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A comprehensive study on the cattle production situation owned by refugees and hosting communities in the Gambella region, southwestern Ethiopia

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Abstract

This study was designed to assess the state of cattle production and the contributions that cattle production makes to enhance the livelihoods, food security, and nutrition of refugees and the host community in the Gambella region in southwest Ethiopia. Two hundred fifty-five cattle owners were purposefully chosen for the study, and information was gathered through questionnaires, focus group discussions, and key informant interviews. The average number of animals per household (sd; ±0.002 range: 1 to 490) was 32.37. The study observed a total of 8,258 cattle of which 8,146 belonged to the Nuer breed and 112 to the Felata breed. The reason for maintaining cattle varies statistically across the host community, re-settlers, and refugee communities (x2=50.358; p-value =0.000). According to the current study, 92.5% (236/255) of cattle owners used a free-grazing system, and the mean daily milk yield per cow during the dry and rainy seasons, respectively, was 1.35L and 2.09L. All respondents (100%) agree that there exist cattle diseases in the research area, and 79.6% of cattle owners employed traditional medicine to prevent and treat cattle diseases. Some of the potentials for cattle production in the study areas were cultural value, the existence of disease-tolerant breeds, the availability of manpower, and local expertise. Therefore, it is highly advised that a thorough analysis of the various agro-ecologies in the area be necessary to understand the reproductive and productive performance of cattle.

Keywords: Cattle Production; Gambella; Host Community; Refugees; Southwestern Ethiopia.

Introduction

About 60% of rural households in developing countries are estimated to fully or partly depend on livestock for their livelihoods. However, there is no sufficient and appreciable data that entails the contribution of livestock to the livelihoods of the households including both the monetary and the non-monetary benefits. This poses challenges to the design and implementation of effective investments in the sector (Ugo *et al.,* 2011)

Ethiopia has the largest livestock population in Africa and has an estimated population of 57.829 million heads of cattle, 28.89 million sheep, 29.7 million goats, 2.08 million horses, 0.405 million mules, 7.88 million donkeys, 1.22 camels, and 60.50 million poultry (CSA, 2016). The livestock that constitutes Ethiopian farm animals, ruminants comprising of cattle, sheep, and goats are among the main source of draft power (cattle), wealth accumulation purposes, and income generation and are distributed within the different agro-ecological zones of the nation; about 99% of cattle populations are of local Zebu breed. The remaining 1% of exotic breeds is kept mainly for dairy production in urban and peri-urban areas to fulfill local market milk consumption demands (Welay *et al.,* 2018).

Literature indicates that livestock production and productivity are hindered by the poor nutritional value of the forage both in quantity and quality. It is also affected by poor livestock husbandry practices, animal health ailments, and husbandry constraints. The aforementioned constraints resulted from subsistence-oriented livestock production in Ethiopia in particular. The constraints also arise from epidemics and pandemics of animal diseases which have contributed to livestock morbidity and mortality. Consequently, it causes reduced livestock production and productivity oftentimes. In central Ethiopia, livestock husbandry practices are extensively managed on free grazing range/within the extensive system. Specifically, crop-producing farmers keep an average of five to 15 cows/shoats/household (HH) under the free-grazing range system, the animals move about freely to feed on forages/grasses, which are abundantly available during the rainy season. Hardly are the animals provided supplementary feeds (personal observation) and despite poorly designed housing shelter is provided by their owners around their homestead areas to protect them from predators (Steinfeld *et al.,* 2006).

In Ethiopia, where livestock agriculture is merely practiced; cattle are raised extensively in small-holder production systems (Metaferia *et al.*, 2011). As a result of extensive livestock production, productivity is hindered by anthrax, blackleg, lumpy skin disease (LSD), trypanosomiasis, and other major health problems experienced are parasites, with liver fluke being the major internal parasites, followed by ticks and biting flies. Animal health is recognized to be a significant source of production losses such as low weight gain, draught, fertility, and lactation performances (Tadesse, 2014). Factors like low feed supply to livestock, occupation of grazing lands by humans, and the conversion of grazing land into farmlands pose a challenge to the sector. The use of improved forages by smallholder farmers is not common and utilization of agro-industrial by-products is limited to urban and peri-urban areas (Bizelew *et al.*, 2016). Farmers have used traditional medicines and practices to treat their animals for different kinds of livestock diseases. Major animal health constraints and efficient livestock husbandry practices are not yet been identified and developed, respectively (Alemu *et al.*, 2019).

Improvement in cattle productivity can be achieved through the identification of production constraints and by the introduction of improved technologies or by refining existing practices in the system. There are limitations in identifying data on the existing breed type, cattle diseases, sources of cattle production inputs, the production potential of study areas, quality of livestock production, and like. More importantly, there was no study, especially in the refugee camps. Therefore, the research is designed to assess the existing cattle production challenges, opportunities, breed improvement, production system trends, roles of cattle production in improving livelihoods food security, and nutrition of refugee and host communities.

Materials and methods

Study area description

The study was conducted within the refugee hosting communities in Gambella Regional State (Lare woreda, Itang special woreda, and Gambella zuriya woreda) and in Refugee Camps (Kule, Jewi, Teirkidi, and Nyuengyiel) Refugee camps of Gambella Regional State, South Western Ethiopia from February to April 2020.

The Gambella People's Regional State is located in the South Western part of Ethiopia between the geographical coordinates of $6^0$28'38" to $8^0$34' North Latitude and 33^0 to $35^0$11'11" East Longitude. The region is situated 766 km away from the Ethiopian capital Addis Ababa. The region covers an area of about 34,063 km^2. It is bounded to the North, North East, and East by Oromia National Regional State, to the South and Southeast by the Southern Nations and Nationalities and People's Regional State, and to the Southwest, West, and Northwest by the Republic of South Sudan (CSA, 2016).

Most of the Gambella Region is flat and its climate is hot and humid. The mean annual temperature of the Region varies from 17.3^0C to 28.3^0C and the absolute maximum temperature occurs in mid-March and is about 45^0C. The absolute minimum temperature occurs in December and is 10.3^0C. The annual rainfall of the Region in the lower altitudes varies from 900-1,500mm; at higher altitudes, it ranges from 1,900-2,100mm. The annual evapotranspiration in the Gambella reaches about 1,612mm and the maximum value occurs in March and is about 212 mm (CSA, 2016). Based on the 2013/2014 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the Gambella Region has a total population estimation of 406,000 and livestock population of Gambella 253,389 cattle, 39,564 sheep, and 83,897 goats (CSA, 2016).

The population of the refugee camps was coming from South Sudan at various times due to instability in their country. The refugee camps were established at different times depending on the influx of refugees to the region. In the refugee area where the camps are established, there is natural grass and the people had to practice rearing animals in their country the presence of a conducive environment around the refugee camps leads them to keep different farm animals such as cattle, goats, sheep, and fishing using artificial ponds in harmony with the host communities.

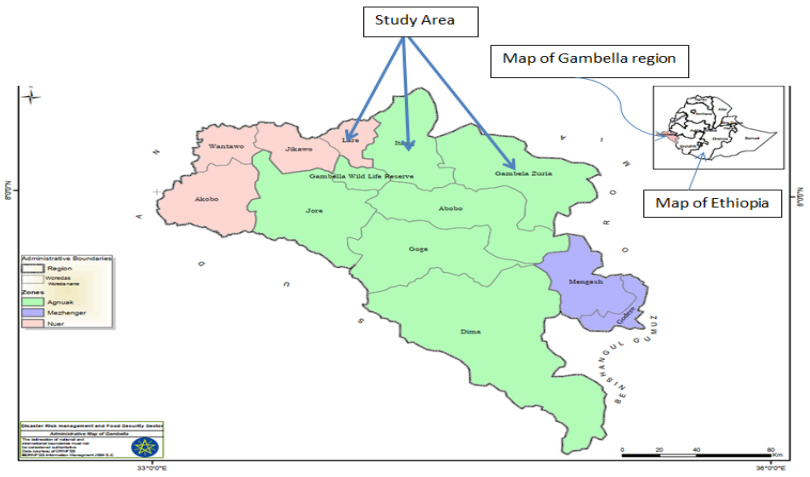

Figure1. Map of the study area; Source: Bureau of Finance and Economic Development, Gambella, Ethiopia (2017)

Study methods

The study was conducted within the refugee Hosting communities and in refugee camps found in Gambella Regional State, southwest Ethiopia from February to April 2020. A cross-sectional study design was employed in the study areas to determine the production situation, the animal health and disease problems, the existing challenges of cattle production, and potential opportunities for the region in general and the study area in particular.

Seven (three woredas and four refugee camps) were selected purposively based on their livestock population and milk shed status. The Source of the study population was both the host communities in different districts of the Gambella Region such as Lare woreda, Itang special woreda, and Gambella zuriya woreda, and refugee communities living in Kule, Jewi, Teirkidi, and Nyuengyiel refugee camps in the Region. The study population constitutes cattle owners from three refugee hosting woredas and the refugee camps that are mainly under the agro-pastoral production and Pastoral production system of the area.

Sample size determination

The sample size was determined based on Yamanes' (1967) sample size determination formula for finite population and a proportional number of respondents were collected from each study site, based on prior information on cattle ownership, farmers' cooperation, logistics, and accessibility.

$$n = \frac{N}{1+N(d^2)}$$

N= populations of cattle owners in the host community and in the refugee, which is 374,214.

d = desired absolute precision which is 94% (95%) confidence level was used due to shortage of time and budget constraints. Therefore, the sample size calculated was 278 but, 255 of the questionnaires were collected appropriately and the remaining 23 were not collected due to quality cases and the absence of farmers in the stated villages.

Sampling procedure and data collection

The mixed (quantitative and qualitative) research approach was used for data collection and a Stratified sampling technique was employed the study population was classified into the refugee hosting communities based on their administrational units and for the refugee employ the refugee camps were used as a stratum. In the process of the questionnaire development, due emphasis was given to the following core subjects: socio-economic characteristics of the household, livestock production and associate constraints, types of feed resources, and time of availability. Enumerators were recruited and trained to administer the pretested questionnaires which were structured and semi-structured. All Cattle owners staying more than 5 years in the study area were included in the present study and experts were selected according to their proximity to cattle and cattle owners.

Different data collection tools such as questionnaires, focus group discussions, and key informant interviews. A structured and semi-structured questionnaire was designed to collect both qualitative and quantitative data from the sample population. The questionnaire was designed and inscribed in the English language. It consisted of four sections. The first section is designed to capture general background information of the respondent while section two is intended

to collect information on cattle production; Section three is for capturing information on milk and meat consumption trend, and Section four is aimed at gathering information on animal health/ diseases problems.

Focus group discussion was employed with developmental agents, community leaders/elders, cattle owners, Community animal health workers, and *Kebele* Administrators on selected issues. Six to eight discussants were incorporated and their views of the agreement were analyzed. Key informants' interview was undergone with the regional and woreda level Livestock and fishery experts in the area of breeding practice, cattle health problems, cattle forage, vaccination practice, and the plan of future cattle production in the study areas.

Source of data

Primary data collection

Primary data were gathered through a combination of techniques; key informant interviews, focused group discussion, and personal farm visits and discussions with farmers using structured and semi-structured questionnaires. Before the actual implementation of the field survey, pretesting of the structured and semi-structured questionnaire survey was carried out by trained data collectors on smallholder farmers in agro-pastoral areas of the Gambella region. Accordingly, the prepared structured and semi-structured questionnaire survey was modified and an interview was conducted to collect the required data. The case study was conducted to collect relevant information on the existing cattle production conditions of refugees and the host communities.

Secondary data collection

Secondary sources of information relevant to the subject were collected from various published papers such as those published on the production system, cattle breed, and system of animal feed conservation and grey literature (reports from woreda and the refugee camp) and were reviewed to extract additional information to complete the primary data. Secondary data were collected to enhance the understanding of the cattle production conditions in the study areas. The main sources for secondary data were reports and documents from district livestock offices. Secondary data collected included information and findings from past studies on the sector

Pilot survey

The pilot survey was conducted in March 2020 before the actual data collection. It was designed to collect data and information that were used to identify the problems facing the cattle owners. Discussions were employed with officials from the regional office of Agriculture, Cooperatives (districts), and office of Livestock and Fishery Development and Refugee representatives to obtain their views on the general status of cattle production in the study areas. Depending on the availability and willingness of respondents to participate in the pilot survey; the selection of members of focus group discussions followed purposive sampling where members were selected from a population of actors who kept cattle. During the pilot study, several issues on cattle production were discussed including, the cattle breed improvement trends, forage availability, seasonality and volumes of milk production, meat production and consumption, cattle health problems/health, and constraints faced so far.

Data management and analysis

Data needed for the study was recorded on a data sheet during data collection. Data recorded were managed using the Microsoft Excel computer program, and entered and stored by SPSS IBM 20 data analysis software. Pretesting of the structured data extraction tool took place on 6% of the sample before the full course of data collection. After minor correction was made to the extraction tool data collection was restarted. The data collected were also checked for completeness and consistency.

To control data quality data collectors were recruited for all the required data. One day of training was provided to them with the aim of the study and the data collection tools. Supervision of data collection was done by the researchers. Data analysis involved both qualitative and quantitative techniques and questionnaires were administered with SPSS IBM v20 software. Chi-square ($\chi 2$) was used for the association of different factors such as host community with refugee, and sex with cattle production. A P-value <0.05 was considered statistically significant at a 95% confidence interval. Qualitative data were transcribed, consolidated, and narrated. Then the data was coded; categorized and finally analyzed using open code 3.6.2.0windows.

Results

Socio-demographic characteristics of the study participants

The study revealed that the overall mean of family size per household was 8.04. Specifically, family size per household in the Host community is 9, in re-settlers 6, and refugee 11. Re-settlers were people who were displaced by a disaster like a flood and re-located by the regional government. Refugee communities are people who came from South Sudan through the border and live in the refugee camps. The majorities 81.6% (208/255) of the total respondents were from male-headed households and the remaining 18.4% (47/255) were from female-headed households. The overall mean age of cattle owners was 43.02 $\pm$ 9 (range=24-70). The overall mean cattle number in the study area was 32.37$\pm$ 0.002 (range=1 to 490) animals per household.

Existing breed type, production potential, production system, and breed improvement of the study area

Dominantly Nuer breeds (disease tolerant cattle) and Felata breeds (which came from central Africa) are kept by the host, the re-settler, and the refugee communities.

Table 1. Herd composition of cattle in the host and refugee community

Herd composition	Nuer breed (n=8146)	Felata breed (n=112)	Total
Ox	703	40	743
Bull	707	21	728
Cow	3850	38	3888
Heifer	1332	7	1339
Calves	1554	6	1560
Total	8146	112	8258

The study revealed that 92.5% (236/255) of respondents are married. From the study areas, 49.8% (127/255) of cattle owners were not educated and only a limited number attained primary education 73.7% (188/255) of the respondent witnessed that their primary occupation is keeping cattle/ livestock.

Table 2. Profiles of the respondents

Parameters	Variables	Frequency (%)
Status of the owner	Refugee	59.6 (152/255)
	Host community	38.8 (99/255)
	Re-settler	1.6 (4/255)
Sex	Male	81.6 (208/255)
	Female	18.4 (47/255)
Marital status	Single	1.6 (4/255)
	Married	92.5 (236/255)
	Divorced	1.2 (3/255)
	Widowed	4.7 (12/255)
Level of education	Primary	29.4 (75/255)
	Secondary	12.2 (31/255)
	Post-secondary	8.6 (22/255)
	Non- educated	49.8 (127/255)
Primary occupation	Waged employee	3.9 (10/255)
	Livestock keeping	58.8 (150/255)
	Business	6.7 (17/255)
	Crop production	30.6 (78/255)

The result showed that keeping cows is higher (2459) in host communities followed by refugee (1279) communities.

Table 3. Information on cattle production and management

Cattle composition	Host community	Re-settler	Refugee	Total
Oxen	514	12	217	743
Bull	533	15	180	728
Cow	2459	150	1279	3888
Heifers	887	80	372	1339
Calves	990	73	497	1560
Total	**5383**	**330**	**2545**	**8258**
Percentage	65.2% (5383/8258)	4% (330/8258)	30.8% (2545/8258)	100%

As shown in Table 3, the majority 98.6% (8146/8258) of the owner in the study area reared Nuer breed cattle than Felata breed 1.4% (112/8258). The refugee

and re-settler come to the region with their cattle from the beginning when they migrate.

Table 4. Information on the breeds of cattle (n) in the study area

Cattle	Host community	Re-settler	Refugee	Total	%
Nuer breed	5346	330	2470	8146	98.6 (8146/8258)
Felatta/Fulani breed	37	-	75	112	1.4 (112/8258)
Total	5383	330	2545	8258	100%

As the above Table indicated re-settler has not kept Felatta breed because of that they prefer the Nuer breed to Felata/Fulani breed. From the focus group discussion, especially in the Nuer community cattle, are everything for life, and marriage is impossible or very difficult without cattle dowry. As respondents stated that "they keep cattle for dowry and it is considered as wealth in the community."

Table 5. Purpose of keeping cattle

Parameters	Source of meet	For income	Dowry
Host community	47	48	4
Re-settlers	0	4	0
Refugee	19	93	40
Frequency (%)	25.9 (66/255)	56.9(145/255)	17.3 (44/255)

The majority 56.9% (145/255) of the community kept cattle as a source of income. Most 59.6% (152/255) of the respondents provide water for their animals twice a day and 33.7% (86/255) of the cattle owners stated that water is freely available for their animals. But, less number 6.7% (17/255) of respondents witnessed that water is available for their animals only once a day. About 74.1% (189/255) of the respondents indicated that cattle owners have shade or a house for their animals and, 25.9% (66/255) did not. The study found that the owners have sheds for their animals 47.8% (122/255) keep their cattle in a separate house with a roof and 16.9% (43/255) of the farmers indicated that separate house without a roof and the remaining respondents (24 in number) are keeping their animals within the family house in the host community.

During the present study 1602 lactating cows were registered in the study area and a total of 1036 from the host community, 488 from the refugee area, and 78

lactating cows from displaced/ re-settled communities. Most 94.9% (242/255) of the respondents are applying twice a day milking frequency and 3.5% (9/255) and 4 (1.6%) of the respondents practice once and three times a day for milking frequency.

Table 6. The average milk production per day per cow in the litter

Seasonal variation of milk production (l)	Mean (±sd)	Range
Dry season	1.35±0.75	0.5-2 L
Wet season	2.09±0.89	0.75-3.5 L

As the above Table indicated, milk production in the study area was reported high in the wet season due to the availability of animal feed. Most 62.7% (160/255) of the respondents stated that they process milk into other milk products like yogurt, butter, and cheese locally. But, 36.9% (94/255) of cattle owners have no idea about milk processing rather than they consume in the form of raw milk.

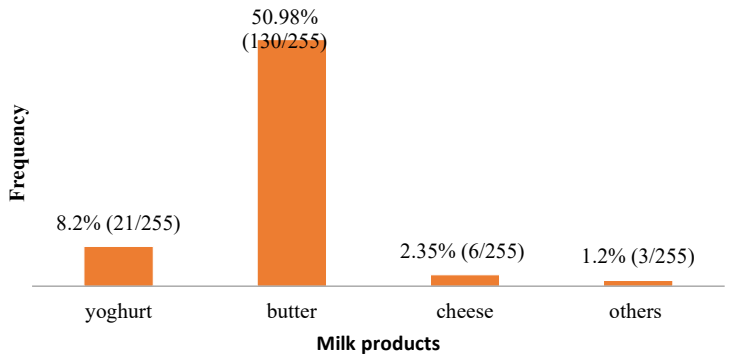

Figure 2. Milk products from the study area

From the total respondents, the result revealed that 52.9% (135/255) of them intended to purchase dairy products from local markets and 47.1% (120/255) are not buying any dairy products from the market.

The produced milk from home is consumed by all members is rated 85.1% (217/255) but, 14.1% (36/255) and 0.8% (2/255) of the respondents stated that the milk is given to infants and the sick person at home respectively. Most of the time milk is consumed after every meal which is witnessed by 46.7% (119/255) of the respondents. Whereas, 37.6% (96/255) and 13.7% (35/255) of

respondents responded that milk is consumed once a day and a few times a week, respectively. Most 66.3% (169/255) of respondents responded that they boil milk before consumption and 33.7% (86/255) of them are not boil milk and consume it in the form of raw milk. In the study area milk is preserved by refrigerator 7.8% (20/255), 61.1% (157/255) by traditional means, 1.2% (3/255) by processing, 28.2% (72/255) by boiling, and 0.8% (2/255) of the respondents use other preservation methods. 41.6% (106/255) of respondents used Plastics, 6.3% (16/255) aluminum cans, 22.4% (57/255) stainless steel, and 29% (74/25) of the respondents used locally accessible materials for milk storage and handling.

The majority 92.5% (236/255) of respondents from the study area had a habit of meat consumption and only 7.5% (19/255) of the farmers respond no. The time when meat consumption is also analyzed and found 51.8% (132/255), 9% (23/255), 14.1% (36/255), 20.4% (52/255) during the holiday, every day, when there is food shortage and others, respectively.

Most 63.9% (163/255) of the respondents stated that there are butchers in their area. Whereas 34.9% (89/255) of the respondents witnessed no butchers in their residents and 40% (102/255) of the respondents suggested that butchers have necessary tools 93.7% (239/255) and 1.6% (4/255) of the respondents consume meat in the form of cooked and fried respectively.

The challenge constraints and opportunities

All 100% (255/255) of the respondents confirm the occurrence of cattle disease in the study area. The majority 91.8% (234/255) of the respondents know the name of the disease locally (Lumpy skin disease, contagious bovine pleuropneumonia, pasteurellosis, foot and mouth disease, Ticks, and trypanosomiasis) and 79.6% (203/255) of cattle owners use traditional medicine for their cattle disease prevention and treatment. In the study area, only 20.4% (52/255) of the respondents did not use traditional ways for the prevention and treatment of their animals. The level of disease severity trend is medium according to responses from the cattle owners at 48.2% (123/255), higher 32.9% (84/255), and lower 18.9% (48/255).

The result revealed that 48.2% (123/255) of the respondents indicated that they buy a drug from a drug shop and administered it by themselves and only 18.8% (48/255) of the respondents took their animals to animal clinics. Biting flies are a major problem in the study area and 94.5% (241/255) of the respon-

dents witnessed that flies are affecting/disturbing their cattle during the night time and the fly population is difficult during the wet 85.9% (219/255) and at the dry season 12.4% (31/255). Farmers were awarded about treatment heal their animals and 64.3% (164/255) of the respondents confirmed that they had a habit of treating animals. From the study area, bacterial, parasitic, and viral disease are the major causes of death for their cattle and accounts for 28.2% (72/255), 20.4% (52/255), and 7.8% (20/255) respectively. More than half 58% (148/255) of the respondents witnessed that their animals are not vaccinated in the past five years and 42% (107/255) of the respondents responded that they got two vaccines in the past five years for their cattle.

Most of the owners (61.2% (156/255) responded that there were no government or non-government organizations' interventions about their animal diseases. But, 38.8% (99/255) of the respondents witnessed that there is government intervention against animal diseases. From the result, poor extension service is done so far by the government and 39.6% (101/255) stated that they got different pieces of training from the government and non-governmental organizations.

Technical constraints

Key informant interview indicated, "There was an effort in the past to identify and eliminate [minimize] constraints we have on animal health and disease aspect. Logically, the disease can be controlled and even prevented before it turns into damaging the more productivity-and health management. Concern has, however, been expressed that in Africa this "preservationist" approach may have been over-emphasized at the expense of "husbandry" constraints. Management constraints relating both to technical problems (e.g., health, nutrition) and resource utilization may have been unduly neglected.

The components of these technical constraints are very well known to veterinarians and animal scientists and are therefore not discussed any further. However, the complex interactions among these factors could represent an important set of constraints. The identification of these interactions is one of the challenges to the regional livestock and fishery services of Gambella. Another problem dealt with here involves the input side of livestock production, particularly animal feed, but the principles mentioned are equally applicable.

Table 7. Major animal health problems in the study area (n=34)

Major Animal Health Problems Identified	Major Symptoms	Mean rank	Overall Rank
Contagious bovine pleuropneumonia (CBPP)	Chest pain and nasal discharge	4.96	1st
Trypanosomosis	Emaciation	5.59	5th
Foot and mouth disease (FMD)	Lameness	5.61	6th
Bovine pasteurellosis	Depression & coughing	5.05	2nd
Anthrax	Sudden death and bleeding	6.65	9th
Blackleg	Depression and lameness	7.78	10th
Lumpy skin diseases (LSD)	Skin granules and swelling	5.09	3rd
Fasciolosis	Emaciation and diarrhea	6.63	8th
Mastitis	Blind teat and pain during touch	5.68	7th
Neonatal diarrhea	Severe diarrhea and death	7.88	11th
Ectoparasites (ticks)	Emaciation/weight loss/	5.52	4th

Table 8. Production challenges

Challenges	Indicators	Consequences
Seasonal occurrence of diseases	At the entry and end of the rainy season, animals get sickness	Reduce production and animals death
Breeding	Only local breeds are available and no breeding strategy naturally or artificially	No improvement in production and productivity
Management	Very poor cattle management practice followed by owners	Animals suffer and reduce their production and productivity
Technology	No new technologies so far	No improvement in production
Theft	Stealing cattle in the nighttime and at grazing areas	Cattle owners are disappointed and stop rearing cattle
Awareness about production	Lacks training on the area cattle production in the study areas	No production improvement
Seasonal fluctuation of forage	Shortage of feed in the dry season and lack of forage preservation	Production reduces
Medication	Due to the absence of drugs, sick animals die in the host and refugee communities	Loss of cattle
Vaccination	Vaccination is very limited in the host community and no vaccination campaign in the refugee community so far	Animals get sick and production reduction
Flooding	During the wet season, the flood covers the grazing land, and biting insects affect the animals during night time	Animals feel discomfort, lose production, and become sick
Lack of supervision and absence of a skilled veterinarian	Cattle owners administer different drugs to their animals by their selves	Creates drug resistance microorganisms in the area
Absence of infrastructures	for instance, cattle pen/shade (Barn or stall especially refugee camps), veterinary clinics, installed vaccination and breeding crushes	Animals are easily affected by sunlight, rain, and disease

The key informant interviewee indicated that

"Theft is the major challenge in the camp animals/ cattle are stolen at grazing area during day time and at the shed in the evening by the refugees and the refugees had linkages with the host community and sell the stolen cattle to the communities. But, due to the creation of strong communication with the woreda and kebele administration, most of the stolen animals returned to their owner".

Opportunities

The opportunities available to the livestock and veterinary services in the study area to increase livestock output through the removal of constraints (or their adverse effects) form part of the current challenge. The magnitude of additional products which could be expected from preventing or reducing loss and wastage, from disease control or eradication, or productivity-enhancing husbandry could well serve as an impetus to the livestock and veterinary services. Let us look at a few quantified examples from recent studies on different sites. In summary, we should seize every opportunity to increase production by:

- Eliminating waste
- Minimizing losses
- Enhancing productivity.

Table 9. Cattle production opportunities in the study areas

Opportunities	Indicators
Cultural value	Marriage in the Nuer community
Disease tolerant breeds	Cattle are trypanosomosis tolerant
Presence of the Baro river	The yearly flowing of the river in the region
Presence of grazing land	Moving from place to place in different seasons
Manpower	No problem for keeping animals from the householder
Productivity	Compared with other local breeds
Market demand	The need for the animal product is high
Indigenous knowledge	Traditional knowledge for disease treatment and management

Discussion

From the study, it was observed that a total of 8258 cattle of which 8146 were Nuer breed cattle and 112 were Felata breed and from the total cattle population, 743 are oxen, 728 bulls, 3,888 cows, 1339 heifers, and 1,560 calves. An-

other study by GebreMariam *et al.* (2013) indicated that Ethiopia's cattle herd structure features relatively high male representation (44.5% of the population), and the largest proportions for both sexes fall into the 3–10-year age category. This is an indication of the uses to which the animals are put: oxen for draft power and cows for milk production. But, in the study area, bulls/ males are kept for reproduction, meat, and dowry purpose.

A study by Alemayehu (2005) showed that forage crops are commonly grown to feed dairy cattle with oats and vetch mixtures, fodder beet, elephant grass mixed with siratro and desmodium species, Rhodes/ lucerne mixture, phalaris/ Trifolium mixture, hedgerows of sesbania, Leucaena, and tree-lucerne being common ones. Whereas, the present study indicated that 92.5% of cattle owners practiced a free grazing system followed by 5.1% tethering and 1.6% semi-grazing, 0.8% zero grazing, and 62.4% (159/255) of the respondents indicated that they didn't grow feed, crops or pasture for their livestock by their own. But, 37.6% of the cattle owners practiced providing crop residues to their cattle as feed during the shortage of pasture.

The study had similar nature to that of Bizelew *et al.* (2016) in which Seasonal fluctuations in the availability and quality of feed inflect serious changes in livestock production. Most 86.3% (220/255) of the respondents did not purchase feed for their animals. 77.3% (197/255) of the respondents indicated that there is a feed shortage in the dry season than in the wet season of the study area and only 22.7% (58/255) of the cattle owners witnessed there is no seasonal feed shortage in their localities. Only 3.1% of the respondents indicated the purchase of feed supplements and feed additives. Whereas, the majority (96.9%) of the respondents witnessed that no purchase of feed supplements and additives was practiced for their animals.

The above result is supported by studies from other parts of Ethiopia and Most (81%) of farmers feed their animals free grazing from the open environment traveling from highlands and midlands to lowlands in search of adequate feed (different species of grasses) and crop residues during the wet season up to the beginning of the dry season (Welay *et al.,* 2018).

One of the key informants stated that 'Availability, quality, and quantity of feeds vary among various production systems. Cattle largely depend on range-

land grazing or crop residues that are of poor nutritive value. Feed is not uniformly supplied and the quality is poor. Natural pasture browses, and bushes account for the major food sources of livestock owned by agro-pastoralists. Of the total respondents, 18% (46/255) of them replied that they practice feed storage to preserve feed for their animals for the dry season. But, the majority (82%) of the respondents did not have feed storage for their animals or feed preservation experience. The remaining (6.3%) and (93.7%) respondents indicated that on-site and river/pond/spring were the source of water for their animals respectively.

In sub-Saharan Africa, technical constraints remain a major impediment to livestock development. The main constraints identified from the study can be grouped in the following broad categories: Animal feed and nutrition; genetic factors; animal health and disease problems; and inadequate management practices. A similar study by Tadesse (2014), Andualem (2016), and Beyene *et al.* (2017) indicated that animal healthcare and improved health management is also one of the major constraints of dairy development in Ethiopia, which caused poor performance across the production system. Many of the problems resulted from the interaction among the technical and non-technical constraints themselves. For instance, poorly fed animals have low disease resistance, and fertility problems, partly because the animal healthcare system relays heavily on veterinary measures.

Conclusions

Results of the study indicated that cattle play a significant socio-economic role in the study area, including the generation of income for households, food, and dowry. The potential for cattle production and productivity are proportionally hampered by various cattle management problems including the prevalence of major endemic diseases, poor feeding, high stocking rate on grazing lands, lack of support services such as extension services, veterinary services, insufficient data to plan improved services and inadequate information on how to improve animal breeding, marketing, and processing. The majority of the respondents used traditional medicine to treat their sick animals.

Therefore, based on the conclusion, it is strongly recommended that a detailed study of different agro-ecologies of the region is imperative to investigate the productive and reproductive performance of cattle, characterization of existing breeds to ascertain the different traits that will give a better performance

which will help in developing future intervention, research on cattle marketing system play a vital role in helping farmers and provision of strong extension services and training on improved forage cultivation, cattle production and management practices in the different parts of the region.

The distribution of livestock diseases is substantially higher. Management practices in livestock production were poorly practiced. This is the greatest threat to livestock production and productivity. More fundamentally, investment in animal infections and infestations control and management practice strategies is necessary to reduce the multiple impacts of livestock diseases and deaths on animal health and production through effective and timely vaccinations. The poor fertility and poor livestock performance can be addressed through better management and crossbreeding with improved breeds.

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