Journal of Reproduction and Infertility 7 (2): 47-62, 2016
ISSN 2079-2166

DOI: 10.5829/idosi.jri.2016.7.2.102165

Characterization of Livestock Production System in Three Selected Districts of Jimma Zone, Southwest Ethiopia

[1]Mohammed Husen, [2]Yisehak Kechero and [3]Meseret Molla

[1]Ethiopian Agricultural Transformation Agency, P.O. Box: 708, Addis Ababa, Ethiopia
[2]Department of Animal Sciences, Arba Minch University, Arba Minch, Ethiopia
[3]Department of Animal Sciences, Jimma University, P.O. Box: 307, Jimma, Ethiopia

Abstract: The cross-sectional field survey was conducted in three selected districts of Jimma zone with the aim of characterizing the prevailing livestock production systems as well as identifying the major constraints and opportunities in relation to livestock production. The study districts were selected based on their livestock production potential and accessibility. Accordingly, 122, 188 and 104 households (HHs) from Kersa, Omo Nada and Tiro Afeta districts, respectively were participated in the study. The respondent HHs were purposively selected depending on their livestock keeping experience. This study revealed that livestock production systems in the three districts were mixed crop-livestock production system which is totally based on the indigenous livestock breeds with no improved input and low output. The average number of livestock in terms of tropical livestock units (TLU) in the three districts was 5.10±0.32/HH, which varied significantly (P<0.01) between the districts. Overall, the herd structure comprised of cattle (4.74±0.24 TLU/HH) (P<0.05), sheep (0.10±0.01 TLU/HH), goats (0.06±0.01 HH), donkey (0.07±0.02 TLU/HH) (P<0.05), horses (0.05±0.02 TLU/HH) and mule (0.06±0.03 TLU/HH). Natural mating was the only means of breeding system (P>0.05). The study on productive and reproductive performance of livestock revealed that average age at first calving (AFC) of cows was 4.50±0.08 years, calving interval (CI) of 25.56±0.43 months, lactation milk yield (LMY) of 203.29±4.75 litters, lactation length (LL) of 7.84±0.30 months and 4.56±0.10, 5.61±0.14 years for draught age and life span of oxen, respectively. Average age at first kidding and kidding interval of goats were 2.05±0.04 years and 15.45±0.30 months, respectively (P<0.05). The average age at first foaling (AFF), foaling interval (FI, P<0.05) and age at first work (AFW) of horses were 4.95±0.14 years, 35.57±1.76 months and 6.28±0.30 years, respectively. The average AFW for mules was 6.60±0.14 years (P<0.05). The average AFF, FI (P<0.05) and AFW (P<0.05) of donkeys were 6.22±0.32, 2.56±0.17 and 6.38±0.37 years, respectively. The main livestock feed resources in the areas were; crop residues, stubble grazing and natural pasture in a decreasing order of importance. The main constraints of livestock production were feed shortage, animal diseases and low productivity of the indigenous livestock breeds. Generally the livestock production in the areas are still traditional without any improved technology. So it needs urgent response by responsible organizations mainly on the areas of feed and genetic improvement.

Key words: Constraints · Livestock · Mixed crop-livestock · Productive and Reproductive performances · Production systems

INTRODUCTION

Livestock contributes 15 to17 percent of GDP and 35 to 49 percent of agricultural GDP and 37 to 87 percent of the household income in Ethiopia [1]. They provide inputs (draught power, manure) to the other segment of the farming system such as crop production and generate consumables or saleable outputs as milk, manure, meat, hides and skin, wool, hair and eggs [2].

There are about five livestock production systems in Ethiopia which is based on integration of livestock with crop production, level of input and intensity of

Corresponding Author: Mohammed Husen, Ethiopian Agricultural Transformation Agency (ATA), P.O.Box: 708, Addis Ababa Ethiopia.

production, agro-ecology and market orientation. The following livestock productions systems are exist in Ethiopia: pastoral, agro-pastoral, mixed crop-livestock farming, urban and peri-urban farming and specialized intensive farming systems [3-5].

Livestock production is the most important agricultural sector in Jimma zone of Southwest Ethiopia and meets the multiple objectives set by smallholder farmers by providing draught power, milk, meat, manure and sources of cash for the households. However there were scanty of information on livestock husbandry practices, productivity, constraints and opportunities on livestock production systems in Jimma zone. In order to plan and implement the possible livestock development strategies in this area, it's essential to know details about the overall production and management systems of livestock's. Hence, the study was conducted with the objective to characterize the livestock production system and constraints of livestock production in three selected districts of Jimma zone, Southwest Ethiopia.

MATERIALS AND METHODS

Description of the Study Area: The cross-sectional field survey was conducted in three districts of Jimma zone (Kersa, Omo Nada and Tiro Afeta). These districts are located in the Gilgel Gibe catchments of southwest Ethiopia (Figure 1). The climate of the Gilgel Gibe catchment is characterized as hot humid tropical with bimodal heavy rainfall which is uniform in amount and distribution, ranging from 1200 to 2800 mm per year, with short and main seasons occurring from mid February to May and June to September, respectively [6]. In normal years, the rainy season extends from mid February to early October. The mean annual temperature of the area is 19.5°C [7].

It is mostly known for its vegetation coverage, suitability for coffee, crop, livestock and bee production. The dominant crops being Maize, Teff, Sorghum, Barley, Wheat, Horse bean, field pea, Coffee, *Chat* (*Cath edulus*), fruits and vegetables. The soil type of the study area is characterized with black to red soils.

Kersa, Omo Nada and Tiro Afeta districts are situated at an altitude ranging from 1740 to 2660, 880 to 3340 and 1640 to 2800 meters above sea level, respectively, with area coverage of 975, 1589.4 and 1001.9 square kilometers , respectively. Human population of Kersa, Omo Nada and Tiro Afeta were estimated to be 131, 150, 194, 978 and 100, 700 people [8].

Sampling Technique: The three districts (Kersa, Tero Afeta and Omo Nada), in Gilgel Gibe Catchments of Jimma zone were purposively selected for this particular study based on their livestock potential, accessibility and availability of research fund obtained through Institutional university cooperation (VLIR-UOS/ IUC-JU) project during planning stage.VLIR-UOS/ IUC-JU program have a multidisciplinary project in the Gilgel Gibe catchments with the aim of investigating the impact of the Gilgel Gibe Dam. For representation of each agro-ecology, three farmers associations (FAs) from each districts representing three topographic locations (HAR: high altitude region, 2001-2800 m.a.s.l); MAR: medium altitude region, 1751-2000 m.a.s.l and LAR: low altitude region1200-1750 m.a.s.l) were selected using stratified random sampling technique. Households (HHs) who have a minimum of 10 years experience in livestock production and have at least two species of livestock were included in the study. Accordingly, 122, 188 and 104 HHs from Kersa, Omo Nada and Tero Afeta districts, respectively and a total of 414 HHs from the three districts, were participated in the study. The selected farmers were interviewed using a structured questionnaire which was pre-tested with 18 farmers in each district.

The total sample size for household interview was determined using probability proportional sample size-sampling technique Cochran's [9].

$$no = \frac{Z^2 * (P)(q)}{d^2} \rightarrow n_1 = \frac{no}{(1 + no/N)}$$

where;

n_o = Desired sample size according to Cochran's [9] when population greater than 10, 000

n_1 = Finite population correction factors [9] population less than10, 000

Z = Standard normal deviation (1.96 for 95% confidence level)

P = 0.1 (proportion of population to be included in sample i.e. 10%)

q = is 1-P i.e. (0.9)

N = is total number of population

d = is degree of accuracy desired (0.05)

Discussion with 10 key informants organized from different groups was held in each study FAs for triangulation purposes and to gain an in-depth insight about the topics covered in the structured questioner for interview and to check whether patterns found in the HHs were valid by focus groups. In general, focus group

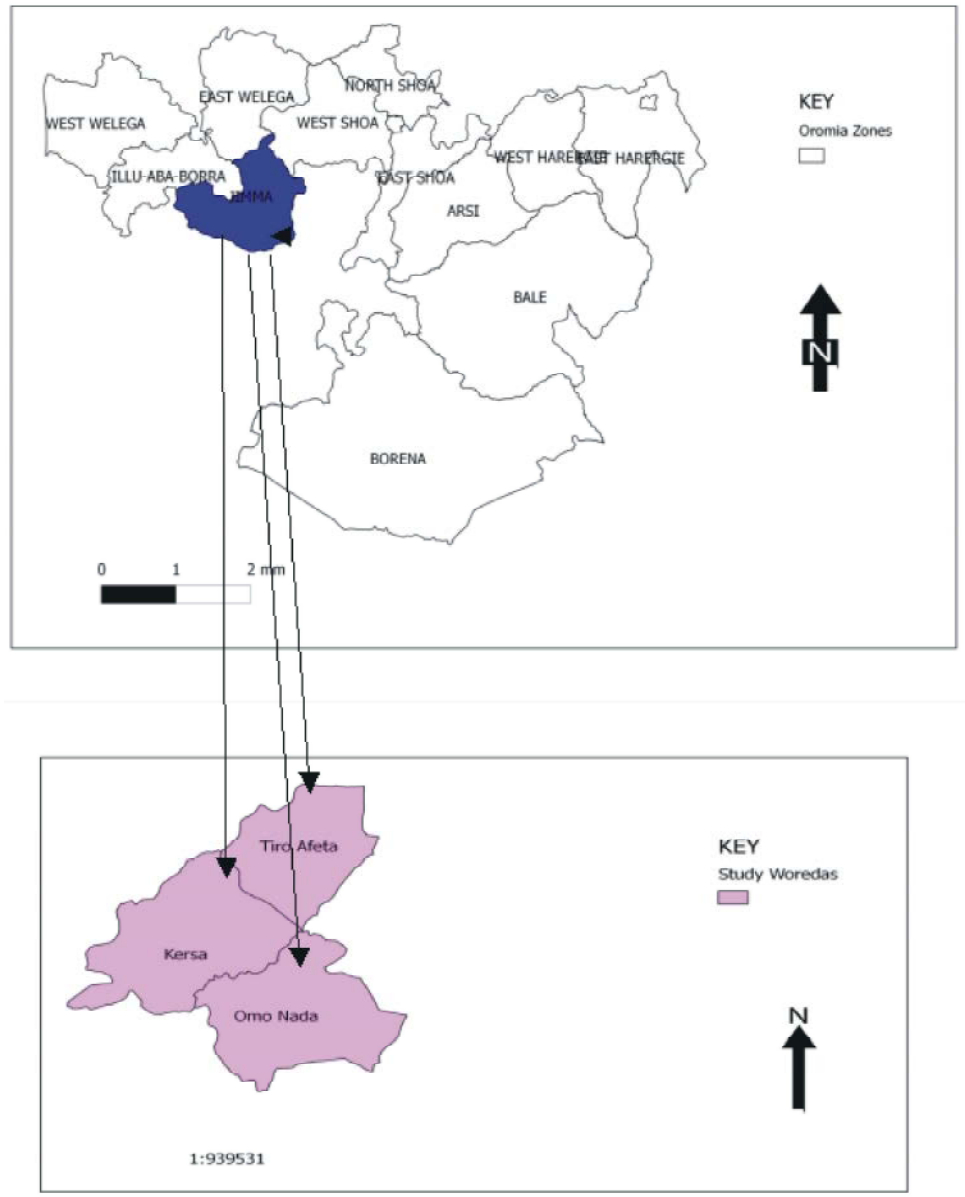

Fig. 1: Map of Oromia region, Jimma zone and the three study districts

discussions using checklists that contained livestock production systems, opportunities and constraints for livestock production coupled with pretested questionnaire helped the researcher to design structured questionnaire. Finally, systematic random sampling technique was followed to select the respondent HHs.

Data Collection Pre-tested structured questionnaire format was used for the interview of sampled HHs to collect socio-economic and farming system characteristics, livestock husbandry and management practice and livestock feed resources.

Socio-Economic Data: Socio-economic data like: age, sex, marital status, educational level and family size of the respondent household, land holding and usage, sources of income, objective of livestock keeping were collected.

Livestock Production Data: Livestock production data like: livestock herd size and composition, reproductive performances like: age at first calving/foaling and calving/foaling interval, lifespan caving, age at first kidding and kidding interval; age at first lambing and lambing interval and production performances like: lactation length and milk yield per-lactation, draught age

of oxen, draught lifespan of oxen, livestock feed resources and utilization systems, constraints and opportunities of livestock production in the study areas were collected.

Statistical Analysis: Data (both qualitative and quantitative) was entered into Microsoft office Excel 2007 sheet every day after administering questionnaire to prevent loss of data. All the surveyed data were analyzed using Minitab Statistical Software [10], version 16.1. Statistical variations for qualitative variables (frequencies and percentages) were tested by means of cross tabs, with significant differences at $P< 0.05$. Mean comparisons were carried out using Chi-square test for the qualitative variables. The descriptive statistics for the quantitative variables were subjected to one way analysis of variance (one-way ANOVA) using the general linear model procedure of Minitab. Mean comparisons were carried out using Tukey test for the quantitative variables. Levels of significance also considered at $P\leq 0.05$. Analyzed data were presented in tables, figures, percentages, means and standard errors. The appropriate statistical model used for characterization of the production systems:

$$Y_{ij} = \mu + l_i + \varepsilon_{ij}$$

where,

y_{ij} = the response of the j^{th} HH in the i^{th} location
μ = overall mean
l_i = effect of i^{th} location (i= 3)
ε_{ij} = random error

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of the Respondents

Households Characteristics: Sex of HH heads, age, educational status and family size are presented in (Table 1).

Out of the overall responded household heads, 94.04% of them were males. Teshager *et al*. [11], reported male dominated HH heads (95.6%) in Ilu Aba Bora zone, Southwest, Ethiopia. According to Workneh and Rowland [12], about 96% of households in Oromia region are male headed. The result of the current study is higher than Yeshitila Admassu [13], who reported 91.3% male headed HHs in Alaba district of Southern Ethiopia.

There was a significant difference ($P <0.05$) in age of the respondents in the study districts and the overall mean age was 45.32 ±0.88 years. The highest mean age was found in Omo Nada (47.34±0.95 years) followed by Tiro Afeta (45.77±0.84 years) and the lowest mean age was found in Kersa (42.86±0.85 years) districts, respectively. The current study is in agreement with the report of Adebabay Kebede [14], who reported 45.08 years in Bure district of northern Ethiopia.

The current finding is higher than the report of Tesfaye Mengsitie [15], who found overall average age of 41.2 years in Metema district, northern Ethiopia. However its lower than Zewdie Wondatir [16], who reported mean age of 47±1.7 years in Highlands and Central Rift Valley of Ethiopia.

There were a significant difference ($P<0.05$) in the educational status of the studied HHs and the overall educational status of the respondent depicts (avg., 80%) illiteracy. Accordingly, the highest level of illiteracy was recorded in Kersa (82.22%) followed by Tiro Afeta (80%) and the lowest level of illiteracy were observed in Omo Nada (71.11%). Similar finding was reported by Yisehak *et al*. [17], in three districts of Jimma zone. The current finding is higher than the finding of Yeshitila Admassu [13], who has reported 58.5% illiterate HHs in Alaba district. Teshager *et al.* [11], reported 11.7% illiterate HHs in Ilu Aba Bora zone of Southwest Ethiopia. Since education is an important tool to bring fast and sustainable development and had roles in affecting household income, adopting technologies, health and the whole socio-economic status of the family this low educational level might had a negative impact to adopt technologies in the study areas. The low level of education in the studied households has an influence on the transfer of agricultural technologies and their participation in development [18].

Family size of the household was not significantly different ($P>0.05$). The overall mean family size in the studied HHs was 8.34±0.41. The result of the current study is in agreement with the finding of Yeshitila Admassu [13], who reported 8.52±0.41 in Alaba district of Southern, Ethiopia. However, the current finding is higher than the average family size reported by CSA [19], Teshager *et al*. [11] and Kedija [20], who reported mean family size of 5.0±0.03, 7.09±0.15 and 6.62±0.22 in Oromia region, Ilu Aba Bora zone and Mieso district, respectively. The main source of labor in the sampled HHs is their family.

Land Holding and its Allocation: Land holding and utilization of the study areas are presented in Table 2. There was no significant difference ($P>0.05$) in total land holding in the districts. The overall average land holdings per household in the districts was 2.14±0.06 ha. The total land holding in the current study is in agreement with the

Table 1: Household characteristics of the respondents in three districts of Jimma zone

	Districts, mean (±SEM)				
Characteristic	Kersa	Omo Nada	Tiro Afeta	Overall	p
Age of respondents	42.86 ±0.85[b]	47.34 ±0.95[a]	45.78±0.84[a]	45.32±0.88	*
Family size	8.48±0.41	7.92±0.32	8.6±0.5	8.34±0.41	ns
	Districts, % of respondents				
Sex of the HH heads	Male	91.11	94.44	96.67	94.07	ns
	Female	8.89	5.56	3.33	5.93	
Number of wives of Male HH	1	87.78	90.00	82.22	86.67	ns
	2	10.00	5.56	13.33	9.63	ns
	3	2.22	4.44	4.44	3.70	ns
Educational status of the HH head	Literate	17.78[b]	28.89[a]	20.00[ab]	20.00	*
	Illiterate	82.22[a]	71.11[b]	80.00[ab]	80.00	*

Means in the same row for each parameter with different superscripts are significantly different ($p < 0.05$); *$p < 0.05$; ns: non-significant difference ($p > 0.05$); SEM: standard error of means

Table 2: Mean ± SEM landholding (ha) per HHs and land use in three districts of Jimma zone

	Districts, (Mean ± SEM)				
Land holding	Kersa	Omo Nada	Tiro Afeta	Overall	P
Grazing (pastureland)	0.23±0.04	0.15±0.03	0.20±0.04	0.19±0.34	ns
Crop land (arable)	1.96±0.11	1.96±1.10	1.91±0.10	1.94±0.01	ns
Total land	2.19±0.12	2.11±0.12	2.11±0.11	2.13±0.06	ns

SEM: standard error of means

finding of Yisehak *et al*. [17], in Jimma zone of Southwest Ethiopia. The total land holdings in the current study areas were greater than the finding of Shitahun Mulu [21] and Belete Shenkute [22], whose have reported 1.55 ha and 1.93 ha in Bure district of Amhara National Region and Goma district of Jimma zone, Oromia National region, respectively. Also, it's greater than the national average land holding of 1.2 ha [19]. In all the study districts discussion with key informants revealed that land holding per HHs where decreasing in the last three decades. This is because land holding is fixed whereas successive new families to be formed due to population growth share only what was previously owned by their families leaving some plots to their families.

Farmers in the studied districts allocate larger proportion of their land for crop production than grazing land which agrees with the finding of Teshager *et al*. [11], in Ilu Aba Bora zone of Southwest Ethiopia. In the current study out of the total land only 0.19±0.34 ha (8.92%) was allocated for grazing in all the study districts. This result is higher than the finding of Shitahun Mulu [21], who reported 0.04±0.01 ha (3.14%) grazing land per household in Bure districts of Amhara region.

Sources of Income in the Studied Households: In the current study both crop and livestock production were the major sources of HHs income (Figure 2). From all the surveyed HHs, 84.07% of them revealed that their major sources of income were both crop and livestock sale followed by crop sale (7.78%) and livestock and its products (6.67%) and the rest was from agricultural and non-agricultural employments. The current finding is in agreement with Teshager *et al*. [11], who reported (72.8%) HHs income from both crop and livestock in Ilu Aba Bora zone of Southwest Ethiopia and Yisehak *et al*. [17], in Jimma zone. According to the results of the study, livestock production has multiple contributions for a source of income and survival of the studied households. Poorer households supplement their annual cash income through local agricultural labor employment (weeding and harvesting) on the fields of middle and better-off households and also participate in sale of charcoal and firewood.

Livestock Holding and Their Role: There was a difference ($p<0.001$) in total livestock composition in TLU between the study districts (Table 3). The overall average holdings of total livestock per HH were 5.10±0.32 TLU. The highest number of livestock in TLU was observed in Tiro Afata 5.99±0.30 followed by Omo Nada 4.79±0.34 TLU and the smallest number was found in Kersa district 4.52±0.32 TLU. In the current work all farmers keep only local breeds of livestock in all the study areas.

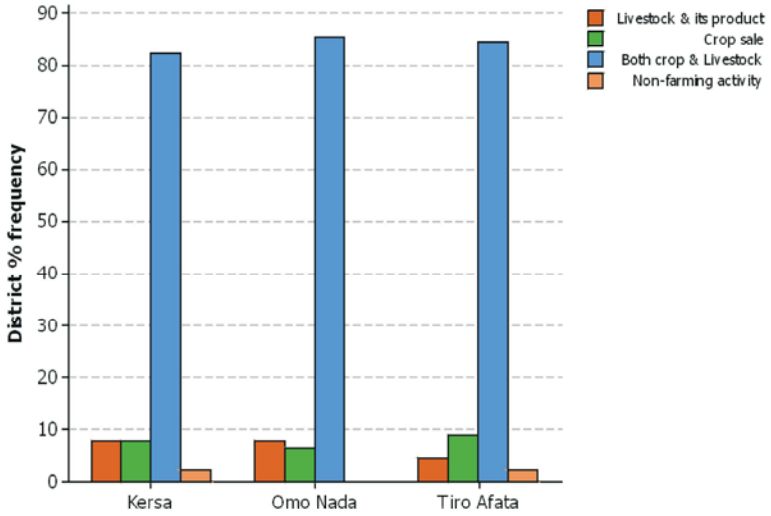

Fig. 2: The main sources of income of the surveyed households in three districts of Jimma zone

Table 3: Mean(±SEM) livestock holding and herd composition per/HH in three districts of Jimma zone

	Districts, mean (± SEM)				
Livestock in TLU	Kersa	Omo Nada	Tiro Afeta	Overall	P
Total Livestock	4.52±0.32[b]	4.79±0.34[b]	5.99±0.30[a]	5.10±0.32	**
Cattle	4.22±0.24[b]	4.47±0.25[b]	5.54±0.23[a]	4.74±0.24	*
Oxen	0.28±0.04[b]	0.20±0.03[b]	0.42±0.05[a]	0.3±0.04	*
Male Cattle	0.59±0.08[b]	0.82±0.10[b]	1.20±0.10[a]	0.87±0.09	**
Female Cattle	3.35±0.20	3.45±0.18	3.92±0.18	3.57±0.19	ns
Sheep	0.08±0.01	0.10±0.01	0.13±0.01	0.10±0.01	ns
Goats'	0.09±0.02	0.05±0.01	0.06±0.01	0.06±0.01	ns
Donkey	0.04±0.02[b]	0.04±0.02[b]	0.13±0.03[a]	0.07±0.02	*
Horse	0.05±0.20	0.04±0.02	0.07±0.03	0.05±0.02	ns
Mule	0.04±0.02	0.09±0.03	0.06±0.03	0.06±0.03	ns

SEM, standard error of means; means with different superscripts in a row indicate statistically significant difference between the districts ($p<0.05$); *$p<0.05$; **$p<0.001$; ns, non-significant difference ($p>0.05$)

The combination of livestock owned in this study was similar to other findings conducted in other rural areas of Ethiopia [23, 12]. Out of the total livestock cattle accounted 4.74±0.24 TLU (92.94%), which could imply that, the importance of cattle in the farming system.

The result of the current finding is lower than the finding of Yeshitila Admassu [13], who reported 9.87 TLU of livestock and out of which 7.38 TLU of cattle in Alaba district of Southern Ethiopia. However, contrary to the present study, there were more numbers of goats (44%), than cattle (42%) and camels (14%) in Mieso district of Hararghe zone [20]. The higher proportion of cattle in the study areas was probably due to the existing farming system of mixed crop livestock production and according to the respondents in the area they used cattle (oxen) primarily for traction purpose in addition to their use as sources of beef and milk for rapidly growing human population.

There was a significant difference ($P<0.05$) in total cattle composition between the study districts. Accordingly, the highest number of cattle in TLU was observed in Tiro Afeta 5.54±0.23 followed by Omo Nada 4.47±0.25 TLU and the smallest cattle number was observed in Kersa 4.22±0.24 TLU. Generally, in all the study districts the herd structure was female dominated ($P>0.05$) compared to males. This shows that cow is the most important animals because it is a source of milk and milk products, replacement stock (calves) and cash. Besides, female animals are highly valued and counted as live resources than male animals. Having a large number of cows are considered by the communities as a prestige and used as markers of wealth status in the studied districts. This finding is in agreement with Teshager *et al*. [11], in Ilu Aba Bora zone of Southwest Ethiopia in which the proportion of cow is higher from all cattle herd structures.

There was a significant difference in male cattle holding (P<0.001) and oxen (P<0.05) in the study districts. The number of male cattle and oxen in Tiro Afeta district was (1.20±0.10 TLU) and (0.42±0.05 TLU), respectively were higher than the two study districts.

Sheep was the second populous livestock next to cattle in all the studied districts. However, there were a comparable number of sheep and donkey (0.13±0.01) and (0.13±0.03), respectively in TLU in Tiro Afeta district which may indicate the importance of donkey.

According to the discussion with key informants across the study districts, the primary purpose of keeping sheep was for cash income and as a source of meat. In times of insufficient crop harvest, sheep are the first animals to be sold to purchase food grain and other family needs and the skin of sheep is also an important source of income in all the studied districts.

Like sheep, goats are mainly kept for meat and cash income. During periods of low crop harvest, goats, like sheep, are sold in order to purchase food and serve as one of the means to minimize food insecurity.

Equines were the most valuable pack animals for transportation of peoples and other goods in many parts of the study areas especially where other means of transportation are not available. Among the equines, donkeys 0.07±0.02 TLU were more abundant followed by horses 0.05±0.02 TLU and Mules 0.06±0.03 TLU and this indicates the importance of donkeys in the farming system. However, there was a significant difference (P<0.05) between the studied districts in composition of donkey. Accordingly, the highest number of donkeys were observed in Tiro Afeta (0.13±0.03 TLU) and this may be due to the poor infrastructure (poor road) and raged topography of Tiro Afeta for modern transportations so that donkeys are more important to transport agricultural inputs (fertilizer, pesticides, herbicides etc) and harvested grains to the farmland/homesteads and to market places respectively. In general as most of the farmlands are far from residence, donkeys are used to transport inputs, farm equipment and harvested grains or crop residues from the farm land and to homesteads or market places in all the study districts. In mixed production systems where animals are used for draught and transport, the proportion of mature oxen or donkeys in herds tends to be relatively high [24]. Horses are used mainly for transporting people and rarely for packing, while donkeys are used solely for packing. In addition to transportation, equines are used for threshing and transporting agricultural products to and from the homestead, drinking water for animals and human beings, wood, crop residues and charcoal to market places. The finding in the current study is in agreement with Lemma [25] and Ahmed *et al.* [26]. According to the discussion with key informants, mules are preferred for transporting people in mountainous rugged and undulating places due to their strength and physical fitness.

Purpose of Livestock Keeping: Livestock keeping has multi advantage in sustaining food security in the current study (p>0.05). Accordingly, the main objectives of livestock keeping were to produce food (milk, milk products and meat), for draught power (traction, pack transport, threshing) and to increase cash income from sale of live animals and animal products (Figure 3). Livestock keeping, however, is primarily a subsistence activity to meet household food needs and supplement farm income. Accordingly, the overall survey result of (88.8%) and (11.2%) depicted that livestock are source of food from direct use/sale of (milk, milk products and meat) to buy food and indirect use of livestock for draught power (traction, threshing) and their manure as fertilizer. The current finding is also in agreement with the report of Teshager *et al*. [11] and Yisehak *et al*. [17], in Ilu Aba Bora and Jimma zones of Southwest Ethiopia, respectively.

Livestock, mainly oxen complement crop production by supplying draught power in all the study districts. According to the discussion with key informants' farmers in the study areas sell livestock mainly small ruminants to mitigate household problems like medication, school fees, payment for fertilizer purchases and others. Livestock also plays an important role in maintaining the livelihoods of the farmers by providing social and cultural identity, medium of exchange and means of savings and investments.

In the high and mid-altitude areas where mixed farming system is practiced, livestock remains an important safety resource, a living bank and a buffer during periods of crop failure and represent more than half the average wealth of rural households [27, 28].

Trends in Livestock Population: According to 60% of respondents in the current study there was an increasing trend in the number of livestock per HH in the last three decades (P>0.05), Table 4. According to the respondents, there were different reasons for an increment in livestock holding per household. Among the reasons, to satisfy an increasing demand for meat and milk (27.41%) for the rapidly increasing human population and to increase cash from sale of live animals and animal products (23.70%) were the major reasons. On the other hand, 40% of the respondents across the districts disclosed a decreasing

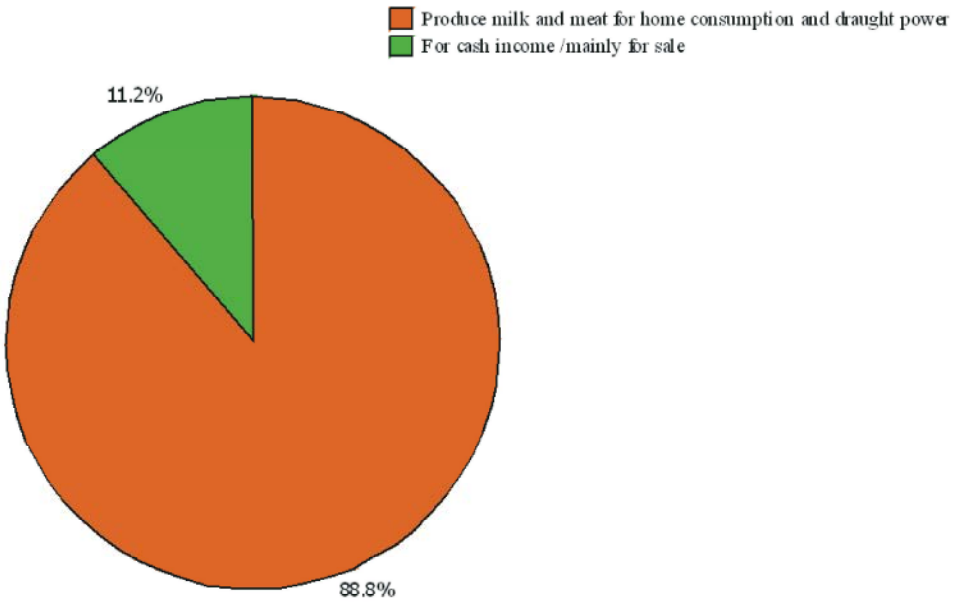

Fig. 3: Purpose of livestock keeping in three districts of Jimma zone

Table 4. Trends in livestock population for the last decades and reason for change in three districts of Jimma zone

	Districts, % of respondents				
Parameters	Kersa	Omo Nada	Tiro Afeta	Overall	P
Increasing	54.44	64.44	61.11	60.00	ns
Decreasing	45.56	35.56	38.89	40.00	ns
Reason for increasing					
To satisfy increasing demand of milk and meat	32.22	22.22	27.78	27.41	ns
To increase cash income	14.44	28.89	27.78	23.70	ns
Unknown	53.33	48.89	44.44	48.89	ns
Reasons for decreasing					
Unknown	42.22^{a}	28.89^{b}	42.22^{a}	37.78	*
Feed/land shortage	32.22^{c}	55.56^{a}	43.33^{b}	43.70	*
Disease occurrence	25.56^{a}	15.56^{b}	14.44^{b}	18.52	*

Different superscripts in a row indicate statistically significant difference between the districts ($p<0.05$); *$P<0.05$; ns: non-significant

trend in the number of livestock per HH in the last three decades. There was a significant difference ($P<0.05$) in reasoning for declining trend in livestock holding per HHs for a decade. Among the reasons, feed shortage was the major prominent in Omo Nada (55.56%) followed by Tiro Afeta (43.33%) and Kersa (32.22%) but disease occurrence was the most prominent in Kersa (25.56%) followed by Omo Nada (15.56%) and the least in Tiro Afeta (14.44%). The current finding is against the report of Yisehak *et al*. [17], who has reported a decreasing trend in livestock holding per household in Jimma zone of Southwest Ethiopia.

Trends in Livestock Species Composition: According to 68.89% of respondents in the current study there was a change in livestock species composition in the last three decades (Table 5). According to 78.15% of the respondents' cattle was the first changing livestock species in the study areas. According to the discussion with key informants decreasing in grazing land, expansion of crop land is enforcing them to reduce large ruminants and shift to small ruminants.

Livestock Management

Animal Housing: Most of the respondents (86.67%) in all districts provided nighttime shelter to their lactating and pregnant cows in human living rooms ($P>0.05$) while the rest 13.33% of respondents house in open yard and separate houses (Table 6). About 89.63% and 10.37% of the calves and small ruminants were housed in the human living rooms. The current study is in agreement with Yisehak *et al*. [17], who reported 88.33% in Jimma zone of

Table 5: Trends in livestock species composition for the last decades and change observed in three districts of Jimma zone

	Districts, % of respondents				
Trend	Kersa	Omo Nada	Tiro Afeta	Overall	P
Exist	65.56[b]	58.89[c]	82.22[a]	68.89	*
Don't exist	34.44[b]	41.11[a]	17.78[c]	31.11	*
Change observed in					
Cattle	77.78[b]	87.78[a]	68.89[c]	78.15	*
Shoats	11.11	4.44	11.11	8.89	*
Equine	4.44	0.00	8.89	4.44	*
Uniform	6.67	7.78	11.11	8.52	*

Different superscripts in a row indicate statistically significant difference between the districts (p<0.05); *P<0.05;ns non significant

Table 6: Livestock housing systems in three districts of Jimma zone

		Districts, % of respondent				
Types of animal		Kersa	Omo Nada	Tiro Afeta	Overall	P
Pregnant/lactating cow	1	85.56	88.89	85.59	86.67	ns
	2	14.44	11.11	14.44	13.33	ns
Caves/small ruminants	1	93.33	87.78	87.78	89.63	ns
	2	6.67	12.22	12.22	10.37	ns

1=housed in human living rooms; 2= housed in separate place; ns, non-significant difference

Southwest Ethiopia. However, its higher than the finding of Teshager *et al*. [11] who has reported 34.4% in Ilu Aba Bora zone of Southwest Ethiopia.

Feed Resources and Feeding Systems: The major sources of feed for livestock in the study areas were natural pasture and roadside grazing, stubble grazing/crop aftermath, crop residue, wild browse/fodder trees and shrubs, crop thinning and non conventional feeds like *chat* (*catht edulus*) leftover and household leftover (Figure 4). Accordingly, natural pasture and crop residues including aftermath grazing were the major feed resources for livestock feeding in the studied areas which agree with the reports of Yisehak *et al*. [17], Tolera *et al*. [29] and Dawit Assefa *et al*. [30] whose have reported natural pasture and crop residue to be the major feed resources for highlands of Ethiopia.

Free/continuous grazing system on private or communal grazing land was the main livestock feeding practiced in the current study. Accordingly, (94.07%) of the respondents practiced free/continuous grazing and the rest (5.93%) of the respondents practiced controlled grazing/tethering of livestock during the main cropping season. The current result is in agreement with the finding of Yisehak *et al*. [17] in Jimma zone of Southwest Ethiopia.

After harvesting the crops, livestock are allowed to graze stubble of different crops (maize, *teff*, sorghum etc) mainly from October to December depending on the type of crop and time of harvest.

Residues of maize, sorghum and *teff* are the main crop residues used as livestock feed in all the study districts.

Sources of Water and Frequency of Animal Watering in the Study Area: The main sources of water in the study areas were presented in Table 7. Accordingly, the main sources of water for livestock were river (95.7%) and shallow-well pond (4.3%). According to Teshager *et al*. [11], the main sources of water for cattle in Ilu Aba Bora zone were river (97.8%), pond (1.7%) and pipe line (0.6%). Farmers in the current study areas water their animals Adlibitum (92.06%), twice a day (5.67%) and once a day (2.27%) both in dry and rainy seasons. The current result is in agreement with the finding of Yisehak *et al*. [17], in Jimma zones of Southwest Ethiopia.

Animal Breeding: Farmers in the studied areas reported that breeding system was entirely natural using local type bulls available in their area (Table 8). Accordingly AI service was not yet started in the study districts and these areas were totally lacking technological intervention to introduce foreign (improved) breed.

According to 94.07% and 90.37% of respondents in the current study their sources of heifer/replacement stock and breeding bull respectively were raised at home and only 5.93% and 9.63% of respondents could purchased replacement heifer and breeding bull, respectively (Table 10). The result of the current study is in agreement with the finding of Yisehak *et al*. [17], who

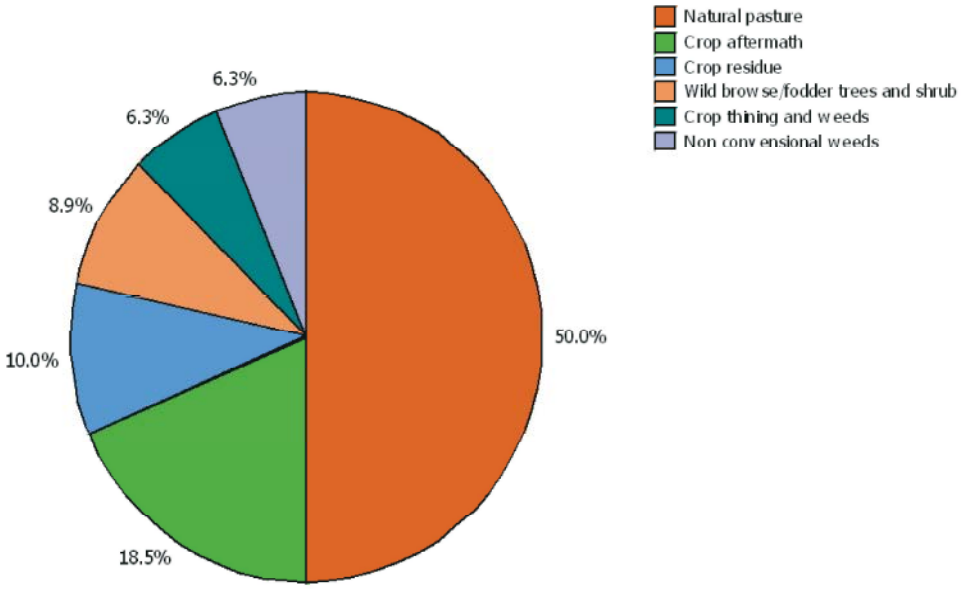

Fig. 4: Major livestock feed resources in three districts of Jimma zone

Table 7: Sources of water and frequency of animal watering in three districts of Jimma zone

	Districts, % of respondent				
Sources of water	Kersa	Omo Nada	Tiro Afeta	Overall	P
River	92.4	96.3	98.5	95.7	ns
Pond	7.6	3.7	1.5	4.3	ns
Watering frequency *Adlibitum*	90.3	92.2	93.7	92.06	ns
Once a day	2	3.8	1	2.27	ns
Twice a day	7.7	4	5.3	5.67	ns

Table 8: Sources of heifer and breeding bull in a sampled HHs in three districts of Jimma zone

	Districts, % of respondent				
Sources	Kersa	Omo Nada	Tiro Afeta	Overall	P
Heifer					
Raised at home	93.33	96.67	92.22	94.07	ns
Purchased	6.67	3.33	7.78	5.93	ns
Breeding Bull					
Raised at home	93.33	88.89	88.89	90.37	ns
Purchased	6.67	11.11	11.11	9.63	ns

ns: non-significant

Table 9: Methods of sick animal treatment in three districts of Jimma zone

	Districts, % of respondents				
Treatment methods	Kersa	Omo Nada	Tiro Afeta	Overall	P
1	6.67^{a}	2.22^{b}	1.11^{b}	3.33	*
2	3.33^{b}	10.00^{a}	3.33^{b}	5.56	*
3	78.89	77.78	80.00	78.89	ns
4	11.11^{b}	10.00^{b}	15.56^{a}	12.22	*

Different superscripts in a row indicate statistically significant difference between the districts (P<0.05); *P<0.05;ns non significant: 1= veterinary assistance; 2=drug purchase; 3=combinations of 1&2; 4=traditional medicine

reported 92.78% of the animals in Jimma zone were obtained from home breeding whereas higher than the finding of Belay Duguma *et al*. [31], who has reported about 25% of the oxen and 72.2% of the cows owned by the households in Dandi district of Oromia region were reared on farm.

Bulls are commonly run with cows all year round and breeding is thus uncontrolled. As cattle herders do not use control breeding, the reproduction of their cattle is primarily regulated by seasonal feed availability [20].

Health Management: In the current study discussion with key informants and survey result revealed that farmers in the study areas uses different treatment methods described on (Table 9). Accordingly, 78.89% of the respondents veterinary assistance and drug purchase from any shops and nearby clinics were the main sick animal treatment practice in the study areas. From all the surveyed households in all the study districts only 3.3% use veterinary assistance as the primary alternative to treat their sick animals. On the other hand, 12.22% of the respondents uses traditional medicine to treat their sick animals.

According to the discussion with key informants and surveyed households the reason why they used drug purchase and traditional medicines to treat their sick animals were due to lack of adequate veterinary services and long distance to clinics.

Productive and Reproductive Performances of Livestock: The overall mean of age at first calving (AFC) and calving interval (CI) of cattle were 4.50±0.08 years and 25.56±0.43 months, respectively (Table 10). The average CI obtained in the current study falls within the range of calving interval for Ethiopian zebu cattle of 12.2 to 26.6 months reported by Mukasa-Mugerwa [32]. However, the overall mean AFC obtained in this study was above the range reported by Mukasa-Mugerwa and Azage Tegegne [33] of 35-53 months. The average AFC and CI in the current study agrees with the finding of Yisehak *et al*. [17] in Jimma zone of Southwest Ethiopia. Similarly, Tesfaye Mengsitie [15], has also reported longer age at first calving of 4.54±0.05 years in Metema district of Amhara region. The mean AFC and CI reported in the current study are higher than the finding of Belay Duguma *et al*. [31], who has reported the mean age at first calving of 50.59±6.94 months and calving interval of 22.19±7.73 months, in Dandi district of Oromia region. Also the current result is higher than the finding of Kedija [20], who has reported an average AFC of 52.49±0.91 months and average CI of 16.01±0.49 in Mieso district, Oromia region. The long calving interval in the current study might be an indication of the poor nutritional and management status of cattle under smallholder farmers. This fact is in line with the report of Mukasa-Mugerwa [32], who indicated that heritability of age at first calving is generally low, indicating that this trait is highly influenced by environmental factors, feed and health. In contrary to the present study, the longer mean AFC of 60 months (5 years) for Horro cattle on farm level was reported by Gizaw Kebede *et al.* [34].

Lactation Milk Yield and Lactation Length: In this study, the average milk yield per cow per lactation and lactation length were 203.29±4.75 liters and 7.84±0.30 months, respectively (Table 10). The mean lactation length in this study is in agreement with Teklay Asgedom [35], who reported lactation lengths of 7.49 months for indigenous cows. The finding of this study is lower in average milk yield per cow per lactation and higher in mean lactation length reported by Kedija [20], in Mieso district of Oromia region which was 271.4 liters per cow per lactation and 7.29±0.17 months respectively. Similarly Yisehak *et al*. [17], has also reported higher average milk yield per cow per lactation and lower lactation length in Jimma zone of Southwest Ethiopia. The mean lactation length in this study is lower than that of Belay Duguma *et al*. [31] and Ulfina *et al.* [36], which were 8.96±4.63 and 9.3±0.9 months in Dandi district and Jimma town, respectively. In the current study the average milk yield per cow per day is around 0.86 litters when adjusted to lactation length of 235 days and this is below the national average value of 1.09 liter/cow/day. The low lactation milk yield in the current study may be attributed to shortage of livestock feeds both in quantity and quality, especially during dry season which is in agreement with the finding of Ahmed *et al.* [26], in the central high lands of Ethiopia.

Reproductive Lifespan of Cattle: The overall mean reproductive lifespan of cow in the current study depicts 8.21±0.02 year (Table 10). The reproductive life span of cow in this study is shorter than Horro a cattle 10.1±0.01 year which was reported by Gebreyohannes and Kebede [37]. According to Yisehak *et al*. [17], the reproductive life span of indigenous cows in Jimma zone was 7.69±0.14 years.

In the current study the overall mean draught age of male cattle and draught lifespan of oxen were 4.56±0.10 and 5.61±0.14 years, respectively. The current finding is in agreement with Yisehak *et al*. [17], who has reported age at first ploughing of 4.47±0.07 and draught lifespan of 5.07±0.08 years for indigenous male cattle in Jimma zone.

Table 10: Production and reproductive performances of livestock in three districts of Jimma zone

		Districts, (means ± SEM)				
Species	Variable	Kersa	Omo Nada	Tiro Afeta	Overall	P
Cattle	Age at first calving (years)	4.59±0.08	4.48±0.08	4.42±0.09	4.50±0.08	ns
	Calving interval (months)	25.31±0.43	25.92±0.40	25.45±0.46	25.56±0.43	ns
	Lactation length (months)	7.75±0.31	7.76±0.30	8.02±0.30	7.84±0.30	ns
	Lactation milk yield (liters)	208.24±5.12	201.13±5.04	200.48±4.93	203.29±4.75	ns
	Days open	247.56±5.84	244.16±6.06	243.68±6.01	245.13±5.97	ns
	Reproductive lifespan of cows (yea)	8.30±0.20	8.35±0.20	7.97±0.21	8.21±0.02	ns
	Draught age of male cattle (years)	4.75±0.11	4.43±0.10	4.41±0.10	4.56±0.10	ns
	Draught life span of oxen (years)	5.48±0.14	5.65±0.14	5.70±0.15	5.61±0.14	ns
Sheep	Age at first lambing (years)	2.44±0.25	2.53±0.25	2.39±0.21	2.46±0.24	ns
	Lambing interval (months)	16.01±0.34	15.99±0.44	15.74±0.35	15.91±0.38	ns
Goats	Age at first kidding (years)	2.06±0.04ab	2.12±0.04a	1.97±0.05b	2.05±0.04	*
	Kidding interval (months)	15.89±0.29a	15.63±0.33ab	14.83±0.27b	15.45±0.30	*
Horse	Age at first calving (years)	5.01±0.11	4.86±0.17	4.98±0.15	4.95±0.14	ns
	Calving interval (months)	29.59±1.13b	37.48±1.95a	39.65±2.2a	35.57±1.76	*
	Age for work (transport) (years)	5.93±0.22	6.33±0.32	6.59±0.35	6.28±0.30	ns
Mule	Age for work (transport) (years)	6.32±0.20b	6.75±0.12a	6.72±0.09ab	6.60±0.14	*
Donkey	Age at first calving (years)	6.57±0.26	5.69±0.37	6.39±0.32	6.22±0.32	ns
	Calving interval (years)	2.88±0.19a	2.48±0.17ab	2.33±0.16b	2.56±0.17	*
	Age for work (transport) (years)	6.95±0.84a	6.20±0.10ab	5.98±0.18b	6.38±0.37	*

Different superscripts in a row indicate statistically significant difference between the districts ($p<0.05$); ns, non-significant difference ($p>0.05$); *$p<0.05$

Reproductive Performances of Sheep and Goat: The mean age at first lambing (AFL) and lambing interval (LI) of sheep were 2.46±0.24 years and 15.91±0.38 months, respectively (Table 10). The mean LI in this study agrees with the finding of Yisehak *et al*. [17], who has reported average lambing interval of 15.80±0.23 months in Jimma zone. The current finding is higher than the finding of Belay *et al*., (2012), who has reported 12.64±5.29 and 7.37±0.77 months of AFL and LI in Dandi district of Oromia region.

The mean age at first kidding (AFK) and kidding interval (KI) of goat were significantly different ($p<0.05$) between the study areas. The overall mean age at first kidding and kidding interval were 2.05±0.04 years and 15.45±0.30 months, respectively. The highest mean AFK was observed in Omo Nada 2.12±0.04 years followed by Kersa 2.06±0.04 years and the minimum AFK was observed in Tiro Afeta district 1.97±0.05 years. The mean KI in the current study is in agreement with the finding of Yisehak *et al*. [17], who has reported average KI of 15.48±0.2 months in Jimma zone. However the mean AFK and KI in the current study are higher than the finding of Belay Duguma *et al*. [31], who has reported mean AFK and KI of 10.90±3.14 and 6.56±1.42 months, respectively in Dandi district of Oromia region.

Productive and Reproductive Age of Equine: Productive and reproductive age of equine animals in the study areas were depicted on (Table 10). The overall ages at first foaling (AFF) and foaling interval (FI) of horses were 4.95±0.14 years and 35.57±1.76 months, respectively. However, there was a significant difference in foaling interval of horses in the study areas ($P<0.05$). Accordingly, the longest FI of 39.65±2.2 months was found in Tiro Afeta district followed by Omo Nada districts 37.48±1.95 months and the short FI of 29.59±1.13 months was observed in Keras district. The mean AFF and FI of horses reported in the current study are lower than the finding of Belay Duguma *et al*. [31], who has reported average AFF and FI of 35.25±18.30 and 18±6 months, respectively in Dandi district of Oromia region.

The overall mean age at work (transport) of horses in the study areas was 6.28±0.30 years.

There was a significant difference in age at first work (transport/draught) of mule ($p<0.05$). Accordingly, the longest age at first work of 6.75±0.12 years was observed in Omo Nada district followed by 6.72±0.09 years in Tiro Afeta district and the short age at first work of 6.32±0.20 years was observed in Kersa district. The overall mean age at first work for mule in the study areas was 6.60±0.14 years.

The overall age at first foaling for Jennies was 6.22±0.32 years in all the studied districts. However, there was a significant difference in foaling interval of Jennies ($p<0.05$). The highest foaling interval of 2.88±0.19 years was observed in Kersa districts followed by 2.48±0.17 years in Omo Nada district and the shortest FI of 2.33±0.16 years was observed in Tiro Afeta district.

The overall mean FI of Jennies in the current finding is 2.56±0.17 years. The mean AFF and FI of Jennies found in the current study are lower than the finding of Belay Duguma *et al*. [31], who has reported average AFF and FI of 45.33±13.52 and 19.86±6.47 months, respectively in Dandi district of Oromia region.

There was a significant difference in age at first work (transport) of donkey (P<0.05) in the study areas. Accordingly, the longest age at first work of 6.95±0.84 years was observed in Kersa district followed by 6.20±0.10 years in Omo Nada district and the short age at first work of 5.98±0.18 years was observed in Tiro Afeta district. The overall mean age at first work in the current study is 6.38±0.37 years. The current finding in age at first work of donkey may contribute to the difference in management system between the study districts.

Constraints of Livestock Production in the Studied Districts: The main livestock production constraints in the current study area are depicted on (Table 11). According to 71.48% of the respondents feed followed by diseases and low productivity of the indigenous livestock breeds were the major problem constraining livestock production and productivity in the study areas. On the other hand, 28.52% of the respondents depicted diseases followed by feed and low productivity of the indigenous livestock breeds as the major challenges of livestock production and productivity in the study areas. However, there was a difference between the study districts (p<0.05). Accordingly, 77.78% of respondents in Omo Nada and 75.56% of respondents in Tiro Afeta districts prioritized feed followed by diseases and low productivity of the indigenous livestock breeds as the main livestock production constraints in their respective districts. In contrary to this , 61.11% of respondents in Kersa district prioritized disease followed by feed and low productivity of the indigenous livestock breeds as the main livestock production constraints. Based on the survey result and discussion with key informants feed shortage was ranked (1st) followed by animal diseases (2nd) and low productivity of the indigenous livestock breeds (3rd) as the main livestock production constraints in all the study districts. The current finding is in agreement with Yisehak *et al*. [17], who have reported feed as (1st) and disease as (2nd) animal production constraints in Jimma zone of Southwest Ethiopia. On the other hand [11], has reported cattle disease, shortage of grazing land, water shortage and inadequate animal health services in descending order as cattle production constraints in Ilu Aba Bora zone of Southwest Ethiopia.

According to discussion with key informants feed constraint was mainly related to shortage of grazing land due to increased population and competition of the available land for crop production. Successive decrease in grass composition and increase in unpalatable plant (bushes/trees) for a decade of the available range lands mainly on communal grazing lands were the main range land related problems. Additionally, grazing land degradation due to soil erosion, overgrazing and tree/bush clearing was also the main cause of feed scarcity.

Livestock disease described by the respondent households and key informants constraining livestock production in the study areas were grouped under: selected infectious diseases, respiratory diseases and gastro-intestinal disorders (Table 12). According to79.63% of the respondents in the study areas selected infectious diseases were the primary livestock diseases constraining livestock production and productivity in the study areas. Respiratory disease like CBPP and CCPP were also described as 2nd livestock diseases constraining livestock production and productivity in the study areas. Types of diseases described by respondents in the current study are in agreement with the findings of Workneh *et al*. [12] in Oromia region who has indicated that the major cattle diseases were Blackleg, Trypanosomosis, Pasteurollosis, Anthrax, Foot-and-mouth disease (FMD), gastrointestinal disorders and respiratory diseases.

The other important constraints of livestock production described by key informants in the current study were lack of credit service, poor livestock extension service and inadequate animal health services.

Accordingly, lack of credit services for livestock producer was one of the limiting factors constraining livestock production in the study areas. Discussion with key informants revealed that lack of own capital which was more aggravated by absence of any governmental or nongovernmental organizations which can provide loan/credit service for small scale livestock producers were the other limiting factors of livestock production in the study areas.

On the other hand lack of training on livestock husbandry and feeding was also described as the main problem related to poor livestock extension service constraining livestock production in the study areas.

Inadequate animal health services mainly related to shortage of veterinarians, lack of nearby animal health clinics and cost of medications were the most constraints related to animal health service in the study areas.

Table 11: Livestock production constraints ranked top three in three districts of Jimma zone

	Districts, % of respondents				
Constraints	Kersa	Omo Nada	Tiro Afeta	Overall	P
Feed-disease-low productivity	61.11[b]	77.78[a]	75.56[a]	71.48	*
Disease-feed-low productivity	38.89[a]	22.22[b]	24.44[b]	28.52	*

Different superscripts in a row indicate statistically significant difference between the districts (p<0.05); *P<0.05

Table 12: Major diseases constraining livestock production in three districts of Jimma zone

	Districts, % of respondents				
Types of diseases	Kersa	Omo Nada	Tiro Afeta	Overall	P
Selected Infectious diseases	76.67	83.33	78.89	79.63	ns
Respiratory diseases	12.22	8.89	12.22	11.11	ns
Gastro-intestinal disorders	11.11	7.78	8.89	9.26	ns

ns: non-significant

Opportunities of Livestock Production in the Study Area: In the current study area there are multiple opportunities for livestock production because the area is highly endowed with natural forests and various annual and perennial plants that can be potential feed sources for livestock.

The area has fertile soil and also receives enough amount of rainfall that can be used to develop various types of grasses, legumes and browses species used as livestock feeds.

The area is also known for coffee production. However, the productivity and the price of coffee have been highly variable. So farmers face income shortage during times of coffee failure. The integration of livestock production is important as they can be intermediate cash sources during coffee failure time.

High demand of livestock and livestock products in the local market as a result of population growth, urbanization and increase in income can be considered as an opportunity for the livestock producers.

Nowadays new big abattoir is constructed in Jimma city which is nearest to the current study area; so that agents and assemblers purchase live animals even at farm gate from producers to slaughter and process in this abattoir for export.

Moreover, Jimma airport is starting international flight soon; which could be another opportunity for export of slaughtered animal carcass to different countries. So there would be a high demand for livestock especially live animals' mainly small ruminants and fattened cattle in the future.

CONCLUSION

The overall average holding of total livestock per HH was 5.10±0.32 in TLU. Out of the total livestock cattle accounts 4.74±0.24 TLU (92.94%) which implies the importance of cattle in the farming system.

Breeding system was entirely natural mating using local type bulls available in the area. AI service was not yet started in the studied districts.

Natural pasture and roadside grazing, stubble grazing/crop aftermath, crop residue, wild browse/fodder trees and shrubs, crop thinning and non conventional feeds like *chat* (*catht edulus*) leftover and household leftover were the major feed resources in the study area. However, natural pasture and crop residues were the major livestock feed sources in the study areas.

Feed shortage, diseases, low productivity of the indigenous livestock breeds, lack of training on livestock production, lack of credit service for livestock producers and inadequate animal health services were the major challenges of livestock production in the study area.

So, from the current study it is possible to conclude the livestock production system in the study area as traditional mixed crop livestock production systems with no improved technology use and low output from the livestock.

Recommendations: Encouraging and advising livestock keepers to allocate grazing land from their total land holding since communal grazing land is not further available due to population growth and expansion of crop farming.

There should be land use policy regulation in the area which can secure areas for livestock feed production to increase the contribution of livestock sector in eradication of poverty and sustaining food security in the smallholder livestock producers as well as in the country.

Urgent livestock developments strategies on the areas of feeding, breeding and husbandry practice is required to benefit the livestock producers in the study area.

REFERENCES

1. Sintayehu Gebre Mariam, Samuel Amare, Derek Baker and Ayele Solomon, 2010. Diagnostic study of live cattle and beef production and marketing: Constraints and opportunities for enhancing the system; Consultant to International Food Policy Research Institute: International Livestock Research Institute.
2. FAO, 2004. Food and Agricultural Organization of the United Nations: Livestock Information Sector Analysis and Policy Branch.
3. Yoseph, M., 1999. Impact of feed resources on productive and reproductive performance of dairy cows in the peri-urban dairy production systems in the Addis Ababa milk shed and evaluation of non-conventional feed resources using sheep. MSc Thesis, Alemaya University of Agriculture, Diredawa, Ethiopia.
4. Mohamed, A.M. Ahmed, Simeon Ehui and Yemesrach Assefa, 2004. Dairy development in Ethiopia, EPTD (Environment and Production Technology Division) Discussion Paper No. 123, International Food Policy Research Institute, U.S.A.
5. Yitaye, A., W. Maria, T. Azage and Z. Wemer, 2007. Urban and peri- urban farming systems and utilization of the natural resources in the North Ethiopian Highlands. PP.5. Conference on International Agricultural Research for Development, University of Kassel- Witzenhausen and University of Göttingen, October 9-11, 2007, Germany.
6. http://en.wikipedia.org/wiki/Jimma_Zone
7. http://www.weatherzone.com.au/world/africa/ethiopia/jimma
8. GOR: (Government of the Oromia region of Ethiopia), 2011. Socio-economic Profile of the Jimma Zone: GOR, Addis Ababa, Ethiopia.
9. Cochran, W.G., 1977. Sampling techniques (3rd ed) Canada, New York: John Wiley & Sons.
10. MNTAB, 2013. Minitab Statistical software version 16.1 MINTAB Inc: Canada
11. Teshager Aayalew, Belay Duguma and Taye Tolemariam, 2013. Socioeconomic and Farm Characteristics of Smallholder Cattle Producers in Ilu Aba Bora Zone of Oromia Regional State, South Western Ethiopia:. Global Veterinaria, 10(5): 607-613, 2013 pp: 607-612
12. Workneh, Ayalew and J. Rowlands, (ed), 2004. Design and execution and analysis of livestock breed survey in Oromiya regional state, Ethiopia. OADIS (Oromia Agricultural Bureau), Addis Ababa, Ethiopia and ILRI (International Livestock Research Institute), Nairobi, Kenya, pp: 260.
13. Yeshitila Admassu Mekonnen, 2008. Assessment of Livestock Feed Resources Utilization in Alaba Woreda, Southern Ethiopia: A Thesis Submitted to the Department of Animal Sciences, School of Graduate Studies Haramya University: In Partial Fulfillment of the requirements for the degree of Master of Science in Agriculture (Animal Production)
14. Adebabay Kebede, 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. A master thesis In Agriculture (Animal Production). , Department of Animal Science and Technology; School of Graduate Studies Bahir Dar University.
15. Tesfaye Mengsitie, 2007. Characterization of Cattle Milk and Meat Production, Processing and Marketing System In Metema District, Ethiopia. A master thesis in Animal Sciences, Department of Animal and Range Sciences, Awassa College of Agriculture, School of Graduate Studies Hawassa University Awassa, Ethiopia.
16. Zewdie Wondatir, 2010. Livestock Production Systems in Relation with Feed Availability in the Highlands and Central Rift Valley of Ethiopia. A master thesis in Agriculture (Animal Production), School of Animal and Range Sciences, School of Graduate Studies Haramaya University
17. Yisehak K., T. Taye and H. Aynalem, 2013. Characteristics and Determinants of Livestock Production in Jimma Zone/Southwestern Ethiopia. International Center of Agricultural Research in the Dry Area, ICARDA, Aleppo, Syria.
18. Mulugeta Ayalew, 2005. Characterization of Dairy Production Systems of Yerer watershed in Ada Liben Wereda, Oromia Region, Ethiopia. An MSc thesis , School of Graduate Studies of Alemaya University, Alemaya University, pp: 140.

19. CSA (Central Statistical Agency), 2008/2009. Agricultural Sample Survey 2008/2009, Volume II Report on Livestock and Livestock Characteristics (Private and Peasant Holdings) Statistical Bulletin 446. Addis Ababa.
20. Kedija, H., 2007. Characterization of milk production system and opportunities for market orientation: Acase study of Mieso district, Oromiya region, Ethiopia, M.S. thesis, Haramaya University, Ethiopia.
21. Shitahun Mulu Belay, 2009. Feed Resources Availability, Cattle Fattening Practices and Marketing System in Bure Woreda, Amhara Region, Ethiopia. A master thesis of Science Degree In Livestock Production and Pastoral Development. Please Add University.
22. Belete Shenkute, 2009. Production and Marketing Systems of Small Ruminants in Goma District of Jimma Zone, Western Ethiopia: M.Sc. Thesis (Animal Production), Department of Animal and Range Sciences, Hawassa University College of Agriculture, Awassa, Ethiopia.
23. IPS (International Project Service), 2000. Resource potential assessment and project identification study of the Somalia Region: Socio-economic assessment. Investment office of the Somalia regional state. Research Report. Vol.III. Somalia, Ethiopia, pp: 351.
24. ILCA: (International Livestock Center for Africa), 1990. Livestock system research manual. Working paper 1. Volume 1. ILCA, Addis Ababa, Ethiopia, pp: 287.
25. Lemma, G., 2002. Crude protein and mineral status of Forages grown on pelvic vertisol of Ginchi, central highlands of Ethiopia. PhD dissertation Presented to the University of the Free State, Bloemfontein.
26. Ahmed, H., E. Abule, K. Mohammed and A.C. Treydte, 2010. Livestock feed resources utilization and management as influenced by altitude in the Central Highlands of Ethiopia. Institute of Plant production and Agro-ecology in the Tropics and Subtropics, University of Hohenheim, Garbenstr. 13, 70599 Stuttgart, Germany.
27. WISP (World Institute for Sustainable Pastoralism), 2008. Pastoralism in Ethiopia: Its total economic values and development challenges. A knowledge management study.
28. NABC Fact Sheet, 2010. Livestock in Ethiopia and opportunity analyses for Dutch investment.
29. Tolera, A., A. Yami and D. Alemu, 2012. Livestock feed resources in Ethiopia: Challenges, Opportunities and the need for transformation. Ethiopia Animal Feed Industry Association, Addis Ababa, Ethiopia.
30. Dawit Assefa, Ajebu Nurfeta, Sandip Banerjee, 2013. Assessment of feed resource availability and livestock production constraints in selected Kebeles of Adami Tullu Jiddo Kombolcha District, Ethiopia: African journal of Agricultural Research, 8(29): 4067-4073.
31. Belay Duguma, Azage Tegegne and B.P. Hegde, 2012. Smallholder Livestock Production System inDandi District, Oromia Regional State, Central Ethiopia. Global Veterinaria, 8(5): 472-479.
32. Mukasa-Mugerwa, E., 1989. A review of a productive performance of female Bos indicus (zebu) cattle. ILCA Monograph 6. ILCA, Addis Ababa, Ethiopia.
33. Mukasa-Mugerwa, E. and Azage Tegegne, 1991. Reproductive performance in Ethiopia Zebu (Bos indicus) cattle constraints and impact on production. pp: 16-28. In: proceeding of the fourth Animal Conference of Ethiopian Society of Animal production (ESAP), 13- 15 Nov, 1991 Addis Ababa Ethiopia.
34. Gizaw Kebede, Mulugeta Kebede and Gebre Egziabher Gebre Yohannes, 1998. Dairy and beef technology development and achievements at Bako. Proceedings of the third technology generation transfer and gap analysis workshop. 12-14 November 1996. Nekemte, Ethiopia.
35. Teklay Asgedom, 2008. Assessment Of The Feeding Systems And Feed Resources Of Dairy Cattle In Lemubilbilo Wereda Dairy Products-Processingcooperatives, Arsi Zone Of Oromia Regional State, Ethiopia: MSc thesis, School of Graduate Studies of Addis Ababa University, Faculty of Veterinary Medicine.
36. Ulfina, G., D. Jiregna, T. Alganesh, P. Shiv and M. Late, 2013. Dairy Production Potential and Challenges in Western Oromia Milk Value Chain, Oromia, Ethiopia: Journal of Agriculture and Sustainability ISSN 2201-4357, 2(1): 1-21.
37. Gebreyohannes, G. and M. Kebede, 2006. Herd life and life time calf crop production in relation to age at first calving in indigenous and cross bred cows at Bako, Ethiopia. Ethiop. J. Animal Prod., 66: 55-65.