

## Research Article

### Characterization of Camel Production System in Afar Pastoralists, North East Ethiopia

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**Abstract:** A cross sectional questionnaire survey was conducted to characterize camel production system in Afar Region. From the 110 responses of the camel owners interviewed 68.2% of them prefer camels as their first choice over other livestock species and mainly kept in the society for milk production. Disease accounted 40.9% of the main problems of camel rearing society of the Afar pastoralist and about 35.8% of the camel culling reasons were attributed to camel diseases. External parasite infestation and pneumonia were the most common health problems with 51% and 31.8% respectively. More than 80% of breeding male camels were selected from the own herd and rarely acquired from other sources. The (Mean±S.D.) age at first calving was 5.36±0.74 years in afar female camels and the life span ranges from 14-29 years. Daily milk yield of Afar camels ranges from 2.01-12.0 liters per day in 2-3 milking times. The average age to select breeding male is 2.75±1.50 years. The production system of the Afar society has never got enough support from the respected bodies. Policy makers, researchers and funding agencies should give attentions to camels in combating food security in the ever widening desertification in areas like Afar.

**Keywords:** *Camelus dromedarius*, culling reasons, desertification, main production constrains

## INTRODUCTION

Ethiopia has diversified topographic conditions with altitudes ranging from extremes of 4500 m above sea level in the Semen Mountains to areas 100 m below sea level in the Danakil depression. Within this diversity, climatic conditions vary from arid, tropical, sub-tropical and temperate. Given its diversified topographic and climatic conditions, the huge livestock population size, the different species of animals, which have evolved over time and adapted to the ecological conditions of their habitat, Ethiopia can be considered a centre of diversity for animal genetic resources. Ethiopia has Africa's largest livestock population. Over 60% of its land area is semi-arid lowland, dominated by a livestock economy (ANRS, 2010; Rota, 2009).

In situations where rainfall is scarce and unpredictable, pastoralist is a more appropriate livelihood strategy than rain-fed agriculture (Gwida, 2010; Raziq *et al.*, 2008; SOS-Sahel Ethiopia, 2007; Hatfield and Davies, 2006). For this reason, in the face of increasing concerns about climate change, the long-term development and policy trends that have marginalized pastoralists for more than a century need urgently to be reviewed from the perspective of current-day local realities of pastoralists' lives, livelihoods and relationships with others. However, pastoral communities are marginalized and generally not given due consideration in wider socio-political analysis. At a

wider sense the danger of undervaluation of real economic values of pastoralist is that it may wrongly lead to the tendency of gradual replacement of pastoralist by other land use systems that may be economically less feasible and may impose high costs on the environment in pastoral rangeland areas. One of the basic livelihoods of these pastoralists are livestock in general and camels in particular to be given due attention.

The species of domestic camels found in Ethiopia is one-humped dromedary camel (*Camelus dromedarius*). Camels play diverse roles in livelihood of the poor pastoralists, including the building of assets, insurance against unexpected events; have spiritual and social values, traction and movement of goods, food supply income generation in Ethiopian pastoralists and very recently it plays pronounced role in the export revenue of the country in both live animal and carcass export (SOS Sahel-Ethiopia, 2007; Ali *et al.*, 2004). Pastoralists own all the 3 million camel populations in Ethiopia supporting more than 10 million pastoralists (Tezera *et al.*, 2010; Bekele *et al.*, 2002). The camels have been bred owing to the extraordinary power to withstand thirst and hunger for long duration in the most inhospitable ecological conditions (Al-Dahash and Sassi, 2009).

Camels are extremely important livestock species in the arid and semiarid zones in Asia and Africa. Camels contribute significantly to the livelihood of the

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pastoralists and agro-pastoralists living in the fragile environments (Tura *et al.*, 2010; Abbas *et al.*, 2000). The increasing human population pressure and declining per capital production of food in Africa precipitated an urgent need to develop previously marginal resources, such as the semi-arid and arid rangelands and to optimize their utilization through appropriate livestock production systems among which camel production is certainly the most suitable (Mehari *et al.*, 2007; Wardeh, 2004; Getahun and Kassa, 2002; Schwartz and Dioli, 1992). But unfortunately, less attention has been given to camel production improvements for many years when planning national development.

The potential of camelids is generally underestimated for different reasons. The main ones include milk and meat production is yet mainly intended for subsistence farming, or, in case of surplus considered as a gift. The second reason could be the availability of very few references, even if recording data are now more reliable than in the past. Elsewhere, as the camelids are living most of the time in remote areas (desert or high mountains), their accessibility could be difficult. However, according to some convenient surveys, camelids are essential for animal protein supply of human in these marginal areas, contribute to the maintenance of rural activities and economical development and finally facilitate the integration in the global economy (Khanvilkar *et al.*, 2009).

Despite the camel's considerable contribution to food security in semi dry and dry zones and its being a major component of the agro-pastoral systems in vast pastoral areas in Africa and Asia, little is known about its production potential and production systems compared to other domestic animals. Researchers and funding agencies have been very reluctant to act on camel research for improvement of their production. Information on camel production potential and production systems especially in North East of the Afar region of Ethiopia is very limited. Therefore; the study was conducted in Afar regions of camel breeding area with the general objective of characterizing camel production systems. The specific objectives of this research were:

- To characterize production systems and performance of Afar camel kept under pastoral management system
- To assess major husbandry practices and production constraint in the Afar camel production system

## MATERIALS AND METHODS

**Study area and study animals:** The survey was conducted in Zone-1 of the Afar Regional State. The Afar Regional State forms part of the Federal

Table 1: The six local seasons in the Afar pastoral area

Months	Local name	Description
September-December	Gilal	Cool weather
January-February	Daba /Dababa	Showers
March-April	Sugum	Short rain
May-June	Hagai	Hot period
July-August	Kerma	Main rain
August-September	Koneito	Showers

Getachew (2004)

Democratic Republic of Ethiopia. Afar region makes the northeastern rangelands of Ethiopia with an estimated area of 96.7 thousand square kilometers and a total human population of 1.39 million. About 90.9% of the human population is rural inhabitants. Generally Afar area is characterized by arid and semi arid climate receiving a bimodal rainfall. The long rain usually occurs in the months of mid June to mid September, while the short rains usually come in March and April. There six recognized seasons in the area (Table 1). The region has 5 administrative zones and 29 districts (CSA, 2005). The field work was undertaken between the months of July October 2011 and April 2012. Five districts (Afambo, Asayta, Dubti, Chifra and Adaar) of Zone -1 were included in this study as specific study sites.

Much of Afar region is dry and rocky, unsuitable for cultivation. Out of the total area of the region (estimated at 97,250 km<sup>2</sup>) cultivated and arable land constitutes 5.24%, forest 1.54%, bush and shrub 18.62%, grassland 1.56%, marshy land 2.74%, water bodies 0.63% and degraded and rocky land 63.7%. The Afar National Regional State is characterized by an arid and semi-arid climate with low and erratic rainfall. The altitude of the region ranges from 120 m below sea level to 1500 m above sea level. Temperatures vary from 20°C in higher elevations to 48°C in lower elevations. Rainfall is bi-modal throughout the region with a mean annual rainfall below 500 mm in the semi-arid western escarpments and decreasing to 150 mm in the arid zones to the east. Afar is increasingly drought prone. The production system of the Afar region is dominated by pastoralism (90%) from which agro-pastoralism (10%) is now emerging following some permanent and temporary rivers on which small scale irrigation is developed (Ministry of Agriculture and Rural Development, 2008).

Of the total livestock population in Ethiopia, pastoralists own about 12% of cattle, 26% sheep, 66.6% of goats and 100% of the camels (EEA, 2005). The livestock population in Afar region includes 2.32 million cattle, 2.50 million sheep, 4.44 million goats, 0.86 million camels, 38,320 chickens, 187,450 asses, 3160 mules, 900 horses and 810 beehives (CSA, 2008). The camel (*Camelus dromedaries*) is an important livestock species uniquely adapted to hot arid environments. Camels have multiple function and purposes, including milking, packing and draught power source. Study on production, reproduction of Afar camel was conducted during the study period by using well structured questionnaire.

**Study design and data collection methodology:** A cross sectional study design and set of detailed structured questionnaire was used to collect information from a total of 110 camel owners in different site by guided interviews. The questionnaire was previously used in Sudan and Saud Arabia and found to be effective for such studies (Ishag and Ahmed, 2011; Algaylia and Mansour, 1998) and used for the current research with some modification to fit in the Afar situation. Observational studies were also applied in the study areas in addition to historical information about the pastoral system and herd production collected from direct questioning of the pastoralist.

Primary and secondary data were the sources of information to collect. Primary data sources were the key informants during guided interviews and group discussion in the respective selected woredas and the secondary data were collected from different regional, zonal and woreda level agriculture and pastoralist offices. Purposive sampling procedure was implemented because of difficulty to apply random sampling due to the mobile, scattered and less accessible nature of pastoral communities and the household heads were selected based on camel possessions and willingness to be part of the survey.

Eight enumerators who knew the area and well acquainted with the culture and the local language were recruited and “trained” on the methods of data collection and contents of the interview under close supervision of the researchers. The method of data collection employed was a single-visit formal survey (ILCA, 1990).

Camel breeders with long experience in camel rearing were selected and interviewed to gather reliable information on the production, adaptation and reproduction system variables. The questionnaires were designed to obtain information on general household characteristics, livestock and herd structure, herd management, breeding practices, disease prevalence, production objectives, feeding management and production constraints. Analysis from this kind of survey has also given information about the general composition of the herd specifying the animal breed, age, sex, purpose, reproduction and production parameters.

**Data analysis:** The collected data were entered in to Excel, 2007 spread sheet for storage. The SPSS statistical computer software version 15 was used to

analyze the data in descriptive statistical. Results were represented mainly in the form of narrations, tabular summaries and figures.

## RESULTS

All of the Afar pastoralists participated in this research was illiterate and they all have never grown crops. All of them exercised migration in the past 12 months at least once in search of water and feed for their animals and characterized as nomadic. Generally, responses to the questionnaires related to herd size in this society is unthinkable because of some traditional, misunderstanding and misinterpretations of such inquiries.

**Description of the afar camels:** One of the qualitative factors used to describe the Afar camel is coat color. The color of the afar camel varies from reddish-brown, ashy-white to dark brown, although the predominant color was the reddish-brown. The reddish-brown camel was smaller in size as compared to ashy-white camel. Newly born calves are normally darker than their parents for the first few days. The hair is generally fine, soft and quite short, covering most parts of the body. The hair is longer on the top of the head, on the backs of the neck, shoulder and hump. The body conformation of the Afar camel is compact. Legs are long with hind quarters light and sloping and the feet were soft and oval. Neck is shorter and down ward oriented. The body is shorter and lighter.

### Management system:

**Labor distribution and feeding practices:** The main reason of camel management in Afar area is for milk production, packing and meat. Husbands and sons are the responsible members of the family to manage camels in the afar society. Wives are not allowed to milk the camels as they have strong traditional prohibition in this society. The unbalanced responsibilities and gender inequality is pronounced. The labor distribution of camel husbandry is summarized in Table 2.

Feeding practices in the afar camel production system in the study area is browsing 43.6% and browsing and mineral supplementation 56.4%. In the present study, afar pastoral people migrate mostly in the dry season to search for pasture, water and to prevent their animals from diseases occurring during those dry

Table 2: Labor distribution in camel management system in Afar pastoral area

Family	Feeding (%)	Breeding (%)	Herding (%)	Health care (%)	Marketing (%)	Housing (%)	Milking (%)
Husbands	15.5	20.0	10.9	17.3	100.0	14.5	26.4
Sons	10.0	14.5	48.2	20.0	0.0	6.4	16.4
Wives	0.0	0.0	0.0	0.0	0.0	0.0	0.0
husbands and sons	74.5	65.5	40.9	62.7	0.0	68.2	57.2
Hus. and wives	0.0	0.0	0.0	0.0	0.0	3.6	0.0
Sons and wives	0.0	0.0	0.0	0.0	0.0	3.6	0.0
	0.0	0.0	0.0	0.0	0.0	3.6	0.0

Table 3: Ranking of livestock species on their relative importance in Afar pastoralists

Ranking	First (%)	Second (%)	Third (%)	Fourth (%)	Fifth (%)
Camel	68.2	9.1	10.9	11.8	0
Goats	27.3	65.5	6.4	19.1	0
Cattle	3.6	3.6	42.7	19.1	0
Sheep	0.9	20.9	23.6	29.1	0
Donkey	0	0	0	0	2.7

Table 4: Source of breeding male camel in the Afar camel herd

Source breeding camel	Replacement (%)	Source (%)
Own herd	76.4	80.0
Other herds	0.0	0.9
Purchased	0.0	0.0
Own and other herd	15.5	11.8
Own herd and purchased	5.5	7.3
Other herd and purchased	2.7	0.0

Table 5: The average milk yield in liters per day and lactation length of Afar camels

Milk yield litters/day	Mean±S.D.	Range
Beginning of lactation	7.62±2.53	3.00- 16.00
Middle of lactation	5.41±1.87	2.50- 13.00
End of lactation	3.00±1.29	1.00 - 9.00
Lactation length in month	12.00	12.00

seasons in the area. Very rare migration occurred during rainy season to high land areas due to the Awash River flooding problem.

**Livestock composition and priority species:** Camel, goat, cattle, sheep and donkey are livestock species in the ranking order of their relative preference as shown in Table 3. In Afar pastoral area as is true in most of other pastoral systems camel is the best adapted animal because of its ability to resist drought and thirst by their special physiological and anatomical adaptation mechanisms over other domestic livestock species.

**Breeding practices and reproductive performance:** In more than 98% of the camel herds afar pastoralists keep only one breeding male. In very few of the herds 2-4 breeding males are kept. The sources of breeding camel in Afar pastoralist production systems are own herd, other herd and purchased as indicated in Table 4, however majority of them select breeding male camels from their own herd. In cases where the breeding male die and in small herds the owner can use breeding male from other nearby herd for free. Son of the former breeding male camel can be replacement breeding male for the same herd but cannot mate his mother. The fate of male camels not selected for breeding are selling at their early age, castration and separation from herd for fattening and selling purposes, 40.9, 7.3 and 51.8%, respectively (Table 4).

The average age to select of breeding male camel in the present study is shown to be  $2.75 \pm 1.50$  years. The mean age at sexual maturity is found to be  $5.5 \pm 2.1$  years ranged from 3 to 8 years. Peak rutting vigor of the breeding male camel is seen at an average age of 5 years. The reproductive span of male breeding camel

varied from 12-30 years. The ratio of male to females in a breeding herd is found to be 1:30 but might be goes up to 1:50, in cases where the male is in his peak rutting vigor and in good season of the year.

Female Afar camels can reach puberty as early as three years and in some cases can be delayed up to eight years with mean  $3.97 \pm 0.61$  years (Mean+S.D). Generally age at first calving was found to starts when the camel was four years to five years but sometimes it extend six to eight years depend on management systems. In the present study the mean age at first calving was found to be  $5.36 \pm 0.74$  years and the range from four year to eight years. The Afar female camel can remain fertile to an age up to twenty nine years and they produce up to ten calves but in the present study in pastoral production system only small numbers of breeding females reach this age and the average life time calf production is about 8+3 and the mean reproductive span was  $21.70 \pm 3.85$  with range 14 years to 29 years. The mean calving interval and number of services per conception in Afar camels are  $2.6 \pm 1.4$  years and  $1.63 \pm 0.85$  respectively. Gestation length ranges from 12-13 months with average length of  $12.04 \pm 0.2$  months.

**Production performance:** Milk is a usual and favorite food for afar camel owners. Daily milk yield of Afar camels range from 2.01-12.0 liters per day depend on feed availability, season and water access (Table 5). Lactation length is 12 month in most of the cases but factors affecting lactation length include season of the year and demand for milk for more prolonged time. Lactation length can be prolonged when there is good feed availability and if demand for milk by the owners is increasing.

The frequency of camel milking by the pastoralists vary and it depends up on the following factors: quality of milk produced per animal, extent of demand for milk, season and number of milking camel present in the herd, availability of other food for the camel owner, age and health of the calves. Generally the camels are milked two to three times per day. The camels give more milk when milked in the evening than morning.

Information from Afar camel owners indicates that first parturition lactations are much smaller than the subsequent lactations. Afar camel owners believe a camel would give more milk when milked three times than twice. The importance of the presence of calf on milk let down is well understood by camel owners and in most circumstances the calves are always present to initiate milk let down before the camels milked.

**Main constraint and diseases in afar camel production:** Feed shortage and water problem (51.8%), disease prevalence (40.9%) and other problems (7.3 %) were the principal constraints of the pastoralists in their camel production. In addition to the above main problems for the Afar pastoralists, lack veterinary

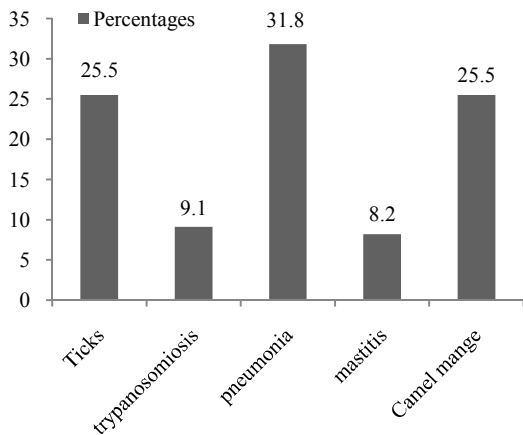


Fig. 1: Major camel diseases and their respective percentages in the Afar camel rearing society

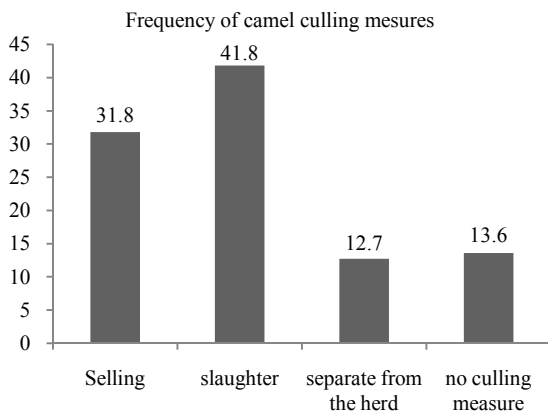


Fig. 2: Frequency distribution of the culling measures taken by Afar pastoralists

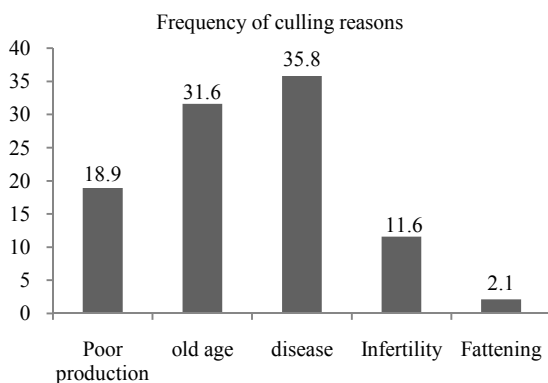


Fig. 3: Frequency distribution of culling reasons of camels in the Afar pastoralists

services, lack of governmental or private drug stores and lack of professionals support towards improvements of production and productivity of their camels are also listed. The other hindrance to their livelihoods is the absence of a pastoral-friendly market system and structures.

Respiratory tract problems and external parasite infestations were the major diseases reported in the study areas. Trypanosomiasis, brucellosis and internal parasite infestation are also the disease of livestock listed by pastoralists in the study area (Fig. 1). Repeated improper application of antibiotic treatment is highly practiced by the pastoralists themselves for any type of health problems of all their livestock species and this might lead to drug resistance to the common antibiotics.

**Measures and reasons to cull of Afar camels:** In most cases of the Afar society, it is very rare to cull female camels. Rather herd off take rate is practiced mostly in male camels not selected for breeding purposes. In very rare cases old, infertile and sick female camels are sold and slaughtered otherwise they are kept in the herd until they die (Fig. 2).

The major reasons to cull female camels in the Afar Society include, diseases, old age, poor productivity, infertility and for fattening in the order of their frequency of cases (Fig. 3).

Afar pastoralists' livelihoods have been marginally dependent on the cash economy. They sell of livestock and animal products (e.g., milk) usually to pay for basic needs (e.g., medical care, veterinary services, food staples, household items and ceremonies). Inadequate market infrastructure (i.e., facilities with water and feed at central stations along the long trekking distances) will go a long way in improving livestock quality, farm gate prices and livestock marketing alternatives, both internal and external. Recurrent drought also forces pastoralists to sell their cattle out of their need. This situation will expose the pastoralists to trek long distance which in turn result in loss of livestock weight, weak bargaining power and reduced prices. Afar pastoralists target two markets, the Ethiopian internal market and the export market to Djibouti. The present study showed similar problems of the Afar pastoralist's market availability. Camel milk marketing in Afar pastoralists have never been practiced, but some green lights are observed in selling camel milk along way to the road from Semera to Asayta.

## DISCUSSION

Based on the season of the year, age, physiological and health status of the camel, supplementary feedings mostly mineral supplement is practiced by the Afar pastoralists. But during dry season, the camels are supplemented with ever green plants when calves 4-5 months age to adapt grazing and browsing. Supplementation of minerals (salt) was carried out in 2-3 months intervals. The feeding behavior in the Afar camel is mostly browsing and frequency of watering in the Afar camels varies based on physiological condition of camel and season of the year. Large proportion of the interviewees in this study chose camels over other livestock species as their first priority to rear for their

livelihood and agrees with previous reports of similar studies conducted in pastoral society including the report of Ishag and Ahmed (2011), ANRS (2010) and Schwartz (1992).

Afar pastoralists have to cover long distances to neighboring Amhara and Tigray Regions, especially during the dry season and even more in periods of drought. Having to cover long distances with cattle in northern Afar always bears the risk that part of the herd perishes due to water or grazing shortage. But camels are primary stock and status indicators and represent the pastoral capital wealth of the Afar society and are essentially raised and kept for this reason. On the other hand, sheep and goats are considered consumer and market goods, which are frequently sold and traded for grains and basic household goods of primary necessity (ANRS, 2010). All the above mentioned reasons and facts lead the Afar pastoralists opt for camel rearing as their primary livelihood and it seems that in the ever widening desertification and climatic changes, highlanders also start to keep camels in addition to other species in the districts of Amhara and Tigray regions adjacent to afar.

The late age of maturity reported in this study is comparable with the report of Tefera and Gebreah (2001) showed age at in male camels of Issa camel and Arabian camel to occur at 5 years and 6 years, respectively. Shorter mean age at puberty of male Afar camel is also comparable with Abebe (1991) who quoted male Ogaden camel reach puberty at 4 years as compared to the current report. In general environmental, husbandry and genetic factor have been reported as the major reasons for the late age at puberty in the camel (Arthur *et al.*, 1989; Wilson, 1984). The selection age for breeding male in the Afar pastoralists vary from the day of birth to age of sexual maturity depending on different criteria of selection where family performance, physical appearance and availability of other source to replace the current bull.

The mean age at first calving in this study is line with Tefera and Gebreah (2001) and Wilson (1998) who reported 5 years and 4.83 years respectively. However, it is found to be slightly higher than the report of Ishag and Ahmed (2011). In the drought times and areas, when feed was scarce, maturity is delayed intentionally by the owners.

In the present study, an average of  $21.70 \pm 3.85$  years and  $22.5 \pm 4.48$  years reproductive span was observed respectively for female and male camels. But Tefera and Gebreah (2001) was reported 15 years and 10 years, respectively for female and male camels in afar pastoral area. During their entire reproductive life span, afar camels produce an average of  $8 \pm 3$  calves and agrees with that of Issa camel (Tefera and Gebreah, 2001). The result is also in agreement with Abebe (1991) who reported female Ogaden camel give 7-8 calves in life time. The number of calves might vary

depending on the age of first service, calving interval and lactation length where by shortening these intervals there is a possibility to get more number of calves. Gestation length is in agreement with the previous reports of Ishag and Ahmed (2011), Wilson (1998), Aboul (1994) and Abebe (1991). A relatively longer gestation period was mentioned for Arabian camel (Yagil, 1985). Environment or breed differences might attribute for such difference.

In the present study male to female camel ratio is 1: 30 which may go up in some instances to 1:50. Tefera and Gebreah (2001) also reported 1:25 and variation up to 1:50 for Issa camels. The main determining factors for this ratio differences are the husbandry practices of the pastoralists and the condition the breeding male camel as described by Tefera and Gebreah (2001). The Afar pastoralists sell male animals not selected for breeding purposes and older males to the neighboring Amhara, Tigray and Oromia highlanders for pack animal purposes. The farmers of these areas seem to feel the use of camels in their farming system and especially in the highlands of South and North wollo, camel keeping is becoming popular these days.

The lactation length in this study is in agreement with the previous findings of Ishag and Ahmed (2011) and Mehari *et al.* (2007). However, it is shorter than report by Schwartz (1992). The milking frequency in the present study ranged between 2 to 3 times in a day. This finding is in reasonable agreement with the finding of Ishag and Ahmed (2011) and Mehari *et al.* (2007). The estimated mean daily milk yield during the early stage of lactation in this study was similar to that reported by Mehari *et al.* (2007) and Abebe (1991), while the estimated daily milk yield during middle and end of lactation were lower than that reported by Mehari *et al.* (2007). However, the current result is higher than the reports from Sudan by Ishag and Ahmed (2011). The variations could be due to the number of animals involved in the study, difference in pastoral practice such as milking frequency and suckling to breed difference as well as other management or environmental difference. The major factors that affect the Afar camel milk includes, feed (quantity and quality), watering frequency, climate, age and parity, milking frequency, calf survival and presence of calf.

The major constraints listed by the Afar pastoralists in this study are similar with previous similar reports from Ethiopia and other African countries though the relative proportion and priority varies from place to place. In the present study about 51.8% of the participated Afar pastoralists said that feed and water shortage is the main problem and this seems lower proportion as compared to report of Ishag and Ahmed (2011) from Sudan which accounts more than 82%. However, 40.9% of the interviewees said that disease is

the major problem of Afar pastoralists and this value is much higher than the report of the above researchers who reported only 14.6%. Other listed constraints include conflicts among tribes and with adjacent peoples of other regions, toxic plants, long market distance and lack of support as to the improvement of production and productivity of their camels.

The public veterinary service delivery in Afar national regional state is generally not able to fully address the needs of the poor livestock owners who entirely base their livelihood on their animals. As a result several infectious and non-infectious diseases are still endemic in the region and have economic repercussions. The disease related livestock losses are often aggravated by recurrent droughts that compromise the nutritional (feed and water) situations. Though, the number of veterinary clinics is increasing from time to time recent years, the clinical infrastructure lack basic facilities (including clinical and diagnostic equipment) required for sound operations.

Regarding the selection of breeding females, all females were used for breeding. This can be explained by the fact that possibility to select among females in larger livestock species is very difficult. This is particularly so due to high calf mortality, long gestation periods, long calving interval, late age of first parturition and the need to build large stock size. Female camel culling is unthinkable in the Afar society tradition. While culling might be desirable from a performance-oriented point, the pastoralists' attitude seems rational and may be justified when considering the slow herd growth in camels. Breeding management usually focused on bull selection. The herders interviewed widely agreed on the perceived proper criteria. Consideration was given to the bull's dam (milk production, fitness), bull's sire (fitness) and bull's performance ranking (body confirmation, fitness, docility, disease, drought tolerance).

The feeding habit of milk and meat in this society is raw milk and cooked meat; however it is customary to eat raw camels' liver together at the place of slaughter. It is very important to create awareness among Afar pastoralists as far as raw milk and meat eating habit is concerned as it is unfortunately higher prevalence rate of zoonotic diseases such as brucellosis in their herds reported from different studies. The Afar people have derived the bulk of their food from milk; meat and butter in the past good days and very recently have made a shift towards grain as a major component of their diet. This is partly attributed to:

- Insufficient milk yield and loss of livestock due to above mentioned factors
- Their gradual integration into market whereby they exchange animal and animal products for grain
- Exposure to relief food provided in the form of grain during the past famine crises and the resultant changes in food habits

Generally there was a total lack of a recording system in all studied areas. None of the interviewees reported that they recorded the performance or health status of their herds and this should be changed for improvement of their herd performances. The good news is every member of the family in the pastoralists knows about each and every camel life history and this is typical in pastoral community.

## **CONCLUSION AND RECOMMENDATIONS**

Camel management is exclusively the responsibility of men in the Afar society with very little involvement of women. Due to lack of better management, nutrition and health care Afar camels could reach puberty age later than they should be. The production of the Afar camels is not fully exploited as they are purely dependent on natural vegetation. The Afar camels are classified as dual-purpose animals (dairy and meat) and are used as pack animals. From the physical appearance, it could be concluded that they can be used for the racing purpose too. The pastoralist management system in the Afar areas are the best production system to be maintained as there is no other systems fit those situations. Identifying breeding goals of camel owners, husbandry practices and production constraints add values as essential steps towards the development of a sustainable breed improvement programs in the camel rearing society of the country. Researchers and funding agencies should pay due attentions to camels as they are the future livestock species in combating food security and environmental sustainability in the ever widening desertification. Indigenous knowledge of the pastoralist should be our foot springs to improve the production and productivity of their camels as they have huge experiences from nature and their environment.

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