academicJournals

Vol. 9(5), pp. 88-94, May 2018
DOI: 10.5897/IJLP2018.0447
Article Number: 8CD9A2B56790
ISSN 2141-2448

http://www.academicjournals.org/IJLP

International Journal of Livestock Production

Full Length Research Paper

Productive and reproductive performance of local dairy cows in selected districts of Sidama Zone, Southern Ethiopia

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Received 16 January, 2018; Accepted 11 April, 2018

The aim of the study was to assess the productive and reproductive performance of local dairy cows and constraints and opportunities of dairy production in selected districts of Sidama zone, Southern Ethiopia. Multistage sampling technique were employed in three districts selected representing highland (Wenisho), midland (Dale) and lowland (Loka Abaya) from Sidama Zone. One hundred and thirty five households who owned local cows were purposively selected from three *kebeles* from each agro ecology (45 from each agro ecology). Data were collected using semi-structured formal questionnaires and focus group discussions. The overall mean for daily milk yield, lactation length, age at first service, age at first calving, calving interval and number of services per conception, were 1.51±0.08 liter/day, 8.21±0.99 months, 42.61±2.82 months, 52.30±2.73 months, 20.08±0.90 months and 2.44±0.73, respectively. The major constraints identified includes feed shortage, disease, lack of improved breed, water scarcity and market problem while increasing demand for milk and milk products from time to time, access for veterinary services, implementation of vaccination before the outbreak of the diseases, availability of different feed resources, and the infrastructure development in the area were the major opportunity for dairy production. The current study revealed that the productive and reproductive performance of local cows is poor and thus, strong extension and interventions from responsible agents are mandatory to overcome identified problems and enhance productivity of dairy sector to ensure effectiveness of smallholder farmers in the study area.

Key words: Agro ecology, local cows, productive performance, reproductive performance.

INTRODUCTION

Livestock provides a significant nutritional supplement to vulnerable groups, increase the resilience of smallholder households in the face of food crises, and help to maintain traditional social safety nets (Randolph et al.,

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2007). Dairy production, among the sector of livestock production, is a critical issue in Ethiopia where livestock and its products are important sources of food and income, and dairying has not been fully exploited and promoted in the country. Dairy production is traditional in most parts of Ethiopia. Depending on the area under consideration cattle, goats, camels and sheep all provide milk for human consumption. However, cattle are the main source of milk production capabilities in the country particularly under smallholder production system (Ketema, 2000; Zegeye, 2003).

Ethiopia has the largest livestock population in Africa and the cattle population was estimated to be about 55.03 million, out of this 55.38% were female and the remaining 44.62% were male cattle. From this, 98.71% were local breeds while the remaining were cross and exotic breeds that accounted for about 1.15 and 0.14%, respectively. A total cow milk production for the country was about 2.9 billion liters with milk consumption of only about 19 kg/year, which is much lower than Africa and the world per capital average of 40 and 105 kg/year, respectively (CSA, 2014). In the country, dairy production depends mainly on local livestock genetic resources, and its production, among livestock sector is important in providing milk and its product.

The reproductive performance of the breeding female is probably the single most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity. According to LeBlanc (2007) cattle profitability is mainly determined by dairy cows reproductive performance which is a major determinant for overall productivity of dairy production systems by affecting the efficiency of milk production, the number of calves produced per cow and lifetime milk production (De Varies, 2006).

An understanding of the productive and reproductive performance provides guidance as to which of the possible new technologies are appropriate and worth pursuing, and which is not. Some works have been undertaken in Sidama Zone in different areas regarding performance, production system and breeding practice of dairy cattle (Beriso et al., 2015; Debir, 2016; Tsegaye et al., 2016). However, there is gap in the present study areas in line with works available in particular concerning the productive and reproductive performances of local dairy cows and identifying constraints and opportunities of dairy production under smallholder production system. This demands the need for generating site specific database under specific production scenarios. Thus, studying productive and reproductive performances and identifying constraints and its opportunity for dairy production is imperative in order to generate baseline information for use primarily by livestock owners, the extension agents and researchers to design improvement and development strategies to improve the productivity of local cows in the area. On the basis of this, the present study was undertaken to study productive and reproductive performance of local dairy cows and constraints and opportunities of dairy production in selected districts of Sidama Zone, Southern Ethiopia.

MATERIALS AND METHODS

The study was undertaken in three Districts, namely Wenisho, Dale and Loka Abaya of Sidama Zone, Southern Nations Nationalities and Peoples' Region (SNNPR), Ethiopia. Sidama Zone is located at 5°45' and 6°45' N latitude and 38°39' and 38°29' E longitude with altitude ranging from 1100 to 3500 m above sea level (masl) (SDC, 2000). The zone is characterized by mixed crop livestock farming. Rainfall pattern of the zone is bimodal type with small rainfall during the months of February to April followed by the main rainy season from July to September.

Dale District is partly located in the Great Rift Valley. The District is situated at 40 km south of Hawassa and at about 320 km south of Addis Ababa. It is located at 6°44' to 6°84'N and 37°92' to 38°60' E with an altitude range of 1001 to 2500 masl (average 1624 masl). The District receives an annual mean average rainfall of 1170 mm and the average annual temperature of 19°C (SEDPSZ, 2004). The district occupies major soil type of Haptic Luvisols and Chromic and also Luvisols Humic Nitisols, Eutic Vertisols, and Eutric Vertisols (IPMS, 2005). The district is characterized by food crops like *enset (Ensete ventricosum)*and maize and diversified cash crops like coffee, fruits (such as banana, avocado, guava), haricot bean and root crops like potato and sweet potato (DWARDO, 2006).

Wenisho is one of the districts in Sidama zone, the Southern Nations, Nationalities, and Peoples' Region of Ethiopia. According to ENMA (2008), the district has a mean annual rainfall and temperature ranging from 832 to 1658 mm and 18 to 21°C, respectively. The pattern of rainfall distribution is bimodal. *Enset* (Ensete ventricosum) which is a staple food and an income source and Coffee and *Chat,* and fruit trees (papaya, banana, avocado and mango) are also among the widely cultivated crops.

Loka Abaya district is lowland which is situated at about 50 km southwest of Hawassa. The District has low rainfall with an erratic pattern during the two rainy seasons; the *belg* (February to April), and the *kiremt* rains (July to early October) (USAID, 2005). The district is endowed with food crop like *Enset*, maize, *teff* and cash crops like *Chat*, coffee among crops cultivated in the district.

Sampling procedure and sample size

In the current study, multistage and purposive sampling technique was used. Initially, three districts were selected based on agro-climatic distribution namely Wenisho (Highland, 2300 up to 3200 masl), Dale (midland, 1500 to 2300) and Loka Abaya (Lowland, 1170 up to 1500 masl). In the second stage representative Kebeles (lowest administration) from respective strata (agro-ecology or district) were selected based on production potential and accessibility and a total of 9, that is, 3 Kebeles from each agro-ecological zone were selected. Finally, a total of 135 households (15 from each Kebeles or 45 from each strata) who own local cows were selected using purposive sampling method. A structured questionnaire were used to obtain information on productive and reproductive performance such as daily milk yield, lactation length, age at first service, age at first calving, calving interval, and number of services per conception and major constraints hindering dairy production in the study area.

Data types and methods of data collection

For the current study, both primary and secondary data were used

Table 1. Herd size and herd structure in TLU.

Variable	Agro-ecology			
	Highland (N=45)	Midland (N=45)	Lowland (N=45)	Overall (135)
Cow	3.53±1.31[b]	2.79±1.28[b]	7.87±2.95[a]	4.73±0.25
Oxen	0.83±0.78[b]	1.17±0.79[a]	0.88±0.83[b]	0.96±0.81
Heifer	1.27±0.56[b]	1.04±0.46[b]	3.26±1.18[a]	1.86±1.37
Bull	1.5±0.97	1.29±1.05	1.51±1.31	1.44±1.12
Calves	0.44±0.26[b]	0.25±0.19[c]	0.91±0.36[a]	0.54±0.39
Sheep	0.11±0.89[b]	0.78±0.97[a]	0.16±0.12[b]	0.12±0.11
Goats	0.19±0.13[b]	0.19±0.12[b]	0.74±0.47[a]	0.37±0.38
Horse	0.89±0.54[a]	0.64±0.58[b]	0.72±0.61[a]	0.75±0.58
Donkey	0.63±0.50[a]	0.6±0.39[a]	0.34±0.35[b]	0.52±0.44
Total Herd Size	9.44±1.88[b]	8.07±2.00[c]	16.42±3.79[a]	11.31±4.55

TLU = Tropical Livestock Unit. Means with different letters of superscripts in the same row differ significantly at P<0.05.

to attain the objectives of the study. Primary data were collected from all purposively selected 135 households who owned local dairy cattle by using semi- structured questionnaire, focus group discussion and field observation. Semi structured questionnaires were prepared and translated into local language, and administered to collect relevant information for the study by trained enumerators who were indigenous to the community with close supervision of researcher. Focus group discussions were held with clan or village leaders, district agricultural experts (extension agents), local dairy cow owners and elderly female and male member of the society who are known to have better knowledge on the dairy production status of the area. Secondary data were also collected from written and unpublished documents of agricultural office of each respective districts, books and journals.

Data management and analysis

Data on productive and reproductive performances were subjected to General Linear Model of SAS (2002) version 9. ANOVA, One-way Analysis of Variance, was applied to observe fixed effects of agro ecology on quantitative dependent variables such as daily milk yield, lactation length, age at first service, age at first calving, calving interval, and number of services per conception. Differences were considered statistically significant at 5% level of significance. Tukey's Studentized Range (HSD) test was used to separate the means based on their significant difference.

Index analysis was used for ranking constraints hindering dairy production according to the method suggested by Kosgey (2004). The ranking was expressed as an Index = the sum of (5 times first order + 4 times second order + 3 times third order + 2 times fourth order + 1 times fifth order) given for an individual variables divided by the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1 times fifth order) for all variables.

The following model was used for the analysis of productive and reproductive performance:

$$Yfk = \mu + df + efk$$

Where; Yfk = the observed productive and reproductive performance; μ = the overall mean;
df = the effect of the f^{th} location (Agro ecology) (1. Highland, 2. Midland, 3. Lowland) and
efk = random residual error.

RESULTS AND DISCUSSION

Herd size, herd structure and purpose of livestock keeping

The livestock composition in the study area is illustrated in Table 1. The overall mean herd size kept in the study area differ significantly among agro-ecologies (P<0.05). The mean value of cows kept in lowland were higher than midland and highland which could be due to the practice that highland and midland farmers kept few and selected dairy cows particularly for milk production and also shortage of grazing land as compared to lowland. However, farmers in lowland keep higher numbers of livestock and their number have been considered as indicator of the status of the farmers in addition to the multipurpose use provided by livestock to their owners. Oxen are used for traction purpose in the area whereas horse and donkey are mainly used for transport of goods and people from one place to another. Goat and sheep provides immediate cash in the area.

The present finding indicated that the livestock in the study area were kept for provision of multipurpose service, including milk production, draught power, transport, meat and organic fertilizer through provision of dung and also for financial and social value according to the feedback obtained from focus group discussion. Moreover, focus group discussion also revealed that there was strong association between crop production and livestock in providing manure as organic fertilizer for different crops since inorganic fertilizers are costly and thus farmers rely more on manure rather than other fertilizer. Andualem (2015) also showed that in the mixed crop-livestock production of the Ethiopian highlands, livestock are subordinate but economically complementary to crop production in providing draft power, which is a vital contribution to the overall farm labor requirement. Cattle also provide meat, milk, cash income

Table 2. Constraints of dairy production in the study area.

Constraint	Priority level					Index	Rank
	1	2	3	4	5		
Feed shortage	84.4	15.5	0	0	0	0.32	1
Disease	15.5	13.3	11.1	0	0	0.27	2
Lack of improved breed	0	8.9	82.2	6.7	2.2	0.21	3
Water scarcity	0	0	2.2	40	57.8	0.16	4
Market problem	0	4.4	4.4	51.1	40	0.12	5
Midland (45)							
Feed shortage	86.7	13.3	0	0	0	0.32	1
Disease	11.1	53.3	35.6	0	0	0.25	2
Lack of improved breed	0	35.6	64.4	0	0	0.22	3
Water scarcity	0	0	0	62.2	37.8	0.11	4
Market problem	0	0	0	37.8	62.2	0.09	5
Lowland (45)							
Feed shortage	20	80	0	0	0	0.28	2
Disease	80	20	0	0	0	0.33	1
Lack of improved breed	0	0	86.7	13.3	0	0.19	3
Water scarcity	0	0	13.3	44.4	42.2	0.08	4
Market problem	0	0	0	40	60	0.09	5

Index = the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1 times fifth order) for individual variables divided by the sum of (5 times first order + 4 times second order +3 times third order + 2 times fourth order + 1 times fifth order) for all variables.

and manure, and serve as capital asset against risk. The result of the current finding was comparable with finding of Zewidie (2010) who reported provision of multipurpose functions by livestock.

Constraints and opportunity for dairy production

The major constraints affecting dairy production in the area are presented in Table 2. Accordingly, feed shortage, disease, lack of improved dairy cow breed, water scarcity and market problem were identified and ranked with their priorities using index method. In highland (Wenisho) and midland (Dale), feed shortage occupied the first position followed by disease, lack of improved breed, water scarcity and market problem in that order. On the other hand, disease was ranked first as major constraints for dairy cow production in lowland (Loka Abaya) followed by feed shortage, lack of improved breed, water scarcity and market problem. The difference in the position of rank of disease in lowland area compared to the two agro ecologies could be due to inadequate extension service provided and management practice of dairy cows. Furthermore, Loka Abaya district was also conducive area for multiplication of Tsetse fly particularly during wet season and encouraged the occurrence of trypanosomiosis in lowland area as information obtained from focus group discussion revealed. Accordingly, the major constraints hindering dairy production in current study area were feed shortage, disease, lack of improved breed, water scarcity and market problem and the study finding was in line with Tsegaye et al. *(*2015) who illustrated shortage of feed, health problem, water scarcity and labor scarcity as major challenges, which affect dairy cattle production and productivity in selected district of Sidama Zone, Southern Ethiopia.

Even though the dairy cow production was constrained with various problems mentioned earlier, opportunity raised during focus group discussion in the area were increasing demand for milk and milk products from time to time, access for veterinary services, implementation of vaccination before the outbreak of the diseases, availability of different feed resources although it vary seasonally, and the infrastructure development in the area. Moreover, the area practiced integrated crop livestock production, which could contribute to the future improvement prospect, via introduction of intercropping of improved forage species even though land holding was small across the study area particularly in midland. Asrat et al. (2013) also demonstrated similar results with the current study in Bodit, Southern Ethiopia and described the major opportunities of dairy industry as rapid urbanization, substantial population growth and change in the living standard of the dwellers and the increased demand for milk and milk products in the area.

Table 3. Productive and reproductive performance of indigenous dairy cows (Mean±SD).

Variable	Agro ecology			Overall (135)
	Highland (N=45)	Midland (N=45)	Lowland (N=45)	
DMY (liter)	1.49±0.06^{b}	1.59±0.07^{a}	1.43±0.17^{c}	1.51±0.08
LL (Month)	8.00±1.14	8.3±0.86	8.2±0.957	8.21±0.99
AFS (Month)	42.2±2.70	42.96±3.23	42.58±2.32	42.61±2.82
AFC (Month)	52.2±2.41^{ab}	51.4± 3.12^{b}	53.28±2.61^{a}	52.30±2.73
CI (Month)	19.94±0.76^{b}	19.32±0.56^{c}	20.97±1.28^{a}	20.08± 0.90
NSPC	2.04±0.73^{a}	2.15±0.71^{a}	3.13±0.75^{b}	2.44±0.73

Mean values represented with different superscripts in the same row differs significantly (P<0.05). N = Numbers of respondents. DMY = Daily milk yield, LL = Lactation length, AFS = Age at first service, CI = Calving interval, NSPC = Number of services per conception.

Productive and reproductive performance of local cows in the study area

Daily milk yield and lactation length

The estimated mean daily milk yield based on the farmers response varied significantly (P<0.05) among the agro ecologies (Table 3). The variation in daily milk yield could be due to availability of feed and the difference in the practice of keeping selected cows among farmers in different agro ecologies. The present estimated daily milk yield of local dairy cows was 1.51±0.08 liter/day and the result was in agreement with Zewidie (2010) who reported 1.5±0.3 kg/day for indigenous dairy cows in Ziway area. The result is also comparable with overall mean estimated milk yield of 1.45 liter/day reported by Beriso et al. (2015) in Chuko district, southern Ethiopia and also with that of Demissu et al. *(*2014) who reported 1.52±0.86 liter/day at Guduru livestock production and research center and its surroundings indigenous cows. On the other hand, the result of the current finding was higher than the report by Merha (2006) who noted average daily milk yield of 0.75 liters for Abergele cattle and 1.15 ± 0.386 liters estimated by Ketema (2014) for cows under smallholder farmers in Kersa Malima district.

The estimated overall mean lactation length in present study was 8.21±0.99 months and there was no significant difference among agro ecologies (P>0.05). The lactation length reported in the present study area was comparable with the result of 8.96 month reported by Belay et al., (2012) for smallholder livestock production system in Dandi district, Oromia Regional State, Central Ethiopia and also with 9.93± 0.2 months (Beriso et al., 2015) in Chuko district, Southern Ethiopia. However, it was longer than the national average of 7 months (CSA, 2005) and 203.54 days or 6.78 month for Simada cattle in Tach Gayint district (Assefa et al., 2015).

Age at first service

The overall estimated age at first service (AFS) by the respondents in the current study was 42.61±2.82 months and not differed significantly (p>0.05) across agro ecology (Table 3). The current result of AFS was in agreement with Adebabay (2009) who noted 42.48 months in Bure district and also comparable with 40.74 months for Simada cattle in Tach Gayint district (Assefa et al., 2015). The current finding is slightly lower than AFS of 44.1±5.9 months reported by Debir (2016) in Sidama Zone, Southern Ethiopia and 44.8 months for Fogera cattle (Gidey, 2001). On the other hand, the result of the current study is higher than 27.5 months reported by Zewidie (2010).

Age at first calving

The overall estimated age at first calving (AFC) was 52.30±2.73 months and higher for lowland agro ecology (P<0.05). These could be due to availability of feed resources since environmental factors particularly nutrition may affect the growth and maturity of heifers and development of reproductive organ properly in order to undertake its function properly.

The result of the current study was comparable with 51.9±5.9 months reported by Debir (2016) in Sidama Zone and 51.24±0.55 month reported by Beriso et al. (2015). However, the result revealed in the current study is significantly higher than 39.8±5.6 months reported by Tadele and Nibret (2014) at smallholder farm conditions in and around Maksegnit town and 46.22±12.15 months reported by Demissu et al. (2014).

Calving interval

The overall estimated mean calving interval (CI) in the current study was 20.08± 0.90 months and differs significantly among agro ecology of study area (P<0.05). The differences in calving interval could be due to longer time taken by dairy cows to conceive due to the effect of nutrition and other managemental aspects like health care within consecutive calving among agro ecology.

The result of the current finding was in line with CI of 19.93±0.2 months estimated by Beriso et al. (2015) for local breed cows, in Aleta Chuko district, 21.18 months reported by Dessalegn (2015) from Benchi-Maji Zone, South West Ethiopia. However, the result of the current finding is lower than 26.04±0.01 months reported by Assefa et al. (2015) and higher than 472 days (15.7 months) reported by Zewidie (2010), 16.01±0.49 months reported by Kedija (2007) in Mieso district and 401 days reported by Alemselam et al. (2015) in and around Mekele.

Number of services per conception (NSPC)

The overall estimated mean for number of service per conception (Mean±SD) by the respondent in the current study was 2.44±0.73. The mean value for NSPC was significantly higher for lowland than highland and midland. The differences may be attributed to differences in management practices such as mating practice in the lowland. The result is comparable with 2.2±0.2 for indigenous cows of Gondar city of Ethiopia (Kumar, 2014) and 2.0±0.65 reported in smallholder farm conditions in and around Maksegnit town (Tadelle and Nibret, 2014).

CONCLUSION AND RECOMMENDATIONS

In general, the study revealed that dairy production in the current study area was hindered with various constraints limiting full exploitation of the productive and reproductive potential of dairy cows even though the area was gifted with varied opportunities. The productive and reproductive performance of local cows in the study area is generally low indicating the need for strong intervention to get to the bottom of the constraints identified to assure increased productivity of dairy cows in the area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

The study was undertaken through the financial support of the Ministry of Education (Selale University). The authors want to thank all of the dairy cattle producers of Dale, Wenisho and Loka Abaya District and Agricultural Office of respective districts of Sidama Zone for their willingness to provide valuable information for the completion of the study.

REFERENCES

Adebabay K (2009). Characterization of milk production systems, marketing and on-farm evaluation of the effect of feed supplementation on milk yield and milk composition of cows at Bure District, Ethiopia. M.sc thesis, Bahirdar University, Ethiopia.

Andualem T (2015). A review on cattle husbandry practices in Ethiopia. Int. J. Livest. Prod. 7(2):5-11.

Alemselam B, Christopher R. Harlow, Goitom G, Desalew T, Gidena D, Tadesse G, Simon CR (2015). Assessment of reproductive performance and problems in crossbred (Holstein Friesian X Zebu) dairy cattle in and around Mekelle, Tigray, Ethiopia. Anim. Vet. Sci. 3(3):94-101.

Asrat A, Zelalem Y, Ajebu N (2013). Characterization of milk production systems in and around Boditti, South Ethiopia. Livestock Res. Rural Dev. 25:10

Assefa G, Mussie H, Mengistie T, Zewdu W, Assemu T (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.

Belay D, Yisehak K, Janssens GPJ (2012). Productive and reproductive performance of Zebu X Holstein-Friesian crossbred dairy cows in Ethiopia. 23. Jimma Town, Oromia, Ethiopia. Glob. Vet. 8(1):67-72.

Beriso K, Tamir B, Feyera T (2015). Characterization of smallholder cattle milk production system in Aleta Chukko District, Southern Ethiopia. J. Adv. Dairy Res. 3:132.

Central Statistical Agency (CSA) (2005). Federal Democratic Republic of Ethiopia Agricultural sample survey. Livestock and livestock characteristics bulletin, Volume II. Addis Ababa, Ethiopia.

Central Statistical Agency (CSA) (2014). Agricultural sample survey 2013/14, Report on Livestock and Livestock characteristics. Volume II, Addis Ababa, Ethiopia.

Debir L (2016). Assessment of breeding practice and evaluation of estrus synchronization of dairy cattle in Sidama zone, Southern Ehiopia. M.sc. Thesis, Hawassa University, Hawassa, Ethiopia.

Demissu H, Gemeda D, Fekadu Beyene (2014). Dairy productive potential, challenges and production pportunities of Horro and their F1 Jersey crossbred cows: A case of Guduru Livestock Production and Research Center and Its Surroundings, West Oromia, Ethiopia. Sci. Technol. Arts Res. J. 3(4):79-84.

Dessalegn G (2015). Assessment of production and reproductive performances of cattle and husbandry practices in Bench-Maji Zone, Southwest Ethiopia. Glob. J. Anim. Sci. Res. 3(2):441-452.

Ethiopian National Meteorology Agency (ENMA) (2008). Meteorological Data, Addis Ababa, Ethiopia, 2008.

Gidey Y (2001). Assessment of calf crop productivity and total herd life of Fogera cows at Andassa Ranch in North-western Ethiopia. MEd Thesis, Alemaya University, Dire-Dawa, Ethiopia.

Kedija H (2007). Characterization of milk production system and opportunity for market orientation: A case study of Mieso district, Oromia Region, Ethiopia. MEd Thesis, Haramaya University, Dire Dawa, Ethiopia.

Ketema H (2000). Dairy development 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).

Ketema W (2014). Assessment of dairy cattle feed resources and milk yields under smallholder farmers in Kersa Malima woreda. Department of Animal Production Studies M.Sc program in Tropical Animal Production and Health, Bishofitu, Ethiopia.

Kosgey IS (2004). Breeding objectives and breeding strategies for small ruminants in the tropics. PhD. Thesis. Wageingen University.

Kumar N, Alemayehu E, Berihu G, Endale B (2014). Reproductive performance of indigenous and HF crossbred dairy cows in Gondar, Ethiopia. J. Agric. Vet. Sci. 7(1):56-61.

LeBlanc S (2007). Economics of improving reproductive performance in dairy herds. Adv. Dairy Technol. 19:201-214.

Merha Z (2006). Genetic Diversity in Northern Ethiopian Cattle Breed: An on-farm and molecular characterization. Doctorial Dissertation, Agricultural University, Wageningen, Netherlands.

Randolph TF, Schelling E, Delia G, Charles FN, Leroy JL, Cole DC, Demment MW, Omore A, Zinsstag J, Marie R (2007). Invited review: role of livestock in human nutrition and health for poverty reduction in developing countries123. J. Anim. Sci. 85(11):2788-2800.

Statistical Analysis System (SAS) (2002). User Installation Guide for the

SAS System Version 9.1, (SAS Institute Inc., Cary, NC, USA)
Sidama Development Corporation (SDC) (2000). Planning and statistics bulletin.
Socio-economic and demographic profile of Sidama zone (SEDPSZ) (2004). Finance and Economic Development Coordination Department. SEDPSZ, Awassa, Ethiopia.
Tadele A, Nibret M (2014). Study on reproductive performance of indigenous dairy cows at small holder farm conditions in and around Maksegnit Town. Glob. Vet. 13(4):450-454.
Tsegay L, Agengew A, Ashenafi S (2015). Dairy cattle production at small holder level in Sidama Zone selected Districts, Southern Ethiopia. J. Food Sci. Quality Manage. 40:35-41.
USAID (2005) SNNPRS Livelihood Zone Profile Report (unpublished), Addis Ababa (web Page) http://pdf.usaid.gov/pdf_docs/pnadj 866.pdf.
Zegeye Y (2003). Imperative and challenges of dairy production processing market in Ethiopia in jobbery and Gebru. G/lands /challenges and opportunities and livestock marketing in Ethiopia processing of the 10th annually conference of Ethiopian society of animal production (ESAP) held in Addis Ababa, Ethiopia, 24-24 August 2002 ESP.
Zewidie W (2010). Livestock production systems in relation with feed Availability in the highlands and central rift valley of Ethiopia. MEd. Thesis, Haramaya University, Haramaya, Ethiopia.