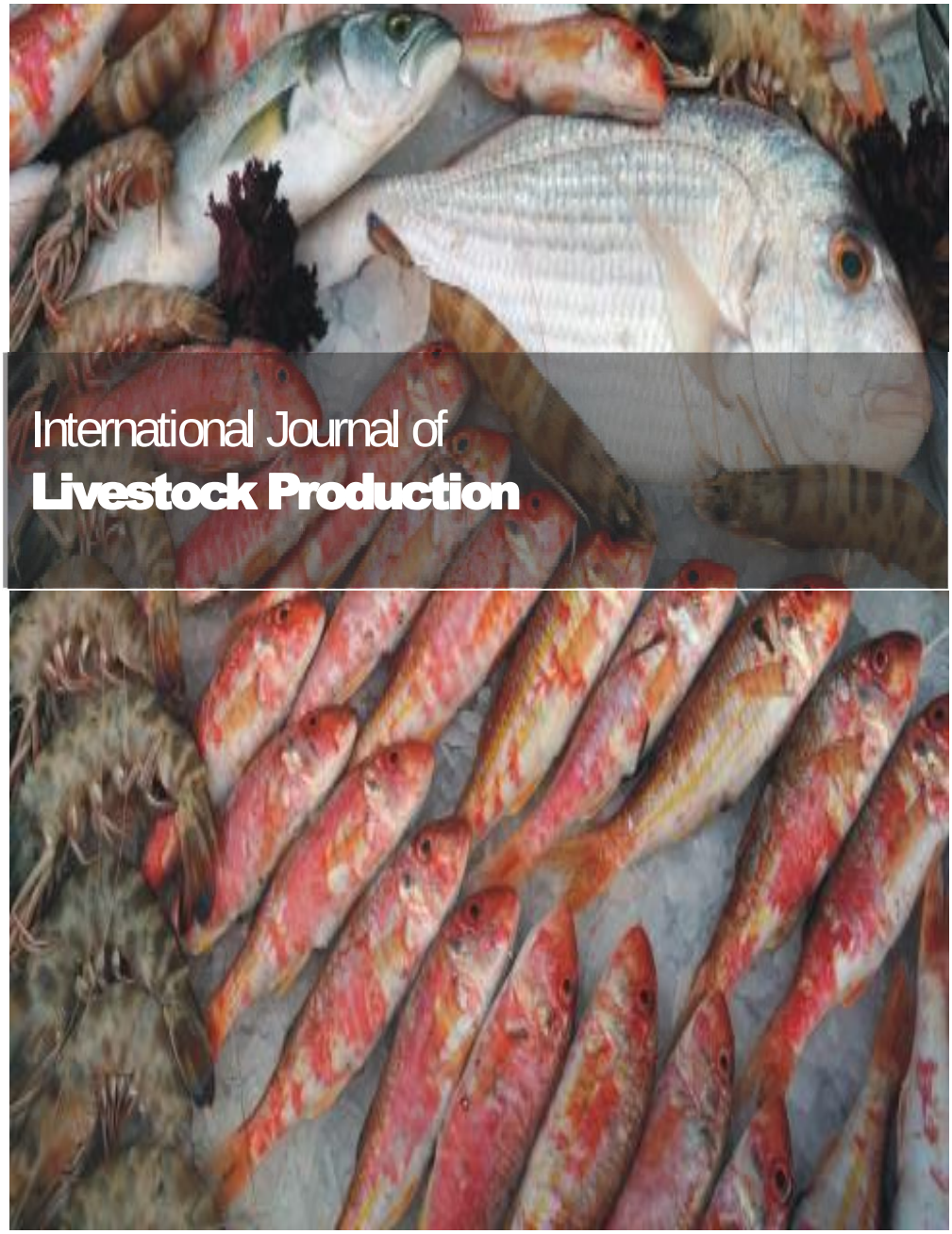
OPEN ACCESS



International Journal of Livestock Production

March 2018
ISSN 2141-2448
DOI: 10.5897/IJLP
www.academicjournals.org

academicJournals

Academic Journals

ABOUT IJLP

The **International Journal of Livestock Production (IJLP)** is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject such as Selective breeding in animal husbandry, the health effects of animal cruelty, fishery in terms of ecosystem health, Fisheries acoustics etc.

The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in the IJLP are peer-reviewed.

International Journal of Livestock Production (IJLP) (ISSN 2141-2448) is monthly (one volume per year) by Academic Journals.

Contact Us

Editorial Office: ijlp@academicjournals.org

Help Desk: helpdesk@academicjournals.org

Website: http://www.academicjournals.org/journal/IJLP

Submit manuscript online http://ms.academicjournals.me/

Editorial Board

International Journal of Livestock Production

Table of Contents: Volume 9 Number 3 March 2018

ARTICLES

academicJournals

Vol. 9(3), pp. 29-41, March 2018
DOI: 10.5897/IJLP2017.0426
Article Number: 19F5B4A55946
ISSN 2141-2448

http://www.academicjournals.org/IJLP

International Journal of Livestock Production

Review

Characterization of productive and reproductive performances, morphometric and challenges and opportunities of indigenous cattle breeds of Ethiopia: A review

Teweldemedhn Mekonnen

Humera Agricultural Research Center, Tigray Agricultural Research Institute, Setit Humera, Tigray Regional State, Ethiopia.

Received 16 November, 2017; Accepted 11 January, 2018

The aim was to review and summarize the fragmented characterization information of indigenous cattle breeds of Ethiopia in productive and reproductive performances, morphometric traits and their production challenges and opportunities. Cattle play vital role in ensuring food security of Ethiopia. They contributed milk which accounted above 80% of the total national annual milk production. Although Ethiopia has large indigenous cattle populations with massive diversity, breed level on-farm and on-station characterizations on lactation performance, reproductive performances, morphometric traits and identification of the major challenges and opportunities is very poor. Morphological markers particularly morphometric traits are very important for livestock characterization. Hence, on-farm and on-station characterization and improvement of indigenous cattle breeds should be practiced. Ethiopian Institute of Biodiversity Conservation, Domestic Animal Diversity Information system and Domestic Animal Genetic Resources Information System documented different types and numbers of indigenous cattle breeds of Ethiopia. Hence, the national, regional and global reporting systems should be standardized. This review also indicated that the critical challenge of the studied indigenous cattle breeds of Ethiopia is scarcity of feed which accounted 77.8% of the first ranked challenges; however, there are no reported production opportunities of each indigenous cattle. Therefore, every shareholder should solve the primary challenge and identify the opportunities. Indigenous cattle breeds of Ethiopia are adapted to harsh climatic conditions; limited and poor quality feed resources utilization and tolerance to a range of diseases. However, the current state of knowledge of indigenous scholars on each indigenous cattle breed is below 50%.

Key words: Indigenous cattle, calf crop, lactation performance, reproductive performance, morphometric traits.

INTRODUCTION

Agricultural sector of Ethiopia accounts for about 42% of the GDP, employs about 85% of the labour force, and

*Corresponding author. E-mail: teweldem2004@gmail.com. Tel: +251914195953.

contributes around 90% of the total export earnings of the country. The sector is dominated by over 15 million smallholders producing about 95% of the national agricultural production. Hence, the overall economy of the country and the food security of the majority of the population depend on smallholder agriculture (CSA, 2015, 2016). Ethiopia is rich in livestock population that owned 59.5 million cattle, 30.7 million sheep, 30.2 million goats and 59.5 million chickens (CSA, 2016, 2017). Major livestock species were imported to enhance livestock productivity of Ethiopia through crossbreeding. Accordingly, the number of breeds of cattle, sheep, goat and chicken imported so far to Ethiopia are 7, 7, 3, and 14, respectively (EIBC, 2012). Cattle are the most important species followed by goats, camels, and sheep in the pastoral livestock production system, and are source of food in the form of milk, meat and blood, and source of other products such as fiber and hides (FAO, 2009). Cattle herds are much larger in the pastoral areas and average about 75 head in Borena, Ethiopia. In the mixed farming areas, herds are much smaller being 5.7 head in East Harerghe, 8.6 in Illubabor and 11.8 in the central highlands (MoARD, 2007). In mixed farming system, cattle provide draught power and manure for cropland fertilization beside to milk production (Agajie et al., 2002), whereas the purpose of keeping cattle in pastoral production system is for breeding and selling, in agro pastoral production system for meat and draught power and in highland mixed crop-livestock production is for draught power and sale of culls (MoARD, 2007). Draft power is critical input in the central highlands of Ethiopia in the prevailing traditional mixed farming system. This is service of oxen and the oxen populations constitute 30% of the total cattle population and on average a household has two oxen (Goe, 1987). The highlands of Ethiopia are dependent on draft power of oxen in that on average an ox works for 900 h/year (Gryseels, 1988).

A more recent report indicated that 98.20% of the total cattle population in Ethiopia are local breeds while hybrid and exotic breeds accounted for about 1.62 and 0.18%, respectively (CSA, 2016/2017). FAO (1993) reported that cow milk constitutes 83.4% of the total milk produced in Ethiopia and CSA (2008/09) also indicated that cattle have the largest contribution (81.2%) of the total national annual milk output. CSA (2014/2015) report on milk utilization indicated that 46.36% of the total annual milk production was used for household consumption, 5.98% was sold, only 0.33% was used for wages in kind and the rest 43.33% was used for other products (could be for the production of butter, Cheese, and others). CSA (2014/15) also reported on beef cattle utilization in that 52.93% of the total annual production was used for household consumption, 33.18% was used sold, 0.71% was paid for wages in kind and 13.18% was used for other products.

40.02% of the total annual cattle hide production was used for household service, 53.94% of the total was sold, 0.27% was paid for wage in kind whereas 5.76% of the total annual production was used for other different products (CSA, 2014/2015). A review by Hedge (2002) indicated that cattle average daily milk yield of pastoral livestock production system varies with season which range from 0.5 to 5 kg per day. The main feed resources of pastoral production system are natural pastures; herbaceous vegetation composed mainly of grasses and forbs, and browses such as shrubs, tree leaves and pods (Adugna and Aster, 2007). Poor health services, feed shortage and low genetic potential of animals are the main constraints that restrain livestock productivity of Ethiopia (Ibrahim and Olaloku, 2000). However, adaptation to harsh climatic conditions, ability to better utilize the limited and poor quality feed resources and tolerance to a range of diseases make indigenous livestock breeds of Ethiopia to be valuable source of genetic material (DAGRIS, 2009).

The national average lactation period per cow was estimated to be about six months and average daily milk yield per cow was about 1.32 L (CSA, 2012/13). Characterization information is essential for planning the management of farm animal genetic resources at local, national, regional and global levels (FAO, 2011). On the contrary, although Ethiopia has large livestock population with massive diversity, breed level characterization and knowledge is inadequate (Workneh et al., 2004) and DAGRIS (2009) also reported that there is little attention given to characterize, identify and conserve the diversity of the various classes of livestock. There are different cattle populations in the country, however, the national cattle characterization work of each cattle population is not well summarized and the current state of knowledge on all indigenous cattle is not known. Moreover, it is obvious and many times reported that cattle productivity in Ethiopia is extremely low. This low cattle productivity is due to different cattle production challenges. Therefore, it is essential to know cattle challenges and opportunities at national level to be an input in the future research and development works. Therefore, the specific objectives of the review system comprised to review the productive and reproductive performances of indigenous cattle, to review the status of morphometric characterization of indigenous cattle and to review the challenges and opportunities of indigenous cattle of Ethiopia.

MATERIALS AND METHODS

Geographical location of Ethiopia

Ethiopia is located in the horn of Africa and is bordered by Eritrea in the north, Djibouti and Somalia in the east, Kenya in the south and Sudan in the west. It is located in 3°N of the equator to latitude 15°N and 33°E to 48°E longitude (MoA, 2004; EIBC, 2014). Ethiopia as a country has an area of 1,127,127 km^2. It is a country of great geographic diversity with wide altitudinal and physiographic variations. The altitude ranges from 116 m below sea level in the Danakil Depression in Afar national regional state to the highest peak of 4,620 m above sea level on Mount Ras Dashen in Amhara national regional state. The mean annual rainfall ranges from 500

to 2800 mm whereas the mean annual temperature ranges from below 10 to 30°C (EIBC, 2014).

Review method

The review system followed reviewing of all the available works concerned on indigenous cattle breeds of Ethiopia. The fragmented available information of indigenous cattle was summarized in tabular form for ease of understanding.

RESULTS

Indigenous cattle breeds of Ethiopia

FAO (2005) reported that cattle contribute 40% of the annual agricultural output and 15% of the total gross domestic product. Ethiopia has 59.5 million heads of cattle (CSA, 2016/2017). Ethiopian Institute of Biodiversity Conservation (EIBC) (2004) reported that Sheko, Fogera, Begait and Borena cattle populations were at decreasing trend. DAGRIS (Access date: November 2017) report indicated that the current number of indigenous cattle breeds of Ethiopia are 37 (Table 1). CSA (2016/2017) reported that about 98.2% of the total cattle population was indigenous cattle population, 1.62% of the cattle populations in Ethiopia were crossbred and 0.18% exotic cattle (Table 2).

Lactation and body weight performances of indigenous cattle of Ethiopia

The Ethiopian government was highly engaged to improve cattle productivity particularly to boost dairy productivity through crossbreeding program. CSA (2008/09) reported that exotic and indigenous cattle crossbreeding program was practiced with encouraging results, however, a strictly controlled breeding program has not been practiced and there has been no dairy herd recording scheme at national level. Zemenu *et al*. (2014) reported that the average daily milk yield (mean± SD) of local cattle at Debremarkos of Amhara national regional state, Ethiopia was 1.50±0.68 and that of cross bred cows (exotic x local cattle) was 7.30±4.65 liters. It was reported that the annual milk production of Ethiopia from cattle was 3,055,903,834 liters and the average milk yield per cow per day at country level is about 1.37 liters whereas the average lactation period per cow was estimated to be about six months (CSA, 2015/2016). The traditional milk production system, which is dominated by indigenous breeds of low genetic potential for milk production accounts for about 97% of the country's total annual milk production (Felleke, 2003). ILCA (1991) reported that indigenous cows produce only 1.5 to 2 liters of milk daily over a 150 to 180 days lactation period. Other national report indicated that the average lactation period per cow at country level is estimated to be about six months, and average daily milk yield (DMY) per cow is about 1.32 L (CSA, 2012/2013). It has also been well documented that, in breeding schemes, the raise in milk production through selection is about 1% per year or 3-4 kg per lactation (Zelalem and Inger, 2000). Moreover, the milk production potential of the zebu breed in the highlands of mixed crop-livestock system of Ethiopia cannot exceed 400-500 kilograms of milk per lactation per cow. Milk production potential of indigenous cattle of Boran, Horro, Barka, Arsi and Fogera is low, ranging from 494 to 809 kg per lactation (EARO, 1999; Zelalem and Inger, 2000). The reported on-station milk yield (Kg/day) performance of Arsi cattle (Kiwuwa et al., 1983), Barka (Goshu, 1981), Boran and Fogera (Gebrewold et al., 2000) was 2.97, 4.31, 2.84 and 4.49, respectively. Other reported on-farm milk yield studies on Fogera cattle (Zewdu, 2004) and Highland zebu (Solomon, 2000) revealed 2.56 and 1.91 Kg/day, respectively.

Reproductive performance of indigenous cattle breeds of Ethiopia

Ethiopia has high potential in livestock genetic resources; however, livestock productivity is below the African average. Total herd off take rate of cattle is estimated at about 7% annually; with carcass weight of 100 to 110 kg. Cows in Ethiopia do not reach maturity until 4 years of age, calve every second year (ILCA, 1991). Reproductive performance is commonly evaluated by analyzing female reproductive traits (Aynalem et al., 2011). The main indicators that would be considered in assessing reproductive performance are age at puberty, age at first calving, calving interval, days open and number of services per conception (Habtamu et al., 2010; Aynalem et al., 2011; Demissu et al., 2013).

Morphometric characterization of indigenous cattle breeds of Ethiopia

As per this review, morphometric characterization of indigenous cattle of Ethiopia is very poor (Tables 4 and 5). A descriptive comparison of the number of indigenous cattle reported and the number of indigenous cattle studied was evaluated. As of IBC (2004) report on the number of indigenous cattle, 44% of the number of indigenous cattle reported were studied their morphometric characterization, but according to DAGRIS (2007) report on the number of indigenous cattle, 34% of the number of indigenous cattle reported were studied their morphometric characterization (Table 7).

Characterization of majority of indigenous breeds and production systems of East Africa including Ethiopia has not yet been undertaken (Ntombizakhe, 2002). Live body weight of cattle is highly correlated with linear body measurements particularly of heart girth and body length (Hamayunm, 2003). On-farm phenotypic characterization of indigenous cattle populations of Awi, East and West Gojjam Zones of Amhara Region, Ethiopia indicated that

Table 1. Reported indigenous cattle breeds and/or strains of Ethiopia.

S/N	List of indigenous cattle breeds and/or strains of Ethiopia reported by local and international officials					
	EIBC (2004)	EIBC (n.d)	DADIS (n.d)	DAGRIS (2007)	DADIS (Access date: 20/11/2017)	DAGRIS (Access date: 21/11/2017)
1	Arsi	Adwa	Abergelle	Adwa	Abergelle	Baherie
2	Begait	Ambo	Abigar	Aliab Dinka	Abigar	Arsi
3	Ogaden	Arado	Abyssinian highland zebu	Ambo	Abyssinian Highland Zebu	Semien
4	Borena	Arsi	Abyssinian short horned zebu	Anuak	Abyssinian Short horned Zebu	Horro
5	Goffa	Bale	Adwa	Arado	Adwa	Harar
6	Arado	Barka	Ambo	Arsi	Ambo	Jijiga
7	Nuer	Danakil	Arado	Bale	Arado	Mahbere-Slassie
8	Guraghe	Dembia	Arsi	Barka	Arsi	Danakil
9	Jidu	Boran	Bambawa	Danakil	Bambawa	Bale
10	Karayu/ Afar	Fogera	Begait	Dembia	Begaria	Sheko
11	Harar	Goffa	Boran	Ethiopian Boran	Begait	Jem-Jem
12	Horro	Guraghe	Danakil	Fogera	Boran	Ogaden Zebu
13	Smada	Hammer	Ethiopian Boran	Goffa	Danakil	Qocherie
14	Fogera	Harar	Fogera	Guraghe	Ethiopian Boran	Danakil
15	Mursi	Horro	Goffa	Hammer	Fogera	Goffa
16	Raya–Azebo	Jem-Jem	Guraghe	Harar	Goffa	Ethiopian Boran
17	Adwa	Jijiga	Hammer	Horro	Gurage	Afar
18	Jem-Jem	Mahbere-Slassie	Harar	Jem-Jem	Hammer	Kuri
19	Sheko	Mursi	Holstein-Friesian	Jijiga	Harar	Anuak
20	Ambo	Ogaden zebu	Horro	Kuri	Holstein-Friesian	Mursi
21	Jijiga	Qocherie	Jem-Jem zebu	Mahbere-Slassie	Horro	Adwa
22	Bale	Raya-Azebo	Jidu	Murle	Irob	Dembia
23	Hammer	Semien	Jijiga zebu	Mursi	Jem-Jem Zebu	Aliab Dinka
24	Medense	Sheko	Medence	Ogaden zebu	Jiddu	Raya-Azebo
25	Abergelle	Smada	Mursi	Qocherie	Jijiga Zebu	Guraghe
26	-	Nuer	Nuer	Raya-Azebo	Medenece	Barka
27	-	Jidu	Raya-Azebo	Red Fulani	Mursi	Medenece
28	-	-	Red Bororo	Semien	Nuer	Somali Boran
29	-	-	Sheko	Sheko	Raya-Azebo	Arado
30	-	-	Smada	Smada	Red Bororo	Smada
31	-	-	Tigrey	Somali Boran	Sheko	Ambo
32	-	-	-	Wegera	Smada	Wegera
33	-	-	-	-	Tigrey	Fogera
34	-	-	-	-	-	Hammer
35	-	-	-	-	-	Murle
36	-	-	-	-	-	Red Fulani
37	-	-	-	-	-	Arado
Total	25	27	31	32	33	37

EIBC: Ethiopian institute of biodiversity conservation, DADIS: domestic animal diversity information system, DAGRIS: domestic animal genetic resources information system, n.d: no date

all the quantitative dependent variables (body length, chest girth, height at withers, pelvic width, mouth circumference, ear length, tail length, dewlap width, horn length) were significantly ($P < 0.0001$) affected by sex of the animal (Fasil and Workneh, 2014).

Production constraints and opportunities of indigenous cattle breeds of Ethiopia

Developing countries, such as Ethiopia, are restrained by different cattle production challenges which include technical, biological, socio-economic and institutional factors that are expressed in scarcity of quality and quantity of feed resources, low producing cattle genotypes, disease susceptibility, reproductive loss, inadequate health service, management and market access are some of the constraints (Ibrahim and Olaloku, 2000). Area and breed specific survey indicated that shrinkage of grazing land, polledness and aggressive behavior of the breed, scarcity of Sheko breeding bulls, misapprehension of importance and status of the Sheko cattle and lack of active intervention on the breed were the major constraints in Sheko cattle production (Takele et al., 2005). Other cattle breed specific survey indicated that constraints of Horro cattle owners were feed shortage, labor shortage, diseases and lack of exotic bull which ranked differently in the mid altitude and highland areas of the breed (Agere et al., 2012). According to Damitie et al. (2015), the major constraints of Fogera cattle were shortage of feed, disease outbreak and occurrences of drought, shortage of water during winter/healthy water, flooding during summer season, market and conflict by grazing land. A survey report indicated that availability of diversified breeds, good fattening weather, and good income generated, good indigenous knowledge of fattening, recent introduction of some improved forage varieties, popularity of fattened Harar bull in the country were opportunities for cattle production in the area (Abdi et al., 2013). Disease, lack of improved cattle breed and feed shortage were identified as first, second and third constraints for dairy cattle production in Debremarkos district of Amhara national regional state of Ethiopia (Zemenu et al., 2014).

DISCUSSION

Ethiopia has more cattle than other livestock species and cattle are substantially important in the livelihood of smallholder farmers and urban people. CSA (2010/11), CSA (2012/13) and CSA (2016/17) reports indicated that the proportion of indigenous cattle versus exotic and indigenous crossbreds and exotic cattle in Ethiopia was not significantly changed. Although Ethiopia has diversified cattle breeds, the Ethiopian Institute of Biodiversity Conservation (EIBC, 2004) reported that Sheko, Fogera, Begait and Borena cattle populations were at decreasing trend. Furthermore, Zerabruk et al. (2007), Mulugeta (2015), Teweldemedhn (2016) and Tewelde et al. (2017) reports revealed that Begait cattle population was at decreasing trend. DAGRIS reported that there were 37 indigenous cattle breeds. There is no recent local report which declares the number of indigenous cattle breeds of Ethiopia except EIBC (2014) report which indicated that there were 28 indigenous cattle breeds. EIBC, DADIS and DAGRIS used the words Begait and Barka interchangeably to name for one cattle breed in which Barka is the naming of Eritrean breeders whereas Begait is the naming of Ethiopian breeders.

The current review indicated that milk yield performance study on indigenous cattle is very poor (Table 3). A comparison of the number of indigenous cattle reported and breed specific milk yield performance study was made.

Taking IBC (2004) report on the number of indigenous cattle, 76% of the number of indigenous cattle reported were studied their milk yield performance but as of DAGRIS (21

November 2017) report on the number of indigenous cattle, 51% of the number of indigenous cattle reported were studied their milk yield performance (Table 8). Live body weight, which is the most economically important, measured at different ages of each indigenous cattle, is not available except in very few indigenous cattle breeds (Table 3). The current state of reproductive performance research work versus number of indigenous cattle reported is incomparable (Table 4). A descriptive comparison of the number of indigenous cattle reported and the number of indigenous cattle studied was evaluated. As of IBC (2004) report on the number of indigenous cattle, 48% of the number of indigenous cattle reported were studied their reproductive performance but according to DAGRIS (21 November 2017) report on the number of indigenous cattle, 32% of the number of indigenous cattle reported were studied their reproductive performance (Table 8).

As per this review, morphometric characterization of indigenous cattle of Ethiopia is very poor (Tables 5 and 6). A descriptive comparison of the number of indigenous cattle reported and the number of indigenous cattle studied was evaluated. As of IBC (2004) report on the number of indigenous cattle, 60% of the number of indigenous cattle reported, their morphometric characterization was studied, but according to DAGRIS (21 November 2017) report on the number of indigenous cattle, 41% of the number of indigenous cattle reported, their morphometric characterization was studied (Table 8). As indicated in Table 7, the production challenges of all indigenous cattle breed of Ethiopia are not identified. A descriptive comparison of the number of indigenous cattle reported and the number of indigenous cattle studied was evaluated. As of IBC (2004) report on the number of indigenous cattle, 32% of the number of indigenous cattle showed that their production challenges were studied, but according to DAGRIS (21 November

Table 2. Proportion of indigenous, crossbred and exotic cattle breeds in Ethiopia.

S/N	Cattle genotypes	Sources				
		CSA (2008/09)	CSA (2010/2011)	CSA (2012/2013)	CSA (2015/2016)	CSA (2016/2017)
1	Indigenous cattle (%)	99.28	99.26	98.95	98.59	98.2
2	Exotic X indigenous crossbred (%)		0.64	0.94	1.22	1.62
3	Exotic cattle (%)		0.1	0.11	0.19	0.18
-	-		100	100	100	100

Table 3. Lactation performance and body weight of indigenous cattle breeds of Ethiopia.

Cattle breed	Production parameters					Farm	Author(s)
	DMY (L)	LMY (L)	LL (month)	BWt (kg)	Adult Wt (kg)		
Horro	-	-	10.5 ± 3.03	-	-	On-farm	Laval and Assegid (2002)
Horro	1.65	475.85	9.57	-	-	On-farm	Agere et al. (2012)
Horro	-	-	-	19.9	-	-	Cited in Aynalem et al. (2011)
Horro	-	550	5.8	-	-	-	Cited in Aynalem et al. (2011)
Horro	-	-	-	-	250	On-farm	DAGRIS (2006)
Horro	-	-	-	-	320-480 M, 210-400 F	On-farm	Rege (1999)
Arsi	1.44±0.04	-	9.57±0.25	-	-	On-farm	Chali (2014)
Arsi	2.2	-		-	-	On-farm	Meseret et al. (2014)
Arsi	-	809	9.07	-	-	-	Gabriel et al. (1983)
Begait	2.52±0.29	-	6.38±0.026	-	-	On-farm	Mulugeta (2015)
Begait	2.7±0.3	-	6.6±0.9	-	-	On-farm	Teweldemedhn (2016)
Begait	2.1±0.04	433.2±3.4	4.9±0.03	-	-	On-farm	Tewelde et al. (2017)
Begait	-	-		22.6	-	-	Cited in Aynalem et al. (2011)
Begait	-	645	6.1	-	-	-	Cited in Aynalem et al. (2011)
Barka	-	-	-	-	360	On-farm	DAGRIS (2006)
Barka	-	869	-	-	-	On-farm	Million and Tadelle (2003)
Barka	-	-	-	-	335-490 M, 295-415 F	On-farm	Rege (1999)
Fogera	3.54±0.14	-	10.5±0.17	-	-	On-farm	Damitie et al. (2015)
Fogera	-	997.5	-	-	-	On-farm	Zewdu (2004)
Fogera	-	-	-	21.9	-	-	Cited in Aynalem et al. (2011)
Fogera	2.32	270	23.3	-	-	-	Cited in Aynalem et al. (2011)
Fogera	1.5	-	-	-	-	On-farm	Belete (2006)
Boran (lowland)	1.85*/0.35**	-	-	-	-	On-farm	Dejene (2014)
Boran (midland)	1.10*/0.95**	-	-	-	-	On-farm	Dejene (2014)
Boran	5.0	-	-	-	-	On-farm	Meseret et al. (2014)
Boran	1.8	520	10.1	-	-	On-farm	Solomon et al. (2011)
Boran	-	-	-	22.9	304	-	Cited in Aynalem et al. (2011)
Boran	1.7	507	8	-	-	-	Cited in Aynalem et al. (2011)
Boran	1.7 ± 0.1 kg	507± 39kg	8 ±0.13	23.3 ± 0.36	-	On-farm	Haile et al. (2009a, 2010)
Boran	-		-	-	268	On-farm	DAGRIS (2006)
Boran	-	867	-	-	-	On-farm	Million and Tadelle (2003)

Table 3. Contd.

Boran	-	-	8	-	-	*On-farm*	Aynalem et al. (2011)
Boran	-	-		-	300-385 M, 300-350 F	On-farm	Rege, 1999
Ogaden	-	682		-	-	On-station	Getinet (2005)
Ogaden	-	-		21.50±0.29	289.57	On-station	Getinet et al. (2005)
Ogaden	-	-		-	280.5 F, 321 M	On-farm	Ermias (2007)
Ogaden	-	-		21.0±0.31 F, 22.0±0.33 M	-	Haramaya University	Getinet et al. (2009)
Sheko		698.3	9.9	-	-	On-farm	Takele et al. (2005)
Sheko	2.79 ± 0.06	850.69± 24.16	10.26±0.2	16.12± 0.22	-	On-farm	Bayou et al. (2015)
Raya sanga	-	594	-	-	-	On-farm	Dereje (2005)
Kereyu	1.8	463.1	-	-	-	On-farm	Shiferaw et al. (2006)
Mursi	2.11±0.06	491.13±21.48	7.79±0.25	-	-	On-farm	Endashaw et al. (2011)
Kuri	-	-	-	-	480	On-farm	DAGRIS (2006)
Zebu	-	929	10.1	-	-	On-farm	Gabriel et al. (1983)
Arado	-	464.34±41.75	8.24±0.75	-	-	On-farm	Niraj et al. (2014)
Arado	-	-		-	205-430 M, 192-350 F	On-farm	Rege (1999)
Smada	1.54	203.54±1.40		-	-	On-farm	Getie et al. (2015)
Danakil	-			-	250-380 M, 200-305 F	On-farm	Rege (1999)
Jiddu	-			-	340-590 M, 325-430 F	On-farm	Rege (1999)
Abigar	-	720 kg	6	-	550 M	On-farm	DADIS
Abyssinian Shorthorned Zebu	-	-	-	-	295 M, 230 F	On-farm	DADIS
Arsi	-	240	3.9	21 (M and F)	280 M, 230 F	On-farm	DADIS
Begait	-	675 kg	6.13		380 M, 280 F	On-farm	DADIS
Boran*	-	1200 kg	5.67	25 (M and F)	700 M, 475 F	On-farm	DADIS
Danakil	-	225 kg	6.67		310 (M and F)	On-farm	DADIS
Boran (E)	3.5 kg	843 kg	7 (Max.)	23 M, 17.8 F	318 M, 225 F	On-farm	DADIS
Boran (E)		-	-	-	500	On-farm	DAGRIS
Fogera		920 kg	9.1	-	-	On-farm	DADIS
Horro		814 kg	5.77	-	-	On-farm	DADIS
Jem-Jem		-	-	-	275 (M and F)	On-farm	DADIS
Red Borroro	-	900 kg	-	-	430 M	On-farm	DADIS
Sheko	-	420 kg	7	-	-	On-farm	DADIS
National	1.32	-	6	-	-	-	CSA (2012/2013)

*Wet season milk yield, **Dry season milk yield, F: female weight, M: male weight, DMY: daily milk yield, LMY: lactation milk yield, LL: lactation length, BWt: body weight, Wt: weight, E: Ethiopian Boran, Max.: maximum.

Table 4. Reproductive performance of indigenous cattle breeds of Ethiopia.

Cattle breed	Reproductive parameters								Farm	Author(s)
	MAFM (month)	FAFM (month)	AFC (month)	CI (month)	RLTB (year)	RLTC (year)	CBRLTC (number)	DO (days)		
Fogera	-	-	50.8±0.36	19.6±0.2	-	-	-	285±4.3	Metekel Ranch	Melaku et al. (2011)
Fogera	-	-	47.61	18.63	-	-	-	-	Metekel Ranch	Addisu and Hedge (2002)
Fogera	-	-	59.90+0.83	25.52+0.52	6.79+0.1	11.30+0.17	4.94±0.17	-	On-farm	Damitie et al. (2015)

Table 4. Contd.

Fogera	-	42.24±0.05	51.4±0.05	21.18±0.70	-	-	-	-	On-farm	Assemu et al. (2016)
Fogera	-	-	50.8+ 0.36	-	-	-	-	-	On-farm	Menale et al. (2011)
Fogera	-	-	-	-	-	9.6	-	-	Andasa ranch	Gidey (2001)
Fogera	-	-	63	37	-	-	-	-	On-farm	Fasil et al. (2006)
Fogera	-	-	53.4	17.5	-	-	-	-	-	Cited in Aynalem et al. (2011)
Fogera	-	-	52.4	19.3	-	-	-	298.4	Metekel ranch	Almaz (2012); Gebeyehu et al. (2005)
Borana	-	-	36-45	-	-	-	-	-	Abernosa Ranch	Ababu Dekeba et al. (2006)
Borana (lowland)	-	-	58.8	16.8	9.86	11.5	7.1	-	On-farm	Dejene (2014)
Borana (midland)	-	-	57.6	13.8	7.68	10.9	6.6	-	On-farm	Dejene (2014)
Boran	-	-	22.56	11.8	-	-	-	-	On-farm	Meseret et al. (2014)
Boran	47.4	42.7	55.5	15.3	11.4	12.7	7.3	-	On-farm	Solomon et al. (2011)
Boran	-	-	42.8	14.9	-	-	-	-	On-farm	Cited in Aynalem et al. (2011)
Boran	-	32.4 ± 1.4	43.5 ± 1.5	14.63± 0.33	-	-	-	141 ± 7	On-farm	Haile et al. (2009b)
Boran	-	-	-	14.63	-	-	-	-	On-farm	Million and Tadelle (2003)
Boran	-	-	57.6	20.7	-	-	-	339	On-station	Yifat et al. (2012)
Ogaden	-	34.4±2.28	49.2±4.43	16.43±0.44	-	-	-	195	Haramaya university	Getinet et al. (2009)
Ogaden	-		49.18±4.43	-	-	-	-	-	-	Getinet et al. (2005)
Horro	46.56±0.06	48.42±0.05	58.08±0.07	21.08±0.3	3.72±0.10	13.67±0.31	6.46±0.13	286.8±9	On-farm	Agere et al. (2012)
Horro	47.52	53.3	-	-	-	-	-	-	On-farm	Jiregna (2007)
Horro	46.56	48.42	58.08±0.07	-	-	-	-	-	On-farm	Ayantu et al. (2012)
Horro	-	-	53	17.6	-	-	-	-	-	Cited in Aynalem et al. (2011)
Horro	-	-	50.0	12.2	-	-	-	152	On-farm	Hailemariam and Mekonnen (1996)
Arsi	36.3±0.6	41.8±0.8	55.4±0.7	-	7.4±0.2	12.1±0.2	7.0±0.2	-	On-farm	Chali (2014)
Arsi	-	-	3.39	14.2	-	-	-	-	On-farm	Meseret et al. (2014)
Arsi	-	-	-	14.63	-	-	-	-	On-farm	Gabriel et al. (1983)
Arsi	-	-	32.8	14.6	-	-	-	211	On-farm	Mulugeta et al. (2008)
Begait	-	35.5	48.68±0.16	17.06±0.11	-	8.20±0.07	-	-	On-farm	Mulugeta (2015)
Begait	42±6	38.4±7.2	50.4±7.2	-	4.2±1.2	11.0±0.8	7±1	229±36	On-farm	Teweldemedhn (2016)
Begait	42.75±0.5	43.97±0.3	52.68±0.4	19.36±0.2	-	-	6.32	-	On-farm	Tewelde et al. (2017)
Begait	-	-	60	15.3	-	-	-	-	-	Cited in Aynalem et al. (2011)
Barka	-	-	-	13.23	-	-	-	-	On-farm	Million and Tadelle (2003)
Barka	-	-	30.3	13.2	-	-	-	253	On-farm	Million and Tadelle (2003); Hailemariam and Mekonnen (1996)
Sheko	-	-	54.1	15.6	6.5	14.7	8.3	-	On-farm	Takele et al. (2005)
Sheko	-	-	-	17.40± 0.20	-	-	-	248.32± 6.02	On-farm	Bayou et al. (2015)
Gojjam Highland Zebu	-	-	49	24	-	-	-	-	On-farm	Fasil et al. (2006)
Highland zebu	-	-	53	15.1	-	-	-	148	On-farm	Niraj et al. (2014)
Zebu	-	-	-	15.03	-	-	-	-	On-farm	Gabriel et al. (1983)
Kereyu	49	47.5	54.1	18	9.2	13.2	7.1	-	On-farm	Shiferaw et al. (2006)
Mursi	43.32±0.96	42.12±0.96	57.48±1.08	14.64±0.56	-	14.08±0.32	10.97±0.22	-	On-farm	Endashaw et al. (2011)
Arado	-	-	39.4 ±1.7	14.4±2.6	-	-	-	431.08±78.03	On-farm	Niraj et al. (2014)
Smada	-	40.74±0.33	49.77±0.33	26.04±0.01	-	-	-	-	On-farm	Getie et al. (2015)
Horro	-	-	50	12	-	-	-	-	On-farm	DADIS

*Pasture feeding, MAFM: male age at first mating, FAFM: female age at first mating, AFC: age at first calving, RLTB: reproductive lifetime of bull, RLTC: reproductive lifetime of cow, CBRLTC: calves born in reproductive lifetime of a cow, DO: days open.

Table 5. On-farm morphometric characterization of indigenous cattle breeds (cows) of Ethiopia.

Cattle breed	Morphometric traits (unit=centimeter)											Author(s)
	BL	CG	HW	PW	RL	TtL	EL	HL	MC	HC	TL	
Ogaden	141.0	161.4	116.4	-	-	-	-	-	-	-	-	Ermias (2007)
Ogaden	121.09± 7.18	150.1±8.20	115.54±5.17	-	-	-	19.7±1.69	8.0±4.83	-	-	71.6± 5.04	Getinet et al. (2009)
Ogaden	121.09	150.11±8.20	115.54	-	-	-	-	-	-	-	-	Getinet et al. (2005)
Arsi	118±9.4	139±7.0	113±2.7	29.±2.3	35±2.5	-	16±1.7	21.0±7.4	37±2.2	-	-	Chali (2014)
Begait	128.1±0.16	159.6±0.24	131.5±0.25	40.0±0.31		11.5±0.03	18.4±0.34	21.1±0.11		-	97.7±0.37	Mulugeta (2015)
Begait	115.5±0.48	153.2±0.56	129.1±0.46	38.1±0.19	21.0±0.24	6.5±0.14	22.8±0.16	22.4±0.69	38.8±0.17	33.7±0.17	96.9±0.72	Teweldemedhn (2016)
Barka	-	-	120-133	-		-	-		-	-	-	Rege (1999)
Boran	120	149.2	114.8	-		-	-	14.3	-	-	-	Solomon et al. (2011)
Mursi	122.09±0.95	144.47±0.89	112.98±1.10	-	20.41±0.25	-	-	30.77±1.05	-	-	-	Endashaw et al. (2011)
Kereyu	121.6	141.6	113.2	-	-	-	-	48	-	-	-	Shiferaw et al. (2006)
Sheko	110.2	136.5	99.4	33.5	-	-	-	-	-	-	-	Takele et al. (2005)
Fogera	119.77	-	-	37.77	-	-	-	-	-	-	-	Zewdu (2004)
Fogera	-	-	100-121		-	-	-	-	-	-	-	Rege (1999)
Raya sanga	119	-	-	35.2	-	-	-	-	-	-	-	Dereje (2005)
Afar sanga	126	-	-	38.7	-	-	-	-	-	-	-	Dereje (2005)
Goffa	107.15±0.62	135.42±0.811	107.18±0.588	37.63±0.28	-	-	19.54±0.199	27.02±1.82	39.09±0.24	29.42±0.299	-	Belay *et al*. (2017)
Danakil	-	-	120-125	-	-	-	-	-	-	-	-	Rege (1999)
Arado	-	-	93-126	-	-	-	-	-	-	-	-	Rege (1999)
Jiddu	-	-	108-124	-	-	-	-	-	-	-	-	Rege (1999)
Abyssinian Short horned Zebu	-	-	105	-	-	-	-	-	-	-	-	DADIS
Arsi	-	-	110	-	-	-	-	-	-	-	-	DADIS
Begait	-	-	125	-	-	-	-	-	-	-	-	DADIS
Boran*	-	-	121	-	-	-	-	-	-	-	-	DADIS
Danakil	-	-	128	-	-	-	-	-	-	-	-	DADIS
Boran €	-	-	118	-	-	-	-	-	-	-	-	DADIS
Fogera	-	-	112	-	-	-	-	-	-	-	-	DADIS
Tigrey	-	-	111	-	-		-	-	-	-	-	DADIS

BL: Body length, CG: chest girth, HW: height at wither, PW: pelvic width, RL: rump length, TtL: teat length, EL: ear length, HL: horn length, MC: muzzle circumference, HC: hock circumference, TL: tail length.

Table 6. On-farm morphometric characterization of indigenous cattle breeds (bulls) of Ethiopia.

Cattle breed	Morphometric traits (unit=centimeter)											Author(s)
	BL	CG	HW	PW	RL	EL	HL	MC	HC	TL	SC	
Ogaden	141.5	161.3	118.0	-	-	-	-	-	-	-	-	Ermias (2007)
Ogaden	120.4 ±7.27	148.2±14.31	115.5± 7.71	-	-	19.6± 1.05	5.9± 3.26	-	-	71.9± 5.15	-	Getinet et al. (2009)
Ogaden	120.45	148.20±14.31	115.47	-	-	-	-	-	-	-	-	Getinet et al. (2005)
Arsi	125±9.8	152±11.0	115.0±3.0	30±3.6	37±3.5	16±2.3	22±8.3	40±3.2	-	-	-	Chali (2014)
Begait	136.0±0.09	168.9±0.10	137.0±0.10	41.5±0.06		18.1±0.07	19.9±0.07		-	100.3±0.06	-	Mulugeta (2015)
Begait	125.6±1.21	167.9±1.58	143.4±1.24	-	20.9± 0.62	23.2±0.49	26.8±2.28	43.1±0.48	35.3±0.61	106.9± 1.49	32.1± 0.46	Teweldemedhn (2016)
Barka	-	-	122-138	-	-	-		-	-	-	-	Rege (1999)

Table 6. Contd.

Boran	127.8	155	117.9	-	-	-	13.7	-	-	-	-	Solomon et al. (2011)
Kereyu	128.3	151.8	118.9	-	-	-	43.5	-	-	-	-	Shiferaw et al. (2006)
Sheko	114.6	141.2	103.6	32.8	-	-		-	-	-	-	Takele et al. (2005)
Goffa	108.05±1.03	138.01±1.57	109.054± 1.06	38.10±0.53	-	19.56±0.32	26.74± 1.747	40.157±0.41	30.83±0.423	-	-	Belay et al. (2017)
Danakil	-	-	130-145	-	-	-	-	-	-	-	-	Rege (1999)
Arado	-	-	117-144	-	-	-	-	-	-	-	-	Rege (1999)
Fogera	-	-	110-145	-	-	-	-	-	-	-	-	Rege (1999)
Jiddu	-	-	109-133	-	-	-	-	-	-	-	-	Rege (1999)
Abyssinian Short horned Zebu	-	-	105	-	-	-	-	-	-	-	-	DADIS
Arsi	-	-	110	-	-	-	-	-	-	-	-	DADIS
Begait	-	-	132	-	-	-	-	-	-	-	-	DADIS
Boran*	-	-	130	-	-	-	-	-	-	-	-	DADIS
Danakil	-	-	128	-	-	-	-	-	-	-	-	DADIS
Boran (E)	-	-	121	-	-	-	-	-	-	-	-	DADIS
Fogera	-	-	127	-	-	-	-	-	-	-	-	DADIS
Tigrey	-	-	122	-	-	-	-	-	-	-	-	DADIS

BL: Body length, CG: chest girth, HW: height at wither, PW: pelvic width, RL: rump length, EL: ear length, HL: horn length, MC: muzzle circumference, HC: hock circumference, TL: tail length, SC: scrotum circumference.

Table 7. Challenges of indigenous cattle production in Ethiopia.

Cattle	First ranked	Second ranked	Third ranked	Author(s)
Fogera	Feed scarcity	Disease	Drought	Damitie et al. (2015)
Fogera	Shrinkage of grazing land	Shortage of land for forage development	Absence of health follow-up and clinic	Assemu et al. (2017)
Fogera	Inbreeding	Uncontrolled inter- and crossbreeding	Diseases and drought	EIBC (2004)
Fogera	crossbreeding	-	-	EIBC (2014)
Mursi	Animal diseases and parasites	Seasonal water and feed shortage	Drought	Endashaw et al. (2011)
Horro (midland areas)	Feed shortage	Labor shortage	Disease	Agere et al. (2012)
Horro (highland areas)	Feed shortage	Disease	Labor shortage	Agere et al. (2012)
Horro (mid-altitude)	Feed shortage	Labor shortage	Disease	Agere et al. (2012)
Horro (highland)	Feed shortage	Diseases	Labor shortage	Agere et al. (2012)
Harar	Feed shortage	Animal health problem	Market problem	Abdi et al. (2013)
Arsi	Feed shortages	Grazing land shrinkage	Shortage of improved breed	Chali (2014)
Begait	Feed shortage	Diseases	Water shortage	Mulugeta (2015)
Begait	Rangeland and feed scarcity	Theft	Scarcity of water	Teweldemedhn (2016)
Begait	High off-take rate (during Ethio-Eritrea war)	-	-	EIBC (2004)
Sheko	Trypanosomiasis	Inbreeding	Interbreeding with other local breeds	EIBC (2004)
Sheko	Crossbreeding	Production system shift		EIBC (2014)
Borena, Afar and Ogaden	Feed shortage	Recurrent drought	Interbreeding and diseases	EIBC (2004)

Table 7. Contd.

Boran (highland)	Feed shortage	Disease and parasites	Grazing land scarcity	Seid (2012)
Boran (mid-altitude)	Feed shortage	Drought	Grazing land scarcity	Seid (2012)
Boran (lowland)	Feed shortage	Drought	***Disease and parasites***	Seid (2012)
Number of records	18	17	17	52
Major challenge	Feed shortage (77.8%)	-	-	-
Overall challenge	-	-	-	Feed shortage (36.5%)

Table 8. Percent of indigenous cattle breeds studied in their milk yield performance, reproductive performance, morphometric characterization and their major production challenges.

Categories	Number of indigenous cattle breeds studied	Percent of breeds studied in reference to EIBC (2004) report of indigenous cattle list	Percent of breeds studied in reference to DAGRIS report (Access date: 21/11/20177) of indigenous cattle list
Milk yield performance evaluation	19	76	51
Reproductive performance evaluation	12	48	32
Morphometric traits characterization	15	60	41
Cattle major challenges identification	8	32	21.6

2017) report on the number of indigenous cattle, 21.6% of the number of indigenous cattle showed that their production challenges were studied (Table 8). As presented in Table 7, the major challenge of the studied indigenous cattle breeds of Ethiopia is scarcity of feed which accounted 77.8% of the first ranked challenges.

CONCLUSION AND RECOMMENDATIONS

Ethiopia has diversified indigenous cattle genetic resources kept under hundreds of millions of poor smallholder farmers. However, most of the indigenous cattle populations of Ethiopia remained largely uncharacterized; characterization work is at its rudimentary stage and the characterized cattle breeds of Ethiopia are even not well characterized. Productivity per unit of animal is extremely poor and some indigenous cattle populations are at decreasing trend which is largely affected by scarcity of feed. This review system ensured that the major challenge of indigenous cattle breeds of Ethiopia is scarcity of feed which accounted 77.8% of the first ranked challenges of cattle production. However, the critical challenge of all indigenous cattle is not yet well identified. Therefore, identification of the major cattle production and breeding challenges of each indigenous cattle breed should be taken into account and further breed specific research and development works should be accomplished so as to enhance their productivity. There are many performance studies on cattle breeds of Ethiopia which entitled local or indigenous cattle productive and/or reproductive performances. Therefore, in this case, the performance study should be on specific cattle breed because local or indigenous cattle performance cannot reflect the performance of specific breed. Indigenous cattle production opportunities are not yet identified and need due attention in the future.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

REFERENCES

Abdi E, Kemal K, Yassin E, Muleta D (2013). Cattle Production in West Hararghe: An Opportunity and Constraints Assessments in Darolabu, Odabultum, Gemechis and Chiro Districts, Oromia Regional State, Ethiopia. Int. J. Livest. Prod. Res.1(1):01- 15.

Agajie T, Chilot Y, Mengistu A, Elias Z, Aster Y (2002).Smallholder livestock production systems and constraints in the Highlands of North and West Shewa zones. pp. 49-71. In: Proceedings of the 9th annual conference of the Ethiopian Society of Animal Production (ESAP), held in Addis Ababa, Ethiopia, August 30-31, 2001.

Agere M, Aynalem H, Tadelle D, Yoseph M (2012). On farm characterization of Horro cattle breed production systems in western Oromia, Ethiopia. Livest. Res. Rural Dev. 24(6):100.

Almaz B (2012). Genetic parameter estimation of growth and reproduction traits of Fogera cattle at Metekel ranch, Amhara region, Ethiopia. MSc thesis submmited to Bahir Dar University college of Agriculture and Environemntal science, Bahir Dar, Ethiopia.

Assemu T, Dilip K, Solomon A, Getinet M (2016). Evaluations of Reproductive Performances of Fogera Cattle Breed in Selected Districts of Amhara Region, Ethiopia. Int. J. Pharma Med. Biol. Sci. 5(1):52.

Assemu T, Dilip K, Solomon, Getinet M (2017). Conservation and Improvement Strategy for Fogera Cattle: A Lesson for Ethiopia Indigenious Cattle Breed Resource Hindawi. Adv. Agric. 2017, Article ID 2149452, 12p.

Aynalem H, Workneh A, Noah K, Tadelle D, Azage T (2011). Breeding strategy to improve Ethiopian Boran cattle for meat and milk production. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 26. Nairobi, Kenya, ILRI.

Bayou E, Haile A, Gizaw S, Mekasha Y (2015). Evaluation of non‐genetic factors affecting calf growth, reproductive performance and milk yield of traditionally managed Sheko cattle in southwest Ethiopia. SpringerPlus 4:568.

Belay Z, Minale G and Ketema W (2017). Phenotypic Characterization of Indigenous Cattle Populations in Gamo Gofa Zone South Western Ethiopia. Eur. J. Biol. Sci. 9(3):124-130.

Belete A (2006). Studies on cattle milk and meat production in Fogera woreda: Production systems, constraints and opportunities for development. April 15, 2006, MSc Thesis, Debub University, Awassa, Ethiopia.

Central Statistical Agency (CSA) (2014/2015). Federal democratic republic of Ethiopia: Agricultural sample survey, 2014/2015 (2007 E.C.) (September – January 2014/2015), volume-2: Report on crop and livestock product utilization (private peasant holdings, Meher season), statistical bulletin-578, June, 2015, Addis Ababa, Ethiopia.

Central Statistical Agency (CSA) (2015/2016). Federal democratic republic of Ethiopia: Key findings of the 2015/2016 (2008 E.C) agricultural sample surveys: Country summary, July, 2016, Addis Ababa, Ethiopia.

Central Statistical Agency (CSA) (2016/2017). Federal democratic republic of Ethiopia: Agricultural sample survey 2016/17 [2009 E.C.], volume-2: Report on livestock and livestock characteristics (private peasant holdings). Statistical bulletin-585, April 2017, Addis Ababa, Ethiopia.

Central Statistical Agency (CSA) (2010/2011). Federal Democratic Republic of Ethiopia: Central statistical agency; Agricultural sample survey 2010/11 [2003 E.C.], volume 2: Report on livestock and livestock characteristics (private peasant holdings), Statistical bulletin 505, February 2011, Addis Ababa, Ethiopia.

CSA (Central Statistical Authority) (2012). Federal democratic republic of Ethiopia, central statics agency, agricultural sample survey: report of livestock and livestock characteristics. Volume-2. March 2012, Addis Ababa, Ethiopia.

Central Statistical Agency (CSA) (2012/2013). Agricultural sample survey. Report on livestock and livestock characteristics. The Federal Democratic republic of Ethiopia, Central Statistical Agency (CSA). Private Peasant Holdings. Statistical Bulletin 570, April, 2013, Addis Ababa, Ethiopia.

Central Statistical Agency (CSA) (2009). Agricultural sample survey (2008/2009). Report on livestock and livestock characteristics. Statistical bulletin 446. Addis Ababa, Ethiopia.

Domestic Animal Genetic Resources Information System (DAGRIS) (2007). Domestic Animal Genetic Resources Information System (DAGRIS). (eds. S. Kemp, Y. Mamo, B. Asrat and T. Dessie). International Livestock Research Institute, Addis Ababa, Ethiopia. Domestic Animal Genetic Resources Information System (DAGRIS) (Access date: 21/11/2017) at http://www.dagris.info/countries/192/breeds, Livestock breeds in Ethiopia.

Damitie K, Kefyalew A, Endalkachew G (2015). Reproductive and Productive Performance of Fogera Cattle in Lake Tana Watershed, North Western Amhara, Ethiopia. J. Reprod. Infertil. 6(2):56-62.

Dejene T (2014). Assessment of dairy cattle husbandry and breeding management practices of lowland and mid-highland agro-ecologies of Borana zone. Anim. Vet. Sci. 2(3):62-69.

Demissu H, Fekadu B, Gemeda D (2013). Early Growth and Reproductive Performances of Begait Cattle and their F1 Jersey Crosses in and around-Guduru, Ethiopia. Livestock Production and Research Center. ISSN: 2226-7522(Print) and 2305-3327 (Online).

Dereje T (2005). On-farm phenotypic characterization of cattle genetic resources and their production systems in South and North Wollo zones of Amhara region, North eastern Ethiopia. MSc Thesis, Alemaya university, Ethiopia. 111p.

Domestic Animal Diversity Information System (DADIS). (Access date: 20/11/2017) at http://dad.fao.org/, Number of breeds by species and country.

Ethiopian Agricultural Research Organization (EARO) (1999). Livestock research strategy (unpublished), Addis Ababa, Ethiopia.

Endashaw T, Tadelle D, Aynalem H, Woudyalew M (2011). Characterization of Mursi Cattle Breed in Its Production Environment, in Salamago Wereda, South-West Ethiopia. MSc Thesis Abstracts, School of Animal and Range Sciences of Alemaya University, Volume I (1980-2013).

Ethiopian Institute of Biodiversity Conservation (EIBC) (2004). The State of Ethiopia's Farm Animal Genetic Resources: Country Report. A Contribution to the First Report on the State of the World's Animal Genetic Resources. IBC. May 2004. Addis Ababa, Ethiopia.

Ethiopian Institute of Biodiversity Conservation (EIBC) (2012c). Ethiopia's Strategy and Plan of Action for Conservation, Sustainable use and Development of Animal Genetic Resources, Addis Ababa, Ethiopia.

Ethiopian Institute of Biodiversity Conservation (EIBC) (2014). Ethiopia's Fifth National Report to the Convention on Biological Diversity, Ethiopian Biodiversity Institute, May 2014, Addis Ababa, Ethiopia.

FAO (Food and Agriculture Organization) (1993). Livestock and improvements of pasture, feed and forage. Committee on Agriculture, 12th session, item 7, 26 April–4 May 1993. FAO, Rome, Italy.

Food and Agriculture Organization (FAO) (2005). Rome, Italy.

Food and Agriculture Organization (FAO) (2009). Contributions of Smallholder Farmers and Pastoralists to the Development, use, and Conservation of Animal Genetic Resources. Commission on Genetic Resources for food and Agriculture. Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture. 5th Session, Rome, 28-30 January 2009. 40 p.

Food and Agriculture Organization (FAO) (2011). Commission on genetic resources for food and agriculture: draft guidelines on phenotypic characterization of animal genetic resources, Rome.

Fasil G, Workneh A (2014). On-farm phenotypic characterization of indigenous cattle populations of Awi, East and West Gojjam Zones of Amhara Region, Ethiopia. Res. J. Agric. Environ. Manage. 3(4):227-237.

Feleke G (2003). Milk and Dairy Products, Post-harvest Losses and Food Safety in Sub-Saharan Africa and the Near East. A Review of the Small Scale Dairy Sector – Ethiopia. FAO Prevention of Food Losses Programme. FAO, Rome, Italy.

Gabriel H, Kiwuwa M, Mohamed Y, Kurtu M, Anderson D (1983). Crossbred dairy cattle productivity in Arsi region, Ethiopia. ILCA research report.

Gebeyehu G, Asmare A, Asseged B (2005). Reproductive performances of Fogera cattle and their Friesian crosses in Andassa ranch, Northwestern Ethiopia. Available at: http://www.lrrd.org/lrrd17/12/gosh17131.htm.

GebreWold A, Alemayehu M, Demeke S, Bediye S and Tadesse A (2000). Status of dairy development. Smallholder Dairy Development Project (SDDP) dairy research in Ethiopia. In: The role of village dairy co-operatives in dairy development. SDDP (Smallholder Dairy Development Project) Proceedings, MOA (Ministry of Agriculture), Addis Ababa, Ethiopia.

Getie A, Hile Melekot M, Taye M, Wuletaw Z, Tesfa A (2015). A Survey on Breeding Practice, and Productive Performance of Simada Cattle in Tach Gayint District, Ethiopia. J. Life Sci. Biomed. 5(6):171-180.

Getinet M (2005). On-station ex-situ phenotypic characterization of Ogaden cattle breed at Alemaya university. MSc Thesis, Alemaya university, Ethiopia. 119p.

Getinet M, Hegde B and Workneh A (2005). On Station Ex-Situ Phenotypic and Morphological Characterization of Ogaden Cattle at Alemaya University, Ethiopia. MSc Thesis Abstracts, School of Animal and Range Sciences of Alemaya University, Volume I (1980-2013).

Getinet M, Workneh A and Hegde BP (2009). Growth and Reproductive performance of Ogaden cattle at Haramaya University, Ethiopia. Ethiop. J. Anim. Prod. 9(1):1607-3835.

Gidey Y (2001). Assessment of calf crop productivity and total herd life of Fogera cows at Andasa ranch in northwestern Ethiopia. MSc thesis. Alemaya University, Ethiopia.

Goe M (1987). Animal traction on smallholder farms in the Ethiopian highlands. Cornell University, USA. (PhD Thesis).

Goshu M (1981). Evaluation of indigenous strains for milk production. In: Summary of Animal Production Research (1968-1980). December, 1981. Addis Ababa University and Debre Zeit Agricultural Research Centre.

Gryseels G (1988). Role of livestock on mixed smallholder farms in the Ethiopian highlands. A case study from the Baso and Worena Wereda near Debre Berhan. PhD dissertation submitted to Agricultural University, Wageningen, The Netherlands. 249 pp.

Habtamu L, Kelay B, Desie S (2010). Study on the reproductive performance of Jersey cows at Wolaita Sodo dairy farm, Southern Ethiopia. Ethiop. Vet. J. 14(1):53-70.

Hailemariam M, Mekonnen, G (1996). Reproductive performance of Zebu, Friesian and Friesian. Zebu crosses. Trop. Agric. 73:142-147.

Hamayun K, Sir ZM, Misri R, Rahmatullab R, Riaz M (2003). Use of Shaeffer's Formula for the Prediction of Body Weight of Slaughtering Cattle. Anim. Vet. Adv. 2(3):176-178.

Hegde BP (2002). Cattle Breeding Strategies to Improve Milk Production in Ethiopia (unpublished), Alemaya University, Ethiopia.

Ibrahim H, Olaloku E (2000). Improving cattle for milk, meat and traction. ILRI Manual 4. ILRI (International Livestock Research Institute), Nairobi, Kenya. 135p.

International Livestock Center for Africa (ILCA) (1991). Hand book of African livestock statistics Working document No.15, ILCA, Addis Ababa, Ethiopia.

Kiwuwa GH, Trail, JCM, Kurtu MY, Worku G, Anderson FM, Durkin J (1983). Crossbred dairy cattle productivity in Arsi region, Ethiopia. ILCA Research Report No.11. ARDU and ILCA, Addis Ababa, Ethiopia.

Laval G, Assegid W (2002). Traditional Horro Cattle Production in Boji District, West Wellega (Ethiopia). Ethiop. J. Anim. Prod. 2(1):97-114.

Menale M, Mekuriaw Z, Mekuriaw G, Taye M (2011). Reproductive performance of Fogera cattle at Metekel Cattle Breeding and Multiplication Ranch, North West Ethiopia. J. Anim. Feed Res. 1(3):99-106.

Meseret T, Berihu G and Berihun A (2014). Survey on Reproductive Performance of Smallholder Dairy Cows in Hawassa City, Ethiopia. J. Reprod. Infertil. 5(3):69-75.

Million T, Tadelle D (2003). Milk production performance of Zebu, Holstein Friesian and their crosses in Ethiopia. Livest. Res. Rural Dev. (15)3:1-9.

Ministry of Agriculture (MoA) (2004). Memorandum on the foreign trade regime: Ethiopia, main draft document (text), Addis Abeba, Ethiopia.

Ministry of Agriculture and Rural Development (MoARD) (2007). Livestock Development Master Plan Study, Phase I Report – Data Collection and Analysis, Volume B – Meat Production

Mulugeta A, Azage T, Hegde BP (2008). Reproductive performance of dairy cows in the Yerer Watershed, Oromiya Region, Ethiopia. Proceedings of the 16th annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia. Part II: Technical Session. pp. 219-229.

Mulugeta FG (2015). Production system and phenotypic characterization of Begait cattle, and effects of supplementation with concentrate feeds on milk yield and composition of Begait cows in Humera ranch, western Tigray, Ethiopia. PhD Dissertation, Addis Ababa University, College of Veterinary Medicine and Agriculture, Debre Zeit, Ethiopia.

Niraj K, Alemayehu E, Berihu G, Endale BG (2014). Reproductive performance of indigenous and HF crossbred dairy cows in Gondar, Ethiopia. IOSR J. Agric. Vet. Sci. 1(2):56-61.

Niraj K, Yemane A, Berihu G, Yohannes HW (2014). Productive and Reproductive Performance of Local Cows under Farmer's Management in and around Mekelle, Ethiopia. IOSR J. Agric. Vet. Sci. 7(5):21-24.

Ntombizakhe M (2002). Choice of genetic types for specific production environment and production system .Case studies (1999-2000) Animal genetics resource for sustainable agriculture and food production. ZaBelo Livestock Consultancy, Bulawayo, Zimbabwe.

Rege JEO (1999). The state of African cattle genetic resources I. Classification framework and identification of threatened and extinct breeds. Anim. Genet. Resour. Inform. Bull. 25:1-25.

Seid GG (2012). Assessment of cattle husbandry and marketing practices in Burji woreda, Segen zuria zone of SNNPRS, Ethiopia. MSc Thesis, Addis Ababa University, college of veterinary medicine and agriculture, Debrezeit, Ethiopia.

Shiferaw G, Hegde BP, Workneh A (2006). *In-Situ* Phenotypic Characterization of Kereyu Cattle Type in Fentalle District of Oromia Region, Ethiopia. MSc Thesis Abstracts, School of Animal and Range Sciences of Alemaya University, Volume I (1980-2013).

Solomon T, Tadelle D, Kefelegn K (2011). On-Farm Phenotypic Characterization of Boran Cattle Breed in Dire District of Borana Zone, Oromia Region, Ethiopia. MSc Thesis Abstracts, School of Animal and Range Sciences of Alemaya University, Volume I (1980-2013).

Takele T, Workneh A, Hegde BP (2005). On-Farm Phenotypic Characterization of Sheko Breed of Cattle and their Habitat in Bench Maji Zone, Ethiopa. MSc Thesis Abstracts, School of Animal and Range Sciences of Alemaya University, Volume I (1980-2013).

Tewelde G, Sintayehu Y, Sandip B (2017). Some morphometrical, production and reproduction traits of Begait cattle reared in Tigray region of Ethiopia. Wayamba J. Anim. Sci. – ISSN: 2012-578X; P1571 - P1585, 2017, First Submitted June 08, 2017; Number 1498735834.

Teweldemedhn M (2016). Characterization of Production System, Productive and Reproductive Performance and Morphological Traits of Begait Cattle in Western Zone of Tigray Region, Ethiopia. MSc Thesis, Haramaya University, Ethiopia.

Workneh A, Ephrem G, Markos T, Yetnayet M, Rege JEO (2004). Farm Animal Biodiversity in Ethiopia: Status and Prospects, Current State of Knowledge on Characterization of Farm Animal Genetic Resources in Ethiopia. Proceedings of the 11th Annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, August 28-30, 2003. ESAP, Addis Ababa. 441pp.

Yifat D, Bahilibi W, Desie S (2012). Reproductive Performance of Boran Cows at Tatesa Cattle Breeding Center. Adv. Biol. Res. 6(3):101-105.

Zemenu Y, Mekonen H, Kelay B, Bimrew A (2014). Characterization of dairy cattle production systems in Debremarkos district, Amhara Regional State, Ethiopia. Pacesetter J. Agric. Sci. Res. 2(4):42-51.

Zerabruk M, Vangeo M, Haile M (2007). The status of cattle genetic resources in north Ethiopia: on-farm characterization of six major cattle breeds. Anim. Genet. Resour. Info. Bull. 40:15-32.

Zewdu W (2004). Indigenous cattle genetic resources, their husbandry practices and breeding objectives in North western Ethiopia. MSc Thesis, Alemaya University, Ethiopia. P 128.

academicJournals

Vol. 9(3), pp. 42-49 March 2018
DOI: 10.5897/IJLP2017.0422
Article Number: F5DEE9255948
ISSN 2141-2448

http://www.academicjournals.org/IJLP

International Journal of Livestock Production

Full Length Research Paper

Variations in village chicken management packages in two agro-ecological zones of Tanzania

Lenox Omondi Pius[1,2*] and Said Hemed Mbaga[2]

[1]Ministry of Livestock and Fisheries, P. O. Box 2870, Dodoma, Tanzania.
[2]Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture, P. O. Box 3004, Morogoro, Tanzania.

Received 7 November, 2017; Accepted 3 January, 2018

This study was conducted in two regions namely, Mbeya in southern highlands (Cool) and Singida in central (semi-arid) Tanzania. Currently, the African Chicken Genetic Gain (ACGG) project is testing tropically high producing adapted breeds in these areas. The objective of this study was to assess status of chicken management practices following the introduction of improved strains. In addition, five attitudinal statements describing different management elements were used to measure farmer's perception on the effect of the use of improved management intervention on production performance of their chicken. A total of 156 households representing 44% (352) of the intervened households were interviewed using semi-structured questionnaire at 48 weeks following introduction of the improved breeds. Data for management practices (housing, feeding and healthcare practices) were assessed using scoring method. For every management aspect, management index was calculated as the proportion of the total score obtained by individual farmer to that of the possible maximum score. The overall result of the present study indicates that most farmers fall under medium status (0.41-0.6) of chicken production practices. Farmers from southern highland zone had better management indices with respect to housing and feeding than those from the central zone. Despite the medium level of management, majority of the respondents in both ecological zones (74.4%) had positive attitude towards influence of management practices on chicken performance. For the improved strains to perform optimally under rural environment, a holistic approach focusing on management elements should be emphasized.

Key words: Management practices, improved breed, rural chicken production.

INTRODUCTION

In recent years, rural poultry genetic improvement programs in tropical countries has often been directed towards adoption of improved chicken breeds that are better in terms of productivity, adaptability and disease resistance (Wondmeneh et al., 2014; Reta et al., 2012; Habte et al., 2013). Basically, such improved breed were developed following low productivity of local chicken and considerable reduced livability of exotic and or cross breeds under extensive management system. Rural poultry genetic improvement program with almost similar

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

is underway in Tanzania. The African Chicken Genetic Gain (ACGG) project is currently testing selected improved breeds for their production and livability potential under rural smallholder conditions in various ecological zones of Tanzania. The main objective of this project among many others, is to improve the livelihood of poor rural farmers, women in particular through introduction of more productive and agro-ecologically adaptable chicken strains. However, experience from previous studies has shown that single intervention to end users had low impact (Wondmeneh et al., 2014; Reta et al., 2012), thus, suggesting that multiple interventions through combined inputs and breed have great likelihood of attaining better impact and sustainability of the interventions. Nevertheless, even where interventions were made, some farmers who are expected to be the end users do not effectively utilize them while expecting better performance (Lyimo, 2013). As a result, majority of farmers often hardly realize full production potential of their flock and thus may lead to negative perception towards the potential of the improved strains. Furthermore, existing studies that investigate the adoption of new agricultural technology in developing countries have failed to consider how farmers' subjective perceptions and subsequent preference of technology affect their adoption decisions (Adesina and Baidu-Forson, 1995).

This study was therefore undertaken to characterize poultry management practices of the beneficiary households, to assess farmers perception towards improved management practices and identify constrains faced by farmers in the intervened areas of southern highlands and central zones of Tanzanian. The results are expected to help the project and other developmental agencies to identify critical entry points that need immediate attention and to select the most appropriate innovation for village chicken production improvement.

MATERIALS AND METHODS

Description of the study area, experimental layout and design

This study was conducted among the intervened villages of southern highlands (Mbeya region) and central zones (Singida region) of Tanzania. Singida region receives rainfall of between 500 and 800 mm per annum. Rainy season commences in November to April whereas, the dry season covers months of May to October. The temperature range is between 15 and 30°C. Mbeya region on the other hand, is located in the south western corner of the Southern Highlands of Tanzania. The region stretches from low altitude of 475 to 2981 masl in the highlands. Average temperature ranges from 16 to 25°C. The region enjoys abundant and reliable rainfall varying from 650 to 2600 mm. The rains normally commence in October to May.

Sampling and sample size

The study involved two intervened districts in each ecological zone. Two out of the four villages from each district were selected for detailed household management study. Quantitatively, a total of 156 out of 176 targeted beneficiary households in the eight selected villages (22 households per village) were successfully interviewed. The household selected represented 44% of the total intervened household (352) in the study zones which had previously received pre-vaccinated, 42 days old chicks of either the two improved breeds namely; Sasso and Kuroiler. The chicks were vaccinated against Mareks and Newcastle at the hatchery, followed by Infectious Bronchitis (IB) at 0, 7 10, 16 and 21 days. Newcastle vaccine was repeated at 10 and 21 days using Lasota vaccine. At 6 weeks, the chicks were again vaccinated for fowl pox before being distributed to farmers. Selected households were those with experience of at least 2 years in keeping chicken and had less than 50 local chickens before the new strains were introduced as per ACGG protocol.

Data collection

Data on poultry management practices from beneficiary households were assessed when the allocated strains had reached 48 weeks of age. Basically, the management aspects assessed were those hypothesized to have direct positive effect on chicken productivity, that is, improved housing, general bio-security status, supplementation level, disease control measures and perception of farmers towards the impact of management practices on overall chicken productivity. Farmers were interviewed using pretested questionnaire and on-site observation to assess the extent of use of the recommended poultry management practices. Farmer's levels of awareness on the effect of management practice on chicken performance were also assessed. Furthermore, constrains that farmer's faces during the study period were also inquired. From the list of the challenges captured, only the first five challenges that had highest frequency were considered.

Determination of management practices level of the respondents

Diseases and health care control measures

The following healthcare elements were used to assess participating households: (i) vaccination against Newcastle diseases; (ii) vaccination against fowl pox; (iii) provision of prophylactic measures; (iv) poultry house disinfection; (v) separation of sick birds from healthy ones and (vi) treating of sick birds. For every healthcare element studied, a score of 1 or 0 was assigned to users or non-users, respectively. Thus, with respect to all healthcare elements studied, the minimum and maximum theoretical score individual farmer could score was 0 and 6 marks, respectively.

Supplementation level

The following elements of feeding were studied: (i) amount supplemented per bird per day; (ii) quality of supplements and (iii) frequency of supplementation. With regards to amount of feed supplemented per bird per day, individual farmer were further ranked into five levels (i) nil; (ii) poor (20 g and below); (iii) inadequate (between 20 to 30 g); (iv) adequate (anything above 40 g) and (v) *ad libitum* feeding.

Regarding the quality of supplementing material, individual farmers were further ranked into five levels considering that the complete diet has to contain ingredients having carbohydrates, fat, protein, minerals or vitamins as follows: The levels were (i) nil/kitchen left overs; (ii) supplemented grains and or their by-products only; (iii) supplemented grains plus oils seeds cakes or

legumes; (iv) supplemented number (i) and (ii) above plus commercial feed ingredients; (v) commercial diet. Lastly, individual farmers were further ranked into five levels with regards to regularity of feeding, that is, (i) occasional feeding; (ii) at least once in a week; (iii) 2 to 3 times in a week; (iv) once per day and (v) 2 to 3 times a day. For all feeding elements studied, Likert scales of 0 to 5 points were allocated to the respective levels according to Parveen (2008) and Elkashef et al. (2016). Finally, the overall score per respondent with regards to supplementation practice was obtained by summing up the score obtained from all the three feeding practices. Thus, with reference to the sub-elements of feeding, the lowest and highest possible score individual farmer could score was 0 and 15 points, respectively.

Poultry housing condition

The following elements of improved poultry housing were used to assess housing structure of participating households: (i) ventilation status and orientation; (ii) spacing requirement of chicken; (iii) floor status; (vi) roof status (spillage); (v) presence of feeder and drinkers; (vi) presence and quality of litter/bedding material; (vii) general hygiene status. The housing structure in this context was not necessarily built using expensive materials to be ranked high but rather to meets the basic requirements regardless of construction materials used. From the developed scale, poultry housing elements were ranked with four levels, that is, (i) poor; (ii) moderate; (iii) good and (iv) very good. A Likert scale of 0 to 4 points was assigned to the respective levels as per Parveen (2008) and Elkashef et al. (2016). Similarly, the overall score per respondent with regards to housing practice was obtained by summing points obtained from each poultry housing element. Thus, with respect to the seven studied housing elements, the minimum and maximum possible score individual farmer could score was 0 and 28 points, respectively.

Determination of famer's perception towards poultry management intervention

Likert scale was used to measure farmer's perception on the effect of the use of improved management intervention on production performance of their chicken. A total of five attitudinal statements describing different management elements were used. After data transformation, a Likert scale was categorized into negative, neutral and positive into which a score of 1, 2 and 3 points were allocated into respective categories. The total score for individual respondent was obtained by summing up the score obtained from all five attitudinal statements. Thus, the highest, middle and lowest possible points were 15, 10 and 3 points, respectively. In this regard, farmers who scored 1 to 9 points were considered to have negative attitude while those who scored 11 to 15 stood for positive attitude. Farmers that scored 10 were considered to have neutral attitude.

Data analysis

All descriptive data collected were coded and analysed for each variable investigated using SPSS version 20.0 (SPSS, 2016).With regards to management data, the total score for individual farmer were used to calculate management index (MI) with respect to the three intervention categories. In all cases, management index was calculated as the proportion of the total score obtained by individual farmer to that of the total scores, that is:

$$\text{Management index (MI)} = \frac{\text{Respondent total score}}{\text{Sum of the total score for a given technology}}$$

Based on computed management index values, participating households were categorized into four management levels: (i) low level (MI 0 to 0.40); (ii) medium level (MI 0.41 to 0.6); (ii) high level (MI 0.61 to 0.80); (iii) very high level (MI 0.81 and above). Cross tabulation analysis was thereafter used to compare management levels to particular technology elements between the two ecological zones. Descriptive statistics such as frequency distribution, percentages and mean were used for categorization of description of the variables. T-test and Chi-square were used to identify whether the differences between zones means were statistically different. Furthermore, multiple linear regression analysis was used to measure association between management indices of the respondents as dependent variable against respondent's socio-demographic and related factors as independent variables.

RESULTS

Respondent's characteristics

Table 1 shows that female constituted majority of the respondents (82.3%). The mean age of the respondents in both zones was 37 years with the mean chicken farming experience of 17 years. Only 20.5% of the respondents had secondary educational level and beyond. The remaining proportions (78.5%) had primary education or were semi illiterate. Southern highland zone had more households rearing their chicken under partial confinement (84.6%) while the predominant system (76.9%) for the central zone was free range.

Management level categories of the respondents

Management level categories of the respondents for the three management aspects are presented in Table 2. Southern highland zone had about 50% of the households who had fairly good housing for their chicken with better feeding (56.4%). Overall, 41% of the households had better management followed by 35.5% who scored medium.

In the central zone, most of the visited households kept their chicken in poor housing structure (48%) and only 16% scored higher. Similarly, feeding was poor for almost two third of the households. Overall, 56.4% of the household fell under medium level of management. With regards to healthcare, there was almost equal distribution of respondents in the three categories.

Management index score between zones

Management index score for the two zones are presented in Figure 1. There was significant difference in management level indices with respect to housing ($P>0.05$) and feeding practices ($P>0.05$) for the two zones in favour of southern highland zone. Healthcare practices were almost similar in the two zones. Overall, management index further revealed significant difference between the two zones.

Table 1. Socio-demographic information of the respondent (N=156), for the two agro-ecological zones.

Variables		Agro-ecological zones		Overall means
		Southern Highland zone	Central zone	
Gender	female	60(76.9)	70(89.1)	130(82.3)
	Male	18(23.1)	8(11.4)	26(17.7)
Education level	Secondary education and above	18(23.1)	14(17.9)	32(20.5)
	Primary education and below	60(76.9)	64(82.1)	124(78.5)
Management system	Partial confinement	60(76.9)	12(15.4)	72(46.2)
	Free range	12(15.4)	66(84.6)	78(50.0)
Age of farmer (years)		35.96	37.98	36.9
Chicken farming experience (years)		15.36	18.64	17.0

Numbers outside and inside parenthesis represents respondent number and percentage respectively.

Table 2. Proportion of household within agro ecology by management level categories.

Recommended practice	Agro-ecological zone							
	Southern highland zone				Central zone			
	Poor	Medium	High	Very high	Poor	Medium	High	Very high
Housing structure	18(23.1)	22(28.2)	38(48.7)	0(0.0)	38(48.7)	32(41.0)	8(10.3)	0(0.0)
Feed and feeding	26(33.3)	44(56.4)	8(10.3)	0(0.0)	52(66.6)	26(33.3)	0(0.00)	0(0.0)
Healthcare	12(15.3)	30(38.5)	32(41.0)	4(5.1)	30(38.5)	16(20.5)	28(35.9)	2(2.6)
Overall	18(23.1)	28(35.5)	32(41.0)	0(0.0)	30(38.5)	44(56.4)	4(5.10)	0(0.0)

Poor = 0.0 to 0.41, Medium = 0.41 to 0.6, high = 0.61 to 0.8, = very high = 0.81 to 1. numbers outside and inside parenthesis represents respondent number and percentage, respectively.

Relationships between management indices and some characteristics of the respondents

Out of the five elements used to characterize the respondents, only two: awareness level and management system adopted (P>0.05) positively affected the overall chicken management indices of participating households (Table 3). The result further shows that sex of the farmer, educational level and poultry keeping experience had no influence on level of management.

Farmer's perception of the interventions

The results for farmer's perception on the importance of poultry management practices on overall productivity are presented in Table 4. There was no significant difference in farmer's perception between agro-ecological zones. Majority of the respondents in both zones (74.4%) had positive attitude towards effects of management interventions on overall flock , while 10.3 and 15.4% had neutral and negative perception, respectively.

Constraints encountered by farmers during the study period

The predominant constrains as perceived by farmers are presented in Table 5. Low price of eggs, high feed cost, diseases, predation and retained eggs in that order, were the first five frequently mentioned constraints.

DISCUSSION

High percentage of women in the current study (82.3%) validated the findings that poultry keeping activity in rural areas is fully in the domain of women (Muchadeyi et al., 2007; Ali, 2012). This observation was expected since more women were recruited in the project using chicken keeping as potential opportunity for their empowerment. Nevertheless, gender of person, educational level and age did not significantly influence overall management level. The difference in management systems observed in the two zones may thus be explained by other socio-economic factors including the relative size of land available for livestock and crop production. The intervened villages in Southern highland are located in peri-urban areas where land is limited but with better access to inputs and markets, while, the villages in Central zone were spatially populated with ample scavenging area but with limitations in market access. The observation conforms to ILRI (1995) report that intensity of production in smallholder agricultural is likely to be higher in areas with small area of land since under

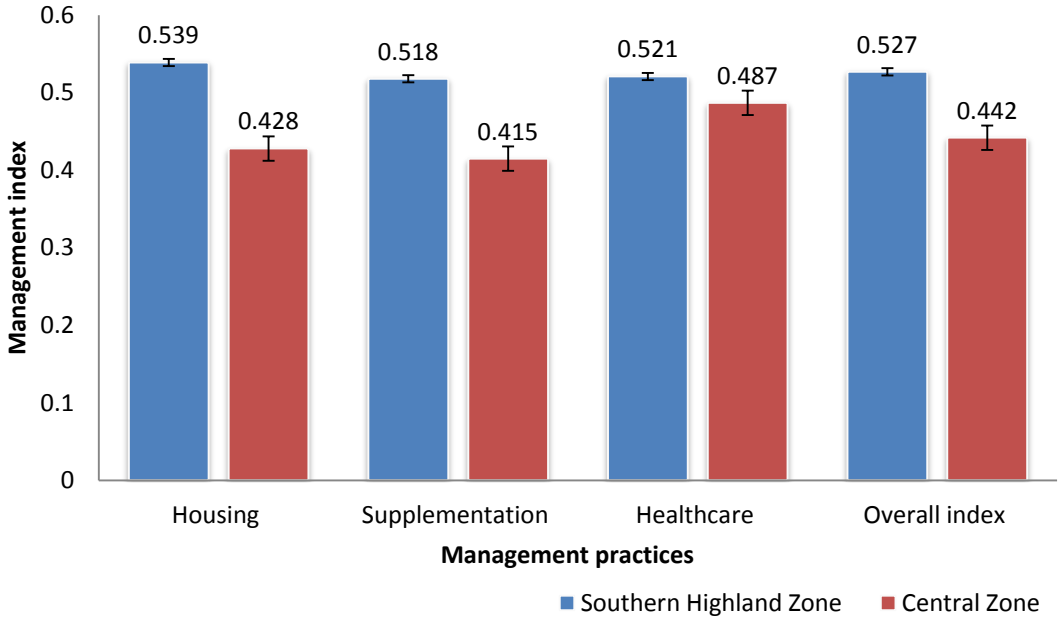


Figure 1. Management index score for the three management aspects by zone.

Table 3. Influence of socio-demographic and related factor on overall management index.

Variables	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
(Constants)	0.136	0.72		1.898	0.060
Sex of the farmer	0.005	0.026	0.014	0.204	0.838
Age of the farmer	-0.002	0.002	-0.115	-0.973	0.332
Level of education of the farmer	0.039	0.023	0.115	1.188	0.093
Management system of the farmer	0.092	0.020	0.341	4.698	0.000
Farming experience of rearing chicken	0.005	0.002	0.265	2.213	0.078
Awareness of the farmer	0.336	0.071	0.337	4.730	0.000

Multiple R = 0.565[a], R^2 = 0.319; Adjusted R^2 = 0.262; Std. Error of the estimate = 0.11706; F-statistics = 5.552, F significance = 0.000[b]; Dependent variable: Overall management index.

Table 4. Overall perception index categories of respondents in the two agro-ecological zones.

Categories	Agro-ecological zone		Total	χ2	df	P-value
	Southern highland zone	Central zone				
Negative	8(10.1)	16(20.5)	24(15.4)			
Neutral	6(7.70)	10(12.8)	16(10.3)	4.908[a]	2	0.086
Positive	64(82.0)	52(66.6)	116(74.4)			

Numbers outside and inside parenthesis represents respondent number and percentage respectively.

search circumstance, farmers will strive to maximize production. Cooler and abundant rain in Southern highland zone may imply intense agriculture activities as compared to semi-arid central zone which in a way could have instilled positive influence on entrepreneurship tendencies. The results conform to what was reported by Tsadik et al. (2015) in Ethiopia where higher adoption rate (48.3%) of poultry technologies was found in the

Table 5. List of challenges encountered by farmers in their order of importance.

Constrains	Responses		
	N	Percentage	Percentage cases
Low eggs prices	118	34.1	76.6
Feeding cost	100	28.9	64.9
Diseases	72	20.8	46.8
Predators	42	12.1	27.3
Retained eggs	14	4.0	9.1

highlands as compared to 33.3% in the lowland agro-ecologies. Despite the observation that educational level did not influence level of management significantly, UNESCO (2012) contended that education is a key socio-economic factor that can enhance the ability of farmers to adopt new agricultural innovations. Likewise, the observed mean age of household heads of approximate 37 years falls within the economic active age group which is comparable to the mean age of 36 years reported for rural poultry farmers in coastal region of Tanzania (Lyimo, 2013).

Availability of feeds and feeding practices are critical in ensuring that farmers optimise the genetic capacity of the flock. Moreover, the difference in management practices with respect to supplementation seems to be rather influenced by the agro-ecologies whereby availability of feeds throughout the year can dictate whether the farmer adopt semi-intensive or scavenging mode of production. For example, Alem (2014) and Habte et al. (2013) reported slightly better performance of both local and exotic breeds in mid-highland than in the lowland ecologies of Ethiopia due to availability of feeds and favourable environment. Likewise, proximity of households as was the case in Southern highland also meant that there was limitation in terms of scavenging feed resource, thus further explain why semi-intensive system was common in this zone. Despite the difference in feeding management, almost all farmers (96.2%) from both ecological zones provided one form or another of supplementary feeds. These results are in agreement with the findings of Lyimo (2013) in Tanzania, Tadesse et al. (2013) in Ethiopia and Elkashef et al. (2016) in India which showed that over 95% of chicken owners in respective study areas supplemented their birds.

Regarding quality of supplementing material, grains and their by-products (maize, sorghum, and rice) and sunflower seed cake appears to be the most important feed resource commonly used by farmers in the two zones. Nonetheless, availability of these feed resources was influenced by season and competition between human and livestock. Farmers reported increased use of supplement during harvesting period and much less during wet season. Previous study by Goromela et al. (2007) in central region of Tanzania observed similar pattern with seasonal availability of feed. Again, the need for cash under smallholder condition during the dry season compel the farmers to sell stock of crops that could have been used to smoothen supplementation of birds during lean periods. These findings suggest the necessity of developing a practical feed supplementation strategy and feed conservation techniques for rural farmers based on estimated scavenging feed resource in the study area.

Furthermore, commercial feed was not an important feed resource in both regions due to prohibitive costs and accessibility. Few farmers especially from southern highland zone used home-made formulations and in some cases, vitamins and bone meals were added. The findings are in agreement with the observation made by Lyimo (2013) and Goromela et al. (2007), in Tanzania, Tadesse et al. (2013) in Ethiopia and Ali (2012) in Sudan noted that commercial feeds and the use of premixes is rare in rural areas. Thus, depending on the season, birds are liable to under nutrition and may explain the often poor performance reported for both local and improved strains (Reta et al., 2012; Wondmeneh et al., 2016).

It was observed that most of the farmers provided some forms of housing for their chickens. However, there was a huge variation in the quality of housing structure across the zones; those from southern zones at least met the minimum standards as compared to those of central zone. Thus, the quality of houses and overall management could be influenced by the level of agriculture productivity which implies better income. Under such circumstance, farmer may perceive the development projects differently hence their willingness to invest. This observation conforms to what was reported by Dorji and Gyeltshen (2012), Tadesse (2013) and Elkashef et al. (2016). As such, most primitive poultry houses and inadequate feeders and drinkers were found in households practicing free range system, suggesting the influence of socio-economic background on level of technology adoption.

On biosecurity, it was anticipated that the levels of biosecurity under rural environment cannot match with prescribed standards for commercial poultry production. Given the training and support extended by the project, majority of farmers adopted ectoparasite control practices as well as vaccination for major diseases such as New castle, Fowl pox and infectious bronchitis. Vaccination

was done to both introduced and the local strains, following project interventions as part of the management packages. Lyimo (2013) in Tanzania and Khandait et al. (2011) in India found that de-worming was uncommon practice in rural setting of developing countries probably due to insufficient knowledge. Nevertheless, all farmers vaccinated their chicken against new castle disease and fowl pox. Newcastle disease (ND) has been ranked the greatest killer disease of free-ranging local chickens in Tanzania (Swai et al., 2007; Minga et al., 1989) and thus its control is very critical in any program seeking to improve rural poultry production. Other diseases which were commonly reported included Coccidiosis, fowl Coryza, fowl typhoid and vitamin A deficiency.

Despite the differences in management levels between the two ecological zones, the overall results indicated that most of the households were responsive in adopting recommended management practices. Lyimo (2013) in Tanzania, Tsadik et al. (2015) and Tadasee et al. (2013) in Ethiopia had similar observation in areas where there were external interventions. Such observations auger well with the fact that majority of farmers had positive perception on influence of best practices in management (74.4%). This could be attributed to the level of awareness created before introduction of the improved breed and extension support consistently provided by the project. Likewise, the project provided pre-vaccinated brooded chicks when they were 42 days. This reduced the higher incidences of chick mortality commonly observed in scavenging mode of production and likely to have raised the farmers' confidence. Minga et al. (1989) and Alexander et al. (2004) showed that vaccination against Newcastle alone can significantly reduce chicken mortalities in rural areas. Apparently, adoption of innovation is a process that can be influenced by the nature of the project and other externalities. For example, Tsadik et al. (2015) in Ethiopia observed that on introducing new technologies, initially, some farmers tended to have either negative or positive perception about the technology. Later on, it was observed that, most of the farmers developed positive perception following their participation and only a few still had negative or neutral perception. Wondmeneh et al. (2016) contends that purposive selection of participating households based on prior experience in chicken production had influence on the overall perception. In the current study, recruited farmers were also required to have at least chicken keeping experience of two years. Even though majority of respondent had positive attitude, the overall level of management observed in this study was at medium level index suggesting that other factors more than awareness level might have contributed to the status. For instance, majority of respondents who did not use the recommended management practices claimed to be aware of their importance although low financial status and a number of other constrains such as low egg prices, high cost of inputs, diseases and predations remained their major challenges. These constraints can therefore partly explain why farmers were reluctant to fully adopt the management practices, especially if they are not guaranteed with market. Wondmeneh et al. (2016) reported that as long as farmers are assured of getting profit, he/she is also likely to invest in technologies. In general, small family poultry producer have poor levels of knowledge on how to raise their birds profitably. And therefore, productivity and the rate of output/rate of input will likely be affected by various socio economic factors such as motives for keeping poultry, flock size and economic cost (of stock, feed and health maintenance). Given the level of management and farmers' perceptions on the contribution of management to overall productivity, the study seek to further establish to what extent the observed levels of management influence the actual birds' performance.

CONCLUSION AND RECOMMENDATIONS

On the basis of the important findings of the study, the following conclusions are drawn and presented.

1. Overall management level of farmers in the study areas were medium and influenced by agro-ecology and level of awareness created
2. Majority of the farmers had positive perception that improved management will have positive impact on overall performance of their birds.
3. In order to optimize productivity of introduced improved strains of chicken in rural areas, a holistic approach that addresses critical management elements is recommended.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Adesina A, Baidu-Forson J (1995). Farmers' perceptions and adoption of new agricultural technology: Evidence from analysis in Burkina Faso and Guinea. West Afr. Agric. Econ. 13:1-9.

Alem T (2014). Production and reproduction performance of rural poultry in lowland and midland agro-ecological zones of Central Tigray, Northern Ethiopia. Afr. J. Agric. Res. 9(49):3531-3539.

Alexander D, Bell J, Alders R (2004).Technology Review: Newcastle disease with special emphasis on its effect on village chickens. FAO Animal Production and Health. pp161. Rome, FAO. P 63.

Ali S (2012). Family poultry as a tool in alleviating environmental hazards in settled areas of transhumant families in Gezira scheme Sudan. Asian J. Rural Dev. 2(1):1-12.

Dorji N, Gyeltshen T (2012). Characterisation of family poultry production in Haa and Mongar districts of Bhutan. LivesT. Res. Rural Dev. 24(155).

Elkashef MSO, Sarmiento-Franco L, Torres-Acosta JFJ (2016). Backyard Chicken Production Skills of Rural Women in Yucatán, México. Asian J. Agric. Exten, Econ. Sociol. 10(1):1-12.

Goromela EH, Kwakke RP, Verstegen MWA, Katule AM (2007). Effect

of season and farming system on the quantity and nutritional quality of scavengeable feed resources and performance of village poultry in central Tanzania. J. Cell. Anim. Biol. 2(3):063-071.
Habte M, Ameha N, Demeke S (2013). Production performance of local and exotic breeds of chicken at rural household level in Nole Kabba Woreda, Western Wollega, Ethiopia. Afr. J. Agric. Res. 8(11):1014-1021.
International Livestock Research Institute (ILRI) (1995). Major Livestock Production Systems in Africa. Livestock Policy Analysis, ILRI Training Manual 2, ILRI, Nairobi, Kenya.
Khandait V, Gawande N, Lohakare SH, Dhenge SA (2011). Adoption level and constraints in backyard poultry rearing practices at Bhandara District of Maharashtra, India. Res. J. Agric. Sci. 2(1):110-113.
Lyimo HE (2013). Impact of adoption of improved local chicken production methods in Tanzania: Case study of UMADEP and ILRP SUA projects. MSc. Dissertation. Sokoine University of Agriculture, Morogoro, Tanzania. P 66.
Minga UM, Katule AM, Maeda T, Musasa J (1989). Potential and problems of the traditional chicken industry in Tanzania. In proceedings of the 7th Tanzania Veterinary Association Scientific Conference, pp. 207-215.
Muchadeyi F, Wollny C, Eding H, Weigend S, Makuza M, Simianer H (2007).Variation in village chicken production systems among agro-ecological zones of Zimbabwe. Trop. Anim. Health Prod.39:453-446.
Parveen S (2008). Access of rural women to productive resources in Bangladesh: Apillar for promoting their empowerment. Int. J. Rural Stud. 15(4):001-008.
Reta D, Negussie D, Alemu Y (2012). Comparative production performance of two exotic chicken breeds under two different feed regimes in three agro-ecologies of central Oromia, Ethiopia - a step forward for distribution or contract rearing of day old exotic chicks under rural setting. Livest. Res. Rural Dev. 24(153).
Swai ES, Karimuribo ED, Kyakaisho PF, Mtui PF (2007). Free-range village chickens on the humid coastal belt of Tanga, Tanzania: their roles, husbandry and health status. Livest. Res. Rural Dev. 19(104).
Tadesse D, Harpal, SH, Mengistu M, Wondimeneh E, Tadelle D (2013). Study on productive performances and egg quality traits of exotic chickens under village production system in East Shewa, Ethiopia. Afr. J. Agric. Res. 8(13):1123-1128.
Tsadik ET, Tamir, Sahile Z (2015). Characterization of the adoption of village poultry technology package elements, chicken breeds and forms in the Central Oromia Region, Ethiopia. J. Econ. Sustain. Dev. 6(13).
United Nations Educational, Scientific and Cultural Organization (UNESCO) (2012). Adult and Youth Literacy. UNESCO Institute for Statistics (UIS) Fact Sheet No. 20.
Wondmeneh EH, Van der W, Udo HMJ, Tadelle D, Van Arendonk JAM (2016). Village poultry production system: Perception of farmers and simulation of impacts of interventions. Afr. J. Agric. Res. 11(24):2075-2081.
Wondmeneh E, Van der W, Tadelle D, Udo HMJ, Van Arendonk JAM (2014). Adoption of exotic chicken breeds by rural poultry keepers in Ethiopia. Acta Agric. Scand. 64(4):210-216.

academicJournals

Vol. 9(3), pp. 50-66, March 2018
DOI: 10.5897/IJLP2017.0423
Article Number: 01FFFD655950
ISSN 2141-2448

http://www.academicjournals.org/IJLP

International Journal of Livestock Production

Full Length Research Paper

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.

Received 10 November, 2017; Accepted 20 December, 2017

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.

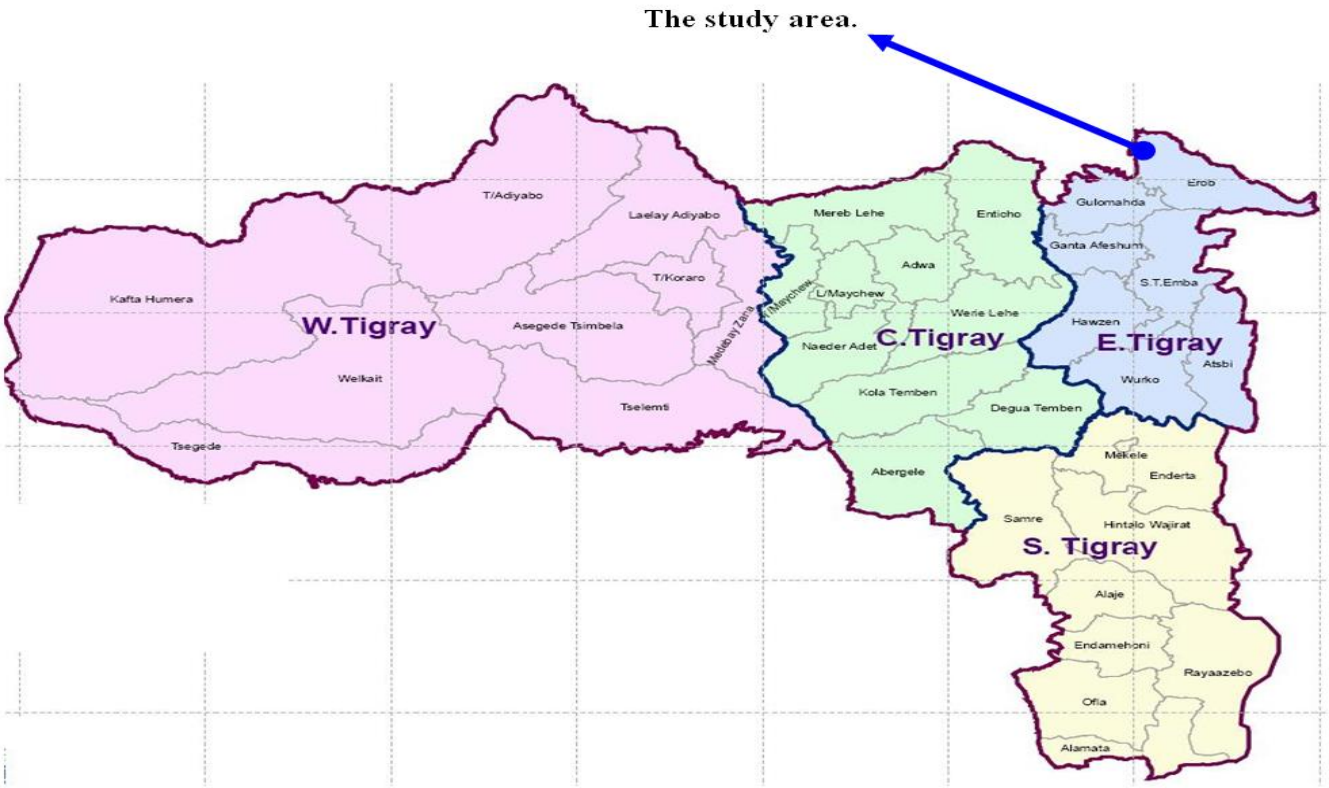


Figure 1. Map of the study area Source: http://www.tigraionline.com/tigrayGIF.gif

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

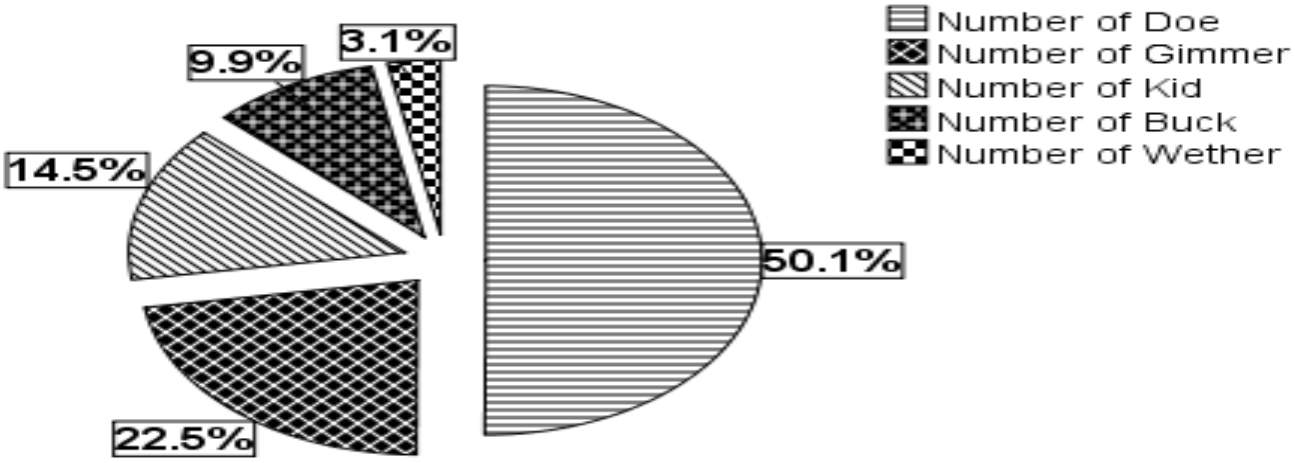


Figure 3. The overall mean goat flock composition of the household.

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

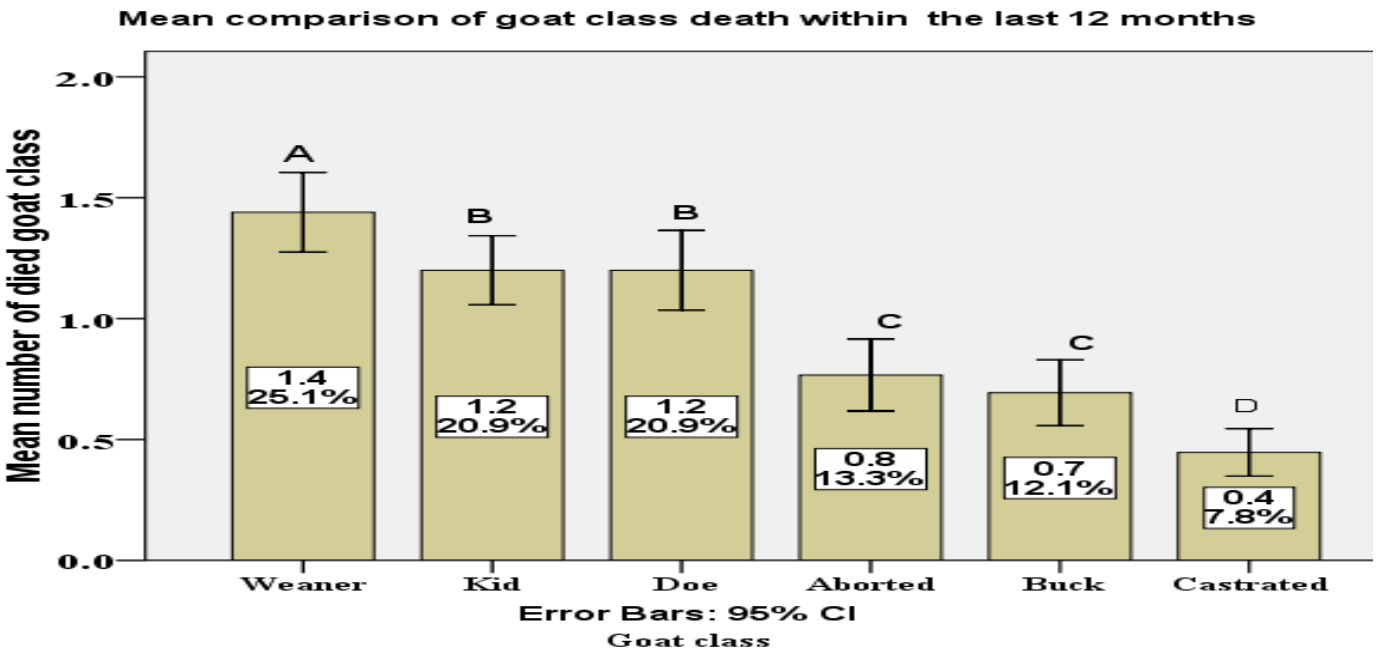


Figure 5. Mean number of goat class died within household flock.

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

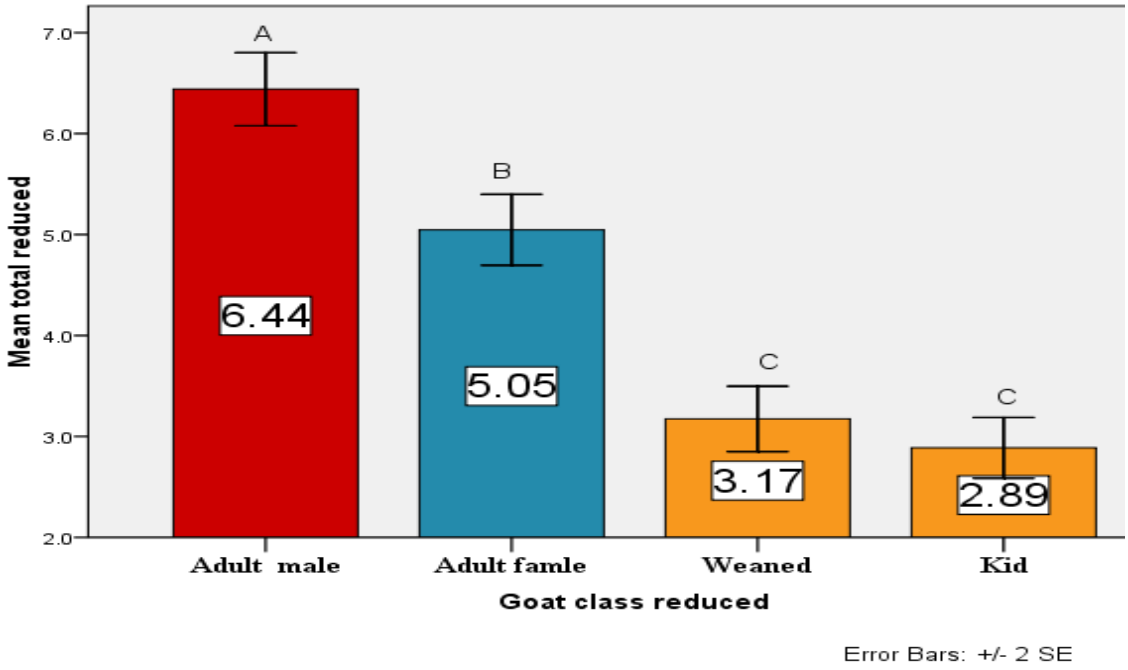


Figure 6. Mean total exit of the goat class from the goat flock.

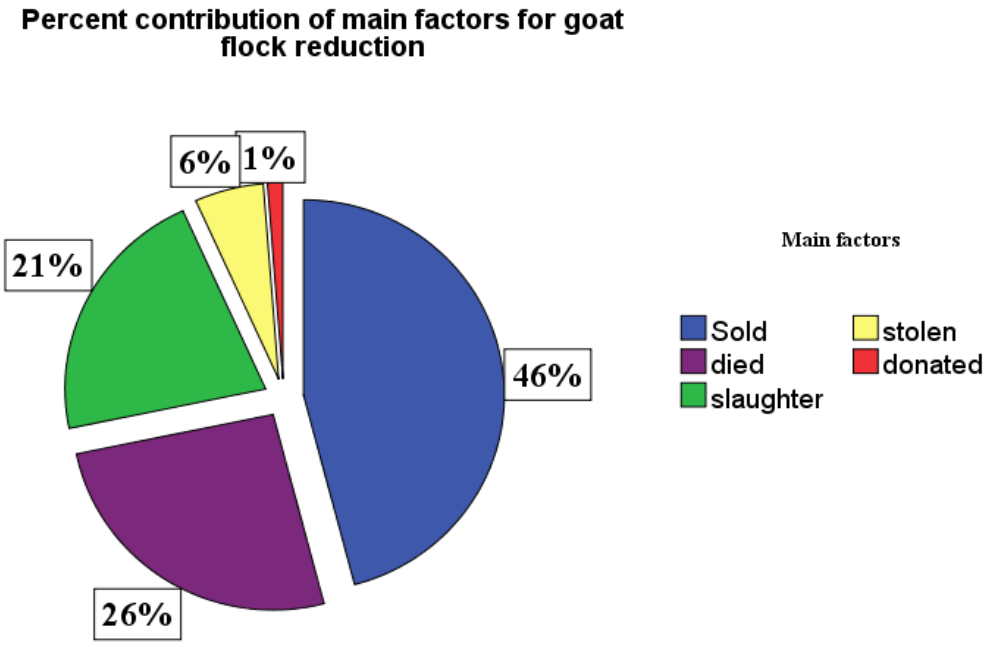


Figure 7. Factors of exit from the goat flock per households.

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%.

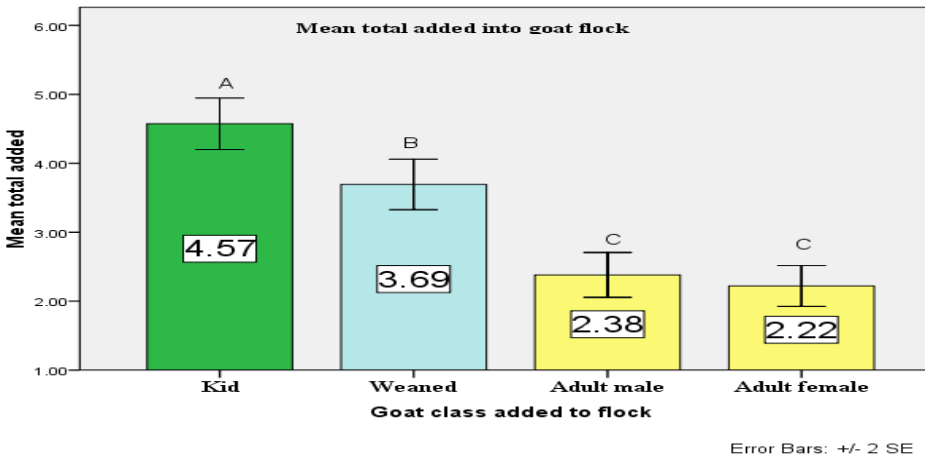


Figure 8. Mean total entry of the goat class from the goat flock.

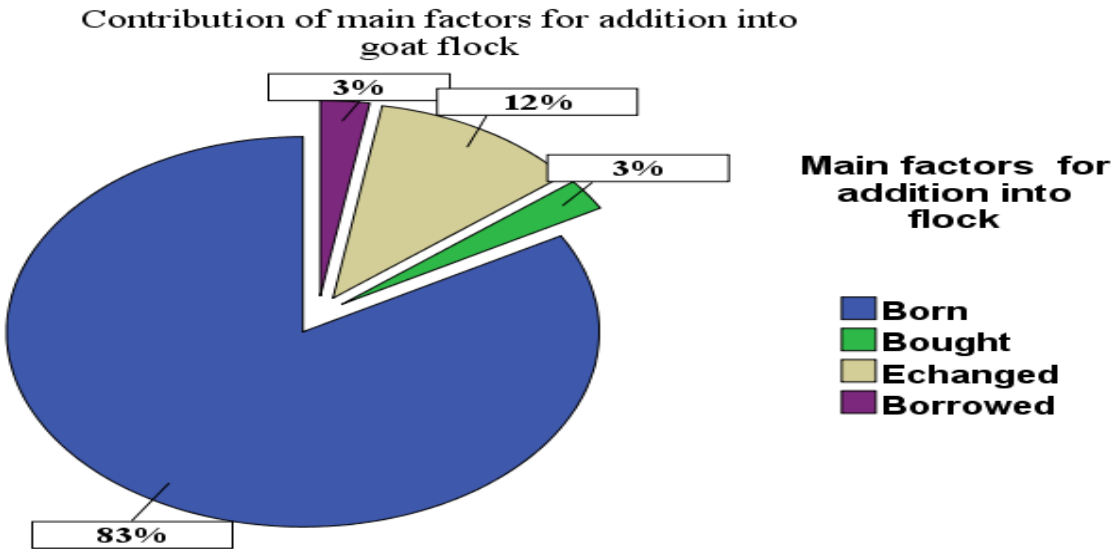


Figure 9. Contribution of the main factors of addition into the goat flock per households.

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

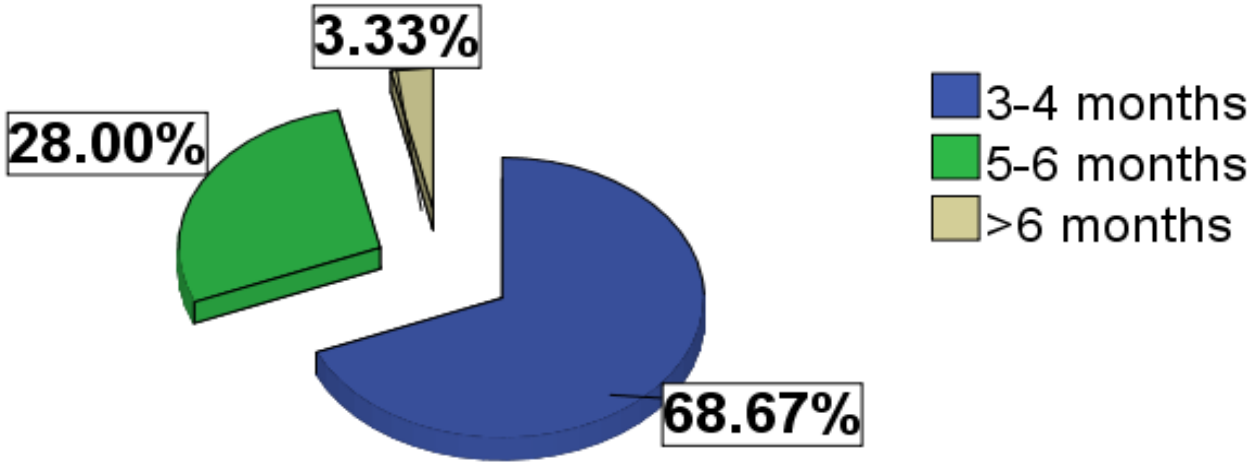


Figure 10. Average weaning age of the kids of Maefur goat breed.

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,

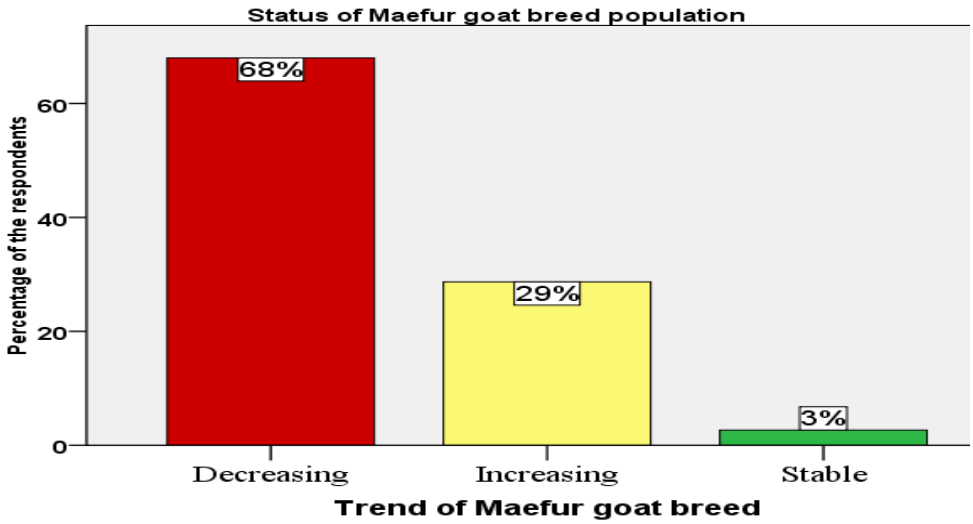


Figure 11. Trend of Maefur goat breed population in the study site (their number per household).

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.

ACKNOWLEDGEMENT

Authors appreciate Mekelle Agricultural Research Center for the financial support granted.

REFERENCES

Adugna T, Aster A (2007). Livestock production in pastoral and agro-pastoral production systems of southern Ethiopia. Livest. Res. Rural

Dev. 19:177. http://www.lrrd.org/lrrd19/12/tole19177.htm .Accessed on August 12, 2017.
Adane H, Girma A (2008). Economic significance of sheep and goats. In: Alemu Yami and R.C. Merkel (eds.). Sheep and Goat Production Handbook of Ethiopia. ESGPIP (Ethiopian sheep and goat productivity improvement program). Branna Printing Enterprise. Addis Ababa, Ethiopia. pp. 325-340.
Alefe TA (2014). Phenotypic Characterization of Indigenous Goat Types and Their Production System in Shabelle Zone, South Eastern Ethiopia. M.Sc. Thesis. School of Animal and Range Sciences, School of Graduate Studies. Haramaya University.
Ameha S (2008). Sheep and goat meat characteristics and quality. Pp. 325-340. In: Alemu Yami and R.C. Merkel (eds.). Sheep and Goat Production Handbook of Ethiopia. ESGPIP (Ethiopian sheep and goat productivity improvement program). Branna Printing Interprise. Addis Ababa, Ethiopia.
Belete SG (2009). Production and Marketing System of Small Ruminant in Gomo district of Jima Zone, western Ethiopia. M.Sc Thesis, Department of Animal Science School of Graduate Studies, Hawassa University, Awassa, Ethiopia.. www.ipms-ethiopia.org. Accessed on July 20, 2017
Central Statistical Agency (CSA) (2017). Agricultural Sample Survey. Volume II: Report on Livestock and livestock characteristics (Private peasant holdings). Statistical Bulletin 570. Central Statistical Agency (CSA), Federal Democratic Republic of Ethiopia, Addis Ababa April 2017.
Domestic Animal Genetic Resources Information System (DAGRIS) (2004). Domestic animal genetic resources information system (DAGRIS). *(*eds). Rege, J.E.O., Workneh Ayalew and Ephraim Getahun). International Livestock Research Institute, Addis Ababa, Ethiopia.. http://dagris.ilri.cgiar.org. Retrieved on May 8, 2017
FARM-Africa (1996). Goat types of Ethiopia and Eritrea. Physical description and management systems.Published jointly by FARM-Africa, London, UK, and ILRI (international Livestock Research Institute), Nairobi, Kenya. 76pp.
Fikru S, Gebeyew K (2015). Sheep and Goat Production Systems in Degehabur Zone, Eastern Ethiopia: Challenge and Opportunities. J. Adv. Dairy Res. 3:134.
Gebrekiros H, Kefelegn K, and Banerjee Ak (2016). On-Farm Phenotypic Characterization of Begait Goat and Their Production System in Western Zone of Tigray, Ethiopia. Int. J. Res. Innov. Earth Sci. 3(1):2394-1375.
Girma D, Mieso G, Feyisa H, Misgana D (2013). Assessment of farmers' management practices and factors affecting goats' production system in adami tulu jido kombolcha district of east shawa zone, ethiopia agriculture and biology journal of north America. Adami tulu agricultural research center p.o.box 35, ziway, ethiopia. Haramaya univesity p.o.box 138, dire dawa, ethiopia. Wallega universirty nekemete, Ethiopia. http://www.scihub.org/abjna. Retrieved on May 8, 2017
Kosgey IS (2004). Breeding objectives and breeding strategies for small ruminants in the Tropics. Ph.D. Thesis, Wageningen University, The Netherlands. (ISBN: 90-5808-990-8) Germany.
Lomba YL (2015). Production objectives, breeding practices and selection criteria of indigenous goat in Loma District, Southern Ethiopia. *Global Journal of Animal scientific Research.* Jimma university department of animal science Ethiopia. http://www.gjasr.com/index.php/GJASR. Accessed on February 07, 2017
Rawlings P, Agyemang D, Clifford D and Bojang N (1992). Ownership pattern and management of small ruminants, equines and pigs in the Gambia. African Livestock Research. NOT CITED
Shapiro BI, Gebru G, Desta S, Negassa A, Nigussie K, Aboset G, Mechal H (2015). Ethiopia livestock master plan. ILRI Project Report.Nairobi, Kenya: International Livestock Research Institute (ILRI).
Solomon G, Azage T, Berhanu G, Dirk H (2010). Sheep and goat production and marketing systems in Ethiopia: Characteristics and strategies for improvement. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers. Project Working Paper 23. ILRI (International Livestock Research Institute), Nairobi, Kenya. P 58. http://www.ipms-ethiopia.org. August 20, 2017.
Solomon G, Komen H, Hanote, Kemp S, Aynalem H, Mwai and Tadelle D (2011). Characterization and conservation of indigenous sheep genetic resources: A practical framework for developing countries. ILRI Research Report No. 27. Nairobi, Kenya, ILRI.
SPSS computer software (version 16.0) (2007). Software Package for Social Sciences for Window.
Tatek WB (2016). Optimizing community-based breeding for indigenous goat breeds in Ethiopia. PhD Dissertation http://opus.uni-hohenheim.de/volltexte/2016/1280/pdf/; Accessed on February, 07 2017.
Tesfay B, Mulugeta G and Tadesse A (2011). Description of cactus pear (*opuntia ficus*- indica (l.) mill. Cultivars from Tigray, northern Ethiopia. Research report No. 1. Tigray Agricultural Research Institute, Mekelle, Tigray, Ethiopia http://www.google.com/url. Retrieved on June 14, 2017.
Tesfaye T (2009). Characterization of Goat production systems and On-farm Evaluation of the Growth performance of Grazing goats supplemented with different protein in metema woreda, amhara region, Ethiopia. M.Sc Thesis, Department of Animal Science School of Graduate Studies**,** Haramaya University.. http://www.ipmsethiopia.org. Accessed on April 20, 2017
Tsedeke KK (2007). Production and Marketing System of Sheep and Goat In Alaba, Southern Ethiopia. M.Sc Thesis. Department of Animal and Range Science School of Graduate Studies, Hawassa University, Awassa, Ethiopia.
Wilson RT, Durkin JW (1988). Small ruminant production in central Mali: reproductive performance in traditionally managed goats and sheep. Livest. Prod. Sci. 19:523-550.
Wilson T (1991). Small ruminant production and the small ruminant genetic resource in tropical Africa. Animal production and health paper. Food and Agriculture Organization of the United Nations, Rome.