



Characterization of Camel Production and Marketing System in Southern Zone of Tigray Region

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To cite this article:

Chala Edea, Etalem Tesfaye, Abera Geleta, Angesom Taye, Atsbaha Hailemariam et al. (2024). Characterization of Camel Production and Marketing System in Southern Zone of Tigray Region. *International Journal of Sustainability Management and Information Technologies*, 10(1), 12-18. <https://doi.org/10.11648/ijjsmit.20241001.12>

Received: December 12, 2023; **Accepted:** January 10, 2024; **Published:** February 5, 2024

Abstract: This study's goal was to fill in an information gap on the camel subsector in regarding to the Raya Azebo and Raya Alemata districts in the southern zone of Tigray region. In the districts the lowland agro-ecology was the focus of the survey. From both districts, four Kebeles were selected at random. The data was collected using a cross-sectional field survey that complied with established sampling techniques. Using a systematic random sampling technique, respondents who owned camels in proportion to population size were selected from a list of households (hhs) in each Kebele. Considering lists of hhs that were available with the development agencies, hhs from each Kebele were selected using systematic random selection. Finally, 250 hhs in total were used in the study areas. Data were analyzed using SAS 9.0 and Tukey pair wise comparison was used to compare means that had significant differences at $P < 0.05$. Descriptive statistics was employed for qualitative data using the statistical package for social sciences version 17.0 (SPSS, 1999). The mean age of the hh head was 39.55 ± 1.67 and 40.60 ± 2.08 in Raya Azebo and Raya Alemata, respectively and the overall age of the hh head was 40.075 ± 0.94 in the studied areas. In the present study, the majority of the respondents were male (86.4%) and the rest were female. Most of interviewed participants were illiterate and only attended elementary school. In the study area, camel rearing was used for a multitude of purposes including transportation from one place to another and selling of the animals for money to buy various items for the hh. The majority of respondents (75.6%) indicated that camel production in the area was extensive, and they were handled on browsing and crop lands. The majority of the respondents (68%) used uncontrolled mating mechanism. Uncontrolled mating was mostly caused by mixed herding and the practice of sharing serving camels. The majority of respondents (67.2%) stated that camel rearing was becoming more and more popular occasionally due to escalating consumer demand. Ectoparasite infestation and internal parasites including GIT parasitism were the most prevalent health issues in the study area. The main effects of camel diseases in the region were frequently reduced physical condition, decreased meat/milk yield and stunted growth. Therefore, further research and investigations should be conducted to identify and alleviate existing constraints related with camel production and management practices in the studied areas.

Keywords: Breeding, Camel Disease, Marketing System, Production Systems

1. Introduction

There are 47 countries and an estimated 25.89 million camels worldwide, according to one study [17]. The number of camels documented worldwide was 35.53 million as of the

most recent statistics available and the populations have occasionally increased [6]. Camels (*Camelus dromedaries*) are very important domestic animals' species uniquely adapted to arid and semiarid zones in Asia and Africa [8]. Africa is home to more than 80% of the camel population,

with 60% living in eastern African countries (Sudan, Somalia, Ethiopia and Kenya) [11]. Areas of camel rearing are expanding partly due to changes in climate especially in Africa [10]. With a population estimated at over 8.1 million, camels are a significant livestock resource in Ethiopia [5].

Camel (*C. dromedaries*), the most climate resilient livestock, plays a significant role in the livelihood of pastoral and agro-pastoral communities in Ethiopia [2]. A large number of dromedary camels are widely distributed throughout the arid/semi-arid lowland areas of Ethiopia predominantly inhabited by pastoral and agro-pastoral communities [13]. Camel (*C. dromedaries*) is Ethiopia's most climate-resistant livestock, plays an important part in pastoral and agro-pastoral people's livelihoods [19]. Camels suffer least and they have survived the crisis without the heavy losses that have occurred in other species. It is one of the most important domestic animal species for pastoralists' survival and serve them as their blood circulation. Under difficult conditions, they produce a significant volume of milk for a longer period of time than other milk-producing animals [3]. In the past few years, with drought and the onset of desertification, most of our livestock have suffered considerably.

Camels are crucial for human animal protein supply within those underdeveloped areas, contribute to the maintenance of rural activities and economic development, and finally facilitate integration into the global economy, according to several practical surveys [12]. The pastoralists who keep the diverse camel populations found in Ethiopia have varied traits of interest for which they are chosen. The mass of camels in the country can be found in the dry areas of the country's eastern regions, such as Afar, Somalia and the eastern parts of Oromia. Management practice in Ethiopia is basically traditional and the pastoralist under this management only practiced an extensive range of camel production system and there is no improved forage production for meat, milk and draft purpose [20]. Camel production is strongly linked to the availability and quality of feed resources at all times of the year [3].

Improving camel milk production can result in significant improvements in human nutrition as well as monetary income generation in rural areas. Camel's milk also improves livelihoods and contributes to national and global economic development [9]. In spite of their invaluable importance, little was known about the production and marketing system of camels, which was considered as corner stone in understanding the role share of camels. This study was, therefore, initiated to bridge the information gap on camel sub sector in reference to Raya Azebo and Raya Alemata districts of southern zone of Tigray region.

Objective:

To assess and characterize the production and marketing

systems of camel in southern zone of Tigray region.

2. Methodology

The survey was conducted in lowland agro-ecology of two districts of southern Tigray, Ethiopia. The area is geographically located at 12015' and 13041' north latitude and 38059' and 39054' east longitude, at an altitudinal range of 930 – 3925 m.a.s.l. long term meteorological data indicates that the area receives 400 to 912 mm of mean annual rainfall with mean daily temperature ranges of 9 to 32°C. The study areas comprise two Woredas (Raya Azebo and Raya Alemata). A reconnaissance survey was conducted to have an understanding of the study area and to select the representative study sites before proceeding to formal survey using focused group discussion and structured questionnaires. The data were collected through a cross-sectional field survey following formal sampling procedures. Four Kebeles were randomly identified and used from both districts. From the list of hhs in each Kebele, a proportional to population size of camel owning respondents were selected using a systematic random sampling technique. Households from each Kebele were selected according to systematic random sampling using lists of hhs available with the development agents. Finally, a total of 250 hhs were used in the studied areas. Data were analyzed using the SAS version 9.0. Means with significant differences at $P < 0.05$ were compared with each other using the Tukey pair wise comparison procedure. Descriptive statistics was employed for qualitative data using the statistical package for social sciences version 17.0 (SPSS, 1999).

3. Result and Discussion

3.1. Socio Economic Characteristics

Family size of hh head and age of the respondents and hh head are presented in Table 1. The overall average family size in the study areas was 4.28 head per hh and ranging from 3.07 to 4.21 head per hh. The mean age of the hh head was 39.55 ± 1.67 and 40.60 ± 2.08 in Raya Azebo and Raya Alemata, respectively and the overall age of the hh head was 40.075 ± 0.94 . The mean age of the respondents (35.85 ± 0.91) in Raya Alemata Woreda was relatively smaller than Raya Azebo (36.19 ± 1.73) and the overall age of the respondents were 35.85 ± 0.91 . Average family size per hh (4.28) in the current study area was lower than 6.22 in the previous study of Tadesse [15] in Tahitay-Adiyabo district of Tigray Region. The average age of respondents was 35.85 old and the current finding was lower than the finding of Abdisa *et al.* [1] who studied in Yabello district and was in ranges of 50-70 years old.

Table 1. Family size and age.

Woreda	Family size/hh (Mean \pm SEM)	Age of respondent (Years)	Age of hh head (Years)
Raya Azebo (N=130)	3.07 \pm 0.29	35.50 \pm 1.73	39.55 \pm 1.67
Raya Alamata (N=120)	4.21 \pm 0.35	36.19 \pm 1.93	40.60 \pm 2.08

Woreda	Family size/hh (Mean±SEM)	Age of respondent (Years)	Age of hh head (Years)
Overall (N=250)	4.28±0.18	35.85±0.91	40.075±0.94

hh: household; N= sample size; SEM: standard error of the mean

Sex of the respondents and their religion in the studied areas is presented in Table 2. In the study areas, the majority of the respondents were male (86.4%) and the rest were female. The results obtained showed that from the total of 250 respondents 56% were Muslims and the rest 44% were Orthodox Christian followers. As a result, the majority of the people that participated in camel production of the studied area were Muslims and most of them were also men. This means that camels were handled and managed by the community's male

hhs. The present results were in agreement with Abdisa *et al.* [1] and Tadesse [15] who reported that the majority of respondents were male in Oromia and Tigray regions, respectively. In the studied areas, the majority of interviewed respondents were Muslims, and camel product consumptions was not their concern, not their religious taboo. In Ethiopia's lowland pastoral or agro-pastoral areas, camel milk consumption was prohibited by Orthodox due to a religious restriction, contrary to the current studied areas [16].

Table 2. Sex and religion of respondent.

Sex and religion	Woredas			X ² - test
	Raya Azebo	Raya Alemata	Total (N)	
Male	120 (92.30)	93 (77.50)	213 (85.2)	0.001
Female	10 (7.70)	27 (22.50)	37 (14.8)	
Total (N)	130	120	250	
Muslim	80 (61.54)	59 (49.17)	139 (55.6)	0.075
Orthodox	50 (38.46)	61 (50.83)	111 (44.4)	
Total (N)	130	120	250	

N=sample size; numbers in bracket are percentages

The analysis for educational status indicated that 27.70% and 28.88% of the respondents had basic education in Raya Azebo and Raya Alemata Woredas, respectively (Table 3). Educational status of the respondents was showed that 27.70% and 15% scored one up to four grades in Raya Azebo and Raya Alemata Woredas, respectively. According to the current study, about 13.80% in Raya Azebo and 7.50% in Raya Alemata were attended above grades 5. In overall about

28%, 22% and 10.8% of the respondents were those attended basic education, one up to four grades and above grade 5, respectively and the majority (39.20%) were not educated. The majority of interviewed respondents in the studied areas was illiterate and attended basic education. These findings were in line with the result of Tadesse [15] in the Tigray region that reported as the majority of the respondents were illiterate and attended primary education.

Table 3. Educational status of the household (N=250) in the study areas.

Education	Woredas			X ² - test
	Raya Azebo	Raya Alemata	Total	
Illiterate	40 (30.80)	58 (48.33)	98 (39.20)	0.002
Basic education	36 (27.70)	34 (28.80)	70 (28.00)	
1-4 th	36 (27.70)	19 (15.00)	55 (22.00)	
Above grade 5	18 (13.80)	9 (7.50)	27 (10.80)	
Total	130	120	250	

N=sample size; numbers in bracket are percentages

3.2. Camel Production and Husbandry Practices

Camels were mostly raised for multipurpose (64.40%) rather than meat consumption (2.40%) only. Camel rearing was utilized for a variety of functions in the studied region including transportation from one place to another as well as the sale of the animals for cash which was used to purchase various needed materials for hh. They contributed to family food security by providing meat as well as being utilized as pack animals for transportation. The current findings were in line with the previous study by Faraz *et al.* [7] who reported that camels' contribution to family food security by providing meat and milk, as well as being utilized as pack animals for transportation. Multiple purpose of camel rearing

in the current study was similar to the previous study of Woldearegay *et al.* [18] in the Raya Azebo district of Tigray region.

Table 4. Purpose of camel production.

Purpose	Frequency	Percentage
Transport and pack	21	8.4
Meat consumption	6	2.4
For sell (trade)	62	24.8
Multipurpose (Transport and pack, sell, meat)	161	64.4
Total	250	100

3.3. Production System

The majority of the respondents (75.60%) indicated that

camel production in the studied area was extensive, and the camels were handled on browsing and on crop lands. In Ethiopia, camel management is basically traditional and there is no improved feed for production. Acacia and cactus plant species were the most common feed sources in the studied areas. This was similar with the finding of Woldearegay *et al.*

[18] in Raya Azebo district of Tigray region that camel management is basically extensive, and there is no enhanced fodder production for meat, milk, or draft purposes. In the studied areas, only 3.60% of respondents were used intensive production systems.

Table 5. Production practice.

Parameters	Woredas		Overall		X ² -test
	Raya Azebo	Raya Alemata	N	%	
Intensive	4	5	9	3.6	0.00
Semi intensive	16	36	52	20.8	
Extensive	110	79	189	75.6	



Figure 1. Some acacia and cactus plant as source of feed.

3.4. Breeding System

Camel breeding management in the studied areas was presented in Table 6. The majority of the respondents (68%) used an uncontrolled mating mechanism. Mixed herding and the habit of sharing serving camels were the main causes of uncontrolled mating. They were unaware of the dangers of inbreeding and allowed a sire to mate with his own mother, daughter and sister. This is in line with the findings of Bekele *et al.* [4], who found that 64.06% of respondents in the Borena zone used an uncontrolled mating method. Some of the respondents (32%) were experienced in controlled breeding systems. This implies that control breeding system of camel in the study area was not common. This finding was disagreed with the result of Woldearegay *et al.* [18] in Raya

Azebo district of Tigray region of 62.50% of the respondent used controlled breeding systems.



Figure 2. Big sized and Redish brown colored camel.

Table 6. Breeding practices.

Parameters	Woredas		Overall		X ² -test
	Raya Azebo	Raya Alamata	N	%	
Controlled	24	56	80	32	0.00
Uncontrolled	106	64	170	68	

3.5. Trends of Camel Production

The camel population trend in the studied area is summarized in Table 7. The majority of the respondents (67.20%) were stated that the trends of camel rearing was

increasing from time to time as a result of rising market demand. This is in line with a previous study of Bekele *et al.* [4] who found a rise in camel market demand in Borena zone. According to Yosef *et al.* [21], camel populations have been increasing in the pastoral areas of Ethiopia during the past 20 years.

Table 7. Population trend of camel in the study area.

Trend	Frequency	Percentage
Increasing	168	67.2
Decreasing	59	23.6
No change	23	9.2
Total	250	100

3.6. Camel Marketing System

Table 8 shows the camel marketing system in the study

Table 8. Marketing system in the study area.

Marketing	Woredas		Total	Percentage	X ² - test
	Raya Azebo	Raya Alemata			
Formal	80	78	158	63.2	0.054
Informal	50	42	92	36.8	
Buyer's source					X ² - test
Primary	73	76	149	59.6	0.000
Secondary	45	16	61	24.4	
Tertiary	12	28	40	16	
Border trading					X ² - test
Yes	88	78	166	66.4	0.088
No	42	42	84	33.6	

**Figure 3.** Formal market.

Table 9 shows the market price of a camel in the study area. Adult male camels sold 23,718±3115.96 Birr on average, whereas adult female camels sold 20,834.4±2021.05 Birr. The average market price of a young male camel was 18,498±2224.1 Birr, while a young female camel was 19,209±2060.2 Birr. According to this survey, as the age of the animal increased so increased the price, because the adult animal was engaged for more purposes than the young. The respondent wanted to raise camels over other livestock because of the greater market price.

Table 9. Market price of camel (in Birr).

Parameters	Mean	Minimum	Maximum
Male adult	23718±3115.96	19000	35000
Male young	18498±2224.1	14000	26000
Female adult	20834.4±2021.05	16500	27000
Female young	19209±2060.2	14500	25000

3.7. Camel Diseases

Disease was the biggest issue with camel farming in the studied areas. The proportions for *Hemorrhagic septicemia*

area. A formal method was implemented by 63.20% who were interviewed. In the study area, primary sellers were engaged by 59.60% of respondents from both formal and informal marketing methods. The number of marketing systems in the tertiary sector was quite low. Border trading systems to Afar, Djoubiti and Sudan were used by 66.40% of respondents in the study region.

and plant poisoning were higher. The most common health concerns in the study area were ectoparasite infestation and internal parasites such as GIT parasitism. Reduced bodily condition, decreased meat/milk yield, and stunted growth were often the main effects associated to camel diseases in the studied areas. This parasitism investigation was confirmed with the finding of Faye *et al.* [9] in Sudan and Simenew *et al.* [14] in Afar region. Additionally, agree with

the finding of Babege *et al.* [3] the prevalence of disease was the main constraints of camel production and productivity in pastoral areas of the country. Toxic plants and parasitic diseases of the current finding was in line with result of Woldearegay *et al.* [18] reported that Infectious diseases, toxic plants and parasitic diseases were the major diseases of camel in Raya-Azebo district of Tigray region.

Table 10. Common disease in the study area.

Diseases	Degree of importance			Total	Percentage	Overall rank
	1 st	2 nd	3 rd			
Hemorrhagic septicemia	155	65	-	220	88	1
Plant poisoning	70	50	70	190	76	2
Ectoparasite	-	63	50	113	45.2	3
GIT parasitism	-	39	70	109	43.6	4

GIT: gastro intestinal tract

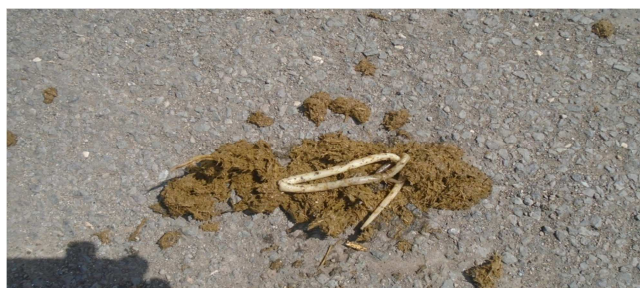


Figure 4. GIT parasite detected during field survey.

4. Conclusion and Recommendation

The aim of this experiment was to assess camel production and marketing system in Raya Azebo and Raya Alemata. Based on the results of the current study camel production in the area was extensive, and they were handled on browsing plants and on crop lands. The majority of the respondents used an uncontrolled mating mechanism. Ectoparasite infestation and internal parasites including GIT parasitism were the most prevalent health issues in the study area. Therefore, further research and investigations should be conducted to identify and alleviate existing constraints related with camel production and management practices. Stakeholders must have made clear intervention by designing different strategies and techniques to modernize camel production and management practices in the country.

Conflicts of Interest

The authors declare no conflicts of interest.

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