INDIGENOUS LIVESTOCK HUSBANDRY AND ETHNO VETERINARY PRACTICES IN ENDAMOHONI DISTRICT OF TIGRAY REGION, ETHIOPIA

M.Sc. THESIS

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This is to certify that the thesis titled ñINDIGENOUS LIVESTOCK HUSBANDRY AND ETHNO VETERINARY PRACTICES IN ENDAMOHONI DISTRICT OF TIGRAY REGION, ETHIOPIAò is submitted in partial fulfillment of the requirements for the degree of Master of Science in Animal Range Sciences with a specialization of Animal Production of the Graduate Program of the School of Animal and Range Sciences, Hawassa college of agriculture, and is a record of original research carried out by Fisahaye Abraha Woldu I.D. No SGS/105/05 under our supervision and no part of the thesis has been submitted for any other degree or diploma.

The assistance and the help received during the course of this investigation have been duly acknowledged. Therefore, we recommend that it will be accepted as fulfilling the thesis requirements.

_____	_____	_____
Name of Major advisor	Signature	Date
_____	_____	_____
Name of Co-advisor	Signature	Date
_____	_____	_____
Name of Co-advisor	Signature	Date

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DEDICATION

I dedicated this thesis to my beloved parents ABRAHA WOLDU and ABEBA GEBRAY and my sisters and brothers for their support and words of encouragement during my moments of anxiety.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my genuine work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. degree at Hawassa University and is deposited at the University Library to be made available to borrowers under rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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ACRONYMS

AI	Artificial insemination
CBPP	Contagious Bovine Pleural Pneumonia
CSA	Central statistic authority
DA	Development agent
ECF	East Coast Fever
RVM	ethno veterinary medicine
FAO	Food and agricultural organization
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HH	household
IFAD	International fund for agricultural development
IG	Improved grasses
IK	Indigenous knowledge
ITK	Indigenous traditional knowledge
LT	legume trees
M.a.s.l	Meter above sea level
RVF	Rift Valley Fever
SPSS	Statistical Package for Social Science
SZT	Southern zone of Tigray
TBD	Tick and tick born disease
UNEP	United Nation Environmental Program me
WDMCF	Wildebeest-derived malignant catarrhal fever
WIPO	World Intellectual Property Organization

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ABSTRACT

INDIGENOUS LIVESTOCK HUSBANDRY AND ETHNO VETERINARY PRACTICES IN ENDAMOHONI DISTRICT OF TIGRAY REGION, ETHIOPIA

By

Fisahaye Abraha (B.Sc.)

Major advisor: Mohammed Beyan (PhD) Co-advisors: SintayehuYigrem (PhD) and Melkamu Bezabih (PhD)

Indigenous knowledge is local knowledge that exists and buildup through experiences of the local community in the day-to-day practice and it is economically inexpensive. Farmers use their indigenous knowledge from time immemorial till today, thus it gives a good solution for their problems. However, this knowledge is not well studied, analyzed and documented to be used as a basis for farming system development. Therefore, this study was conducted with the objectives of identifying and documenting farmers' indigenous knowledge in livestock husbandry, and ethno veterinary practices in Endamohoni distric of southern Tigray. The woreda was purposively selected based on its contrasting agro-ecologies (lowland, midland, and highland) and potential of being the source of traditionally knowledgeable peoples who for generations have been associated with livestock rearing. Six kebeles (two kebeles from each of the three agroecologies) were selected as study sites. A total of 175 households (55 from lowland, 60 each from midland and highland), assumed to have a better indigenous knowledge in livestock production were selected for the study. A structured questionnaire was administered to the selected households to collect data on use of indigenous knowledge on livestock husbandry and ethno veterinary practices. After completing the questionnaires for each division, group discussions have been held and an informal meeting with the key informants for triangulation. Result indicated that 88.3, 76.7 and 92.7 % of the respondents in highland, midland and lowland agroecologies respectively were males. The level of education shows that of all the respondents, 55% in highland, 50% in midland and 72.73% in lowland were illiterate. Sheep and cattle in highlands and midlands and goat and cattle in lowland dominated the livestock populations. Shortage of feed in the study areas was ranked as the first constraints of animal production. Farmers use purchasing of crop residue in the highland and midland, destocking in the midland and movement (urna) in the lowland as mitigation mechanisms. Phenotypic selections of different animal species are employed and also keeping history of pedigree is important instrument in the breeding and selection of animals. Breeding of close related livestock is discouraged in the study sites. Seventeen animal diseases and38 aliments were recorded in the study areas and 65 medicinal plants were accordingly documented to treat those diseases. About 83% of the highland, 75 % of the midland and 92.7% of the lowland farmers acquire ethno veterinary knowledge from their old parents. Of the total medicinal plants, (81 %) were wild. In the preparation of the traditional medicine leaves constitute about 51% and 47 % of the medicine was administered orally. The most common preparation method is by crushing and squeezing (45 %). Farmers are aware of toxicity and provide antioxidants. Farmers used herbals (plants) in dairy utensils cleaning, fumigation, milk processing and preservation. These knowledge and practices of livestock husbandry, animal health and product handling and processing should serve as the basis to develop further interventions to improve livestock productivity in the area. As most of the medicinal plants are grown in wild, it is very important to promote conservation in ex-situ and in-situ. And further biological studies should be conducted on the reported medicinal plant speciesof the study area so as to utilize them in drug development.

Key words: Indigenous knowledge, Ethno veterinary, Agroecology, Livestock husbandry, Medicinal plants Dairy product

1. Introduction

Agriculture and related actives are the major occupation of the population of sub Saharan countries and most of the populations are dependent on the sector directly or in directly for their livelihood (Daniel, 2008). Livestock sector occupies a special position in the national agenda of the economic development of Ethiopia. This sector plays a vital role in revenue generation in the country and is believed to play an important role in poverty alleviation and supporting the socioeconomic development of Ethiopiaôs rural groups (Benin *et al.*, 2003; FAO, 2009; Tadesse, et al., 2014).

Ethiopia possesses the highest livestock resources in Africa and the majority of which are native breeds mostly reared under traditional type of management and are dependent on indigenous knowledge for their nourishment (Hiwet, 2013). These native livestock breeds have adaptive traits that enable them to survive and reproduce under harsh climate, poor nutrition and management conditions (Mwacharo and Drucker, 2005). In Ethiopia, livestock production remains crucial livelihood option and represents a major asset among resource-challenged smallholder farmers, serving as a source of cash income, farm power, milk, meat, skin/ hide and manure (FAO, 2009; Tadesse, et al., 2014).

Indigenous knowledge is a broad concept that covers all forms of knowledge, technology, knowhow, skills, practices and beliefs that enable the community to achieve stable livelihoods in their environment (UNEP, 2008). It has significances role in designing sustainable farming systems, by improving traditional method of livestock management and ability of the stockowners to deal with different challenge of selection, disease tolerance, feeding management, and product handling.

Indigenous traditional knowledge (ITK) maintains genetic resources (both plant and animal) which are essential for the wellbeing, sustenance and development of the environment and livelihood of a community (Banerjee. et al., 2014).

ITK of animal husbandry consists of animal management, hygiene, feeding, watering, animal product handling and disease control (Kumar and Singh, 2011) and it forms the basis to improve the livelihood of the rural populations. Local peoples in many parts of the world use their traditional knowledge to prepare herbal medicines to treat various animal diseases and, this practice has remained there since time immemorial (Patel et al., 2013).

According to Abubakar (1999), over the centuries Africa stockowners, through their own methods of trial and error have learnt a great deal about animal diseases and their treatments. These remedies are define by Mathias and McCorkle (1989) dealing with the folk beliefs, knowledge, skills, methods and practices pertaining to the health care of animals. As reported by Robinson Zhang (2011), 70-95% of the population in the developing countries relies on traditional medicine for main care of their population. Similarly in Ethiopia, traditional medicine are still the most important and sometimes the only sources of remedial for approximately 80% human and more than 90% livestock population (Gidey, 2010). This is regularly practiced in rural areas of Ethiopia due to lack of veterinary clinics, practitioners and absence of regular supply of quality drugs.

Most commercial drugs are also expensive for farmers and pastoralists. Therefore, most of the farmers and pastoralists rely on their traditional knowledge, practice and locally available materials (mainly plants) in controlling diseases of their domestic animals (Mirutse, and Gobena.2003). Besides to this, different ethnic groups have their own practices which are often distinct and unique (Mesfin and Obsa, 1994; Hiwet, 2013). ITK is still unexploited resource in

the development efforts of Ethiopia (Tesfahun, 2000). Thus, documentation of essential ITK of farmers on agricultural practices in general, livestock husbandry, breeding and trait selection criteria, and traditional remedial practice of farmers in particular is necessary before the elder generation passes away

1.1. Statement of the problem

Ethiopia is one of the orgin of of ancient culture and utilizes indigenous traditional knowledge (ITK) as deep-rooted practices along with all part of the society (Hiwet, 2013). Likewise, in Tigray region of Northern Ethiopia, farmers have a long tradition of indigenous knowledge in agricultural practices in general and livestock husbandry, livestock product handling, breed selection, ethno veterinary and soil and water conservation in particular. The region is endowed with large livestock resources with a rich traditional husbandry practices. The livestock husbandry practice has been acquired through experience over years and it is environmentally stable, cost effective and are easily accessible to all members of society from which such practices have been evolved (Banerjee et al., 2014).

However, many of our indigenous knowledge and technologies in agriculture and allied fields have been replaced by the so-called modern and skilled technologies and thus the elder peoples do not access them easily. Now these indigenous practices, which are unwritten body of knowledge, are endangered as it is used only by the aged and elderly farmers. Hence, there is a possibility of them to become extinct if not formally documented and preserved (WIPO, 2011). Similarly, in many cases, individuals who are knowledgeable in traditional practices usually try to keep the knowledge secret and remain unwilling to openly teach to others. This is also considered as another problem causing a loss of knowledge to the country, because such traditional peoples are becoming fewer and fewer in number (Mesfin and Obsa, 1994).

Therefore, documentation has great practical value in almost every activity of human life such as animal health, livestock husbandry agriculture. There exists no empirical evidence to what extent indigenous knowledge differs in different agro-ecologies of Ethiopia in general and in southern Tigray in particular. Hence, the current study was carried out with an aim of identifying and documenting traditional practices related to livestock husbandry (livestock product handling, livestock selection practice and their ethno veterinary practice) performed in different agroecologies of Endamohoni district of southern Tigray, which is located in the northern part of Ethiopia

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1.2. General objective:

To identify and document livestock husbandry and ethno veterinary practices in Endamohoni district, southern Tigray

1.3. Specific objectives:

- ✓ To assess ruminant breeding objectives and trait selection criteria of smallholder farmers in different agro-ecologies
- ✓ To identify and describe ethno veterinary practices
- ✓ To identify and document indigenous knowledge of ruminant livestock management and dairy product handling practices in various agro-ecologies

2. Literature review

2.1 Definitions of Indigenous knowledge

Indigenous knowledge (IK) is a complex body of knowledge, skills and technology, which belongs to a particular geographical community (Matsika, 2012). IK is expresses traditional knowledge, rural knowledge as well as ethno science (Altieri, 1994). According to Ward (1989), IK is peopleôs science, ethno-science, folk-ecology, village science, and local knowledge. Matsika (2012) goes further to list the main characteristics of IK as:

- ✓ A home grown form of knowledge, which is derived from the solution of everyday life problems
- ✓ It is part and parcel of a communityôs cultural practices and ways of life and regularly it is not documented but has passed from one generation to another through oral history Risiro (2013*),* defined IK as a community based functional knowledge system, developed, preserved and refined by generations of people through continuous interaction, observation and experimentation with their surrounding environment. IK is a dynamic system, ever charming, adopting and adjusting to the local situations and has close links with the culture, civilization and religious practices of the communities (Pushpangadan et al*.,* 2002).

2.2 Importance of Indigenous Knowledge

Indigenous Knowledge (IK) is an integral part of the culture and history of a local community. It evolved through many years of regular experimentation on the day-to-day life and available resources surrounded by the community (Jena, 2007). It also indicated that it is essential for maintenance of the plant and animal genetic resources for continued survival of the community. The livelihood of rural population mainly depends on IK, which is essential for their survival.

This knowledge has been integrated with agriculture activities of the population like, animal husbandry and those days used to practice such knowledge for sustainable development (Mahalik and Mahapatra, 2010).

IK is generated by a particular society within a geographical area and it is respected for its ability to solve prevailing problems (Risiro, 2013). Furthermore, IK has been recognized as a valuable input into modern industries such as pharmaceuticals, botanical medicines, cosmetics and toiletries, agriculture and biological pesticides. Most industries look for the time tested traditional knowledge information for developing novel products having commercial acceptability *(*Kumar and Bijoylaxmi, 2011). IK has been based on practical experience; it can be preserved and harnessed for the benefit of both present and future generations, belonging to humanity in general and its communities in particular (Noyoo, 2007).

Risiro (2013) pointed out that the introduction of western education and missionary activities in Africa watered down the value and respect given to indigenous knowledge and cultural beliefs. Some of this knowledge has been regarded as primitive and superstitious even though indigenous knowledge had been respected and practiced by indigenous people on their own custodians and legislators of environmental management. The same author explained that this indigenous knowledge had ensured forests, water resources and animals protected from destruction and extinction. IK plays a substantive part in poverty eradication among communities in different parts of Africa. The knowledge is implicit and thus difficult to systemize it. It is embedded in community practices, institutions, relationships and rituals (Msuya, 2007). Therefore, there is a need to systematically document, validate, standardize and to propagate IK or technologies to reduce dependence on external inputs, to reduce the cost of cultivation and to propagate eco friendly agriculture.

2.3. Indigenous knowledge in Ethiopia

Early Ethiopian Civilization serves as an evidence for the extent and rationality of indigenous knowledge (Tesfahun, 2000). The same author reported that domestication of certain crops like coffee, teff and enset and the development of bench terrace system by the Konso nationalities are among important cases of achievements in agriculture. In Ethiopia, traditional farming represents centuries of accumulated experience and skills of peasants who often sustained yields under adverse farming conditions using locally available resources.

The country has a written language for over 2000 years and owns over 500 yearsô old manuscripts, which deal with traditional knowledge concerning public health and veterinary medicine (Tesfahun, 2004). Ethiopiaôs traditional medicines are faced with problems of continuity and sustainability due to loss of habitats of medicinal plants and loss of indigenous knowledge (Sintayehu, 2011). Therefore, today the issue of medicinal plant conservation, making systematic studies and documentation are obligatory before the accelerated ecological and cultural transformation take place (Endashaw, 2007).

According to Hiwet, (2013) Due to inadequate modern veterinary services in Ethiopia and its inaccessibility in most parts of the country, majority of the countryôs livestock owners mainlydepend on traditional healers and herbalists. Traditional veterinary practices include mechanicalphysical, pharmacological, surgical, rituals and managerial methods of treatment using faunal medicine.

2.4. Indigenous knowledge related to livestock husbandry practices

2.4.1. Indigenous Knowledge related to livestock breeding and trait selection

The result of a study by Hiwet (2013) from Sidama zone of southern, Ethiopia, points out that the prevalent breeding system of livestock is still the age-old phenotypic selection. Animals were identified based on the color and production traits are correlated with the color and other phenotypic traits. The majority of farmers preferred local cows claiming that the crossbred animals are susceptible to feed shortage, disease and adaptation problem.

Banerjee et al. (2014) indicated that common methods of livestock selection are based on phenotypic traits and oral pedigree information about the production performance of the dam. This is because farmers have awareness about heritable attributes of livestock, which included physical, production and behavioral traits in traditional breeding system. Traditional livestock breeders have developed a large variety of institutions and mechanisms for optimizing the genetic quality of their animals within the constraints of their environment (Rollefson, 2000).

Pastoralists are exceptional in identifying and recognizing important information about their herds. They have traditional systems of population classification and are aware of the existence of breeds that have not been documented (FAO, 2009)

Pastoralists, using long tradition of animal breeding practices, select better quality herds by using certain traditional management practices (castration, culling, offspring testing), and pedigree keeping with social restrictions on the sales of genetically valuable breeding animals that lead to closed gene pool with varieties of selection objectives (FAO, 2003).

Kool and Steenbergen (2014) noted that farmers on the highlands focus on the cattle, to produce a strong drafting ox while, pastoralists select a bulls based on the milk productivity of its mother

and grandmother, meat and walking abilities (as they go for long-range grazing and watering) and can quickly adapt to survive under harsh environments.

A study by Semakula et al, (2010) from Uganda indicated that smallholder goat breeders select bucks based on body size, growth rate, fertility, temperament, color body conformation and tolerance to diseases/parasites, whereas for does they select based on horn shape, body size, fertility, growth rate and color.

The results of study by Endashaw et al. (2012) indicates that the mursi and bodi pastoralists of Ethiopia select cows based on their milk yield, coat color, fertility and udder size, whereas bull were selected based on coat color, fertility, body size and horn shape. Shiferaw (2006) reported that Kereyu, cattle owners select animals based on color, giving high importance for white color. Similarly, Shigdef (2011) noted that white and red colors are the preferred coat colors of sheep and goat in the Washera and Fenta districts whereas black color is the least preferred.

Helen et al. (2013) reported from Eastern Ethiopia (Jijiga and eastern Hararghe) that the majority of the community selected potential breeding rams and ewes from within their herds and selection of rams was more frequent than ewes. The common selection criteria of breeding ram include appearance, growth and coat color with some variation in the order of importance of the selection criteria among production systems. In the crop-livestock mixed production system, appearance is given more weight followed by coat color and growth, whereas in the agro-pastoral system growth is given more emphasis followed by appearance and coat color. In the pastoral production system, appearance, age, fast growth and tail type, which indicates fat-rumped sheep are in high demand for religious festivals and export markets. Similarly, Gizaw et al. (2010) has shown that the overall appearance of sheep is an important economic trait that

influences price of traditional markets in Ethiopia. Coat color is also an important selection criterion, with difference in the preference of colors between production systems. Red, white or mixed colors were more preferred in the mixed crop-livestock system, while a black head with a white body was preferred in agro-pastoral and pastoral production systems. According to Edea et al. (2012), black coat color is mostly unwanted color due to less market value across all the production systems and pure white and red head with white body are unwanted colors in both agro-pastoral and pastoral production systems due to less resistance for drought and disease.

Banerjee et al. (2014) indicated that coat color is related to the adaptability and influences the disease tolerance of the livestock, coat color also influences the ability of the livestock to ward away the evil eye, certain coat colors have more market demand than the other do and particular coat color has better ability to tolerate the environmental variations.

Studies by Yosef et al (2014) from pastoral communities of Afar and Somali indicates that trait preference of dromedary camels in Afar was milk production, adaptability, breeding efficiency, growth, ability to give birth to more female and draught capacity. In Somali pastoral communities (Gode and Jijiga) milk production and adaptation to give birth to more number of female than male calves and draught capacity ranked third. As opposed to the other study sites where at least milk production is rated as most important trait, Moyale pastoral communitiesô trait preference indices indicate adaptation to be the priority trait followed by growth and milk yield in their order of importance. In all Somali and most Afar pastoral communities, adaptation trait ranked second in their trait preferences.

Breeding goals of traditional societies are far more multifaceted than in intensive productions systems and comprise many aspects other than high productivity with regard to cash products

(meat, milk). They can include aesthetic preferences, religious requirements and behavioral aspects, such as a satisfied nature, good mothering capacity, and herd ability, the ability to walk long distances and loyalty to the owner (Köhler-Rollefson, 2000).

Local breeds play a multi-functional role in rural livelihoods, contributing cash products and traction. They have also social benefit as ñinsuranceò against natural disasters or economic bottlenecks. Furthermore, indigenous breeds may have valuable genes with future commercial potential. This is all true among the breeds kept by pastoralists, who are regularly exposed to stressful conditions and vagaries of nature such as shortages of feed or water, and in spite of all such calamities excel in the survival and fitness when compared to the temperate and crossbred animals (Koehler-Rollefson, 2001).

2.4.2. Livestock feeding and feed source in Ethiopia

Livestock feed resources used in Ethiopia include natural pasture, crop residue, improved pasture and forage, agro industrial by products and other by-products like food and vegetable refusal, of which the first two contribute the largest feed types (Alemayehu, 2005).

According to Belay et al, (2012), the major sources of feed for livestock are natural pasture, crop residue, conserved hay, stubble grazing and nonconventional feeds. Teff (*Eragrostisteff*) residue in low and medium altitudes and wheat and barley crop residue in the highland areas are main crop residues used as livestock feed. Maize Stover is also an important feed biomass in maize growing areas.

The study conducted by Shitahun (2009) in Bure Woreda, Amhara Regional state, indicates that the major dry season feed resources for cattle in the district were natural pasture (55.7 %), crop residues (20.7 %), stubble (14.3 %) and hay (9.3 %). For sheep, 73.6 %, 12.1 %, and 14.3 % of

the feed was derived from natural pasture, crop residues, and stubble respectively. For goat, 72.9 % was obtained from natural pasture and 27.1 % from crop aftermath. For donkey, crop residues constituted 65.7 %, natural pasture 17.9 % and aftermath 16.4 %. In the wet season, natural pasture is the sole feed sources of livestock.

The feeding system mainly involves free grazing in pastoral and agro-pastoral areas and in the mixed farming systems where grazing land (private or communal) is available. However, in the highland areas, due to the continual shrinking of grazing lands, cut-and-carry system combined with tethering of animals is becoming a common practice. In this latter system of feeding, animals are tethered around the backyard and green forage, hay and crop residues are offered to them. Although grazing on fallow land and cropland after harvest has been a common practice (Tesfaye, 2008), in recent times local bylaws have been enacted preventing free movement of animals in some rural to protect soil and water conservation soil bunds.

2.4.3 Indigenous knowledge (IK) of farmers and copping mechanism of feed shortage in Ethiopia

To mitigate feed shortage farmers indigenously suggested different coping mechanism such as collection and storing of crop-residues (92.16%), preparing of hay from farm boundaries (54.25%), utilizing of browse species(50.93%), utilizing of supplementary feeding either by purchasing or homegrown (44.39%) and selling of older and unproductive animals (28%) in order of importance(Shitahun, 2009).

Bakyusa et al., (2012) reported about the feed scarcity coping mechanisms of livestock owners in the urban and peri-urban areas of Uganda. Farmersô major form of herd reduction reported in urban and peri-urban areas of Kampala was selling, relocating animals to the countryside and

slaughtering. Similarly, when livestock survival is threatened by different stressing factors, destocking is the obvious first action (Salem & Smith, 2008).

Result of study by Seid and Berhan (2014) from Burjiworeda, Segenzuria zone of south Ethiopia indicated that 24% of the livestock owners relied on stored crop residues during feed scarcity periods and about 55% depend both on migration and natural pasture. Thus, the strategies to cope with feed shortage in dry and wet seasons were feeding on farm residues and on natural pasture. Also 40% in highland, 21.7% in mid-altitude and 25% in lowlands send their animals to others areas of ample natural pasture. About 30% in highland, 10% in mid-altitude and 40% in lowlands resist the condition through relaying on both farm residues and natural pasture.

2.5. Indigenous knowledge (IK) of milk and milk product handling, processing and consumption pattern in Ethiopia

2.5.1. Milk and milking procedure of traditional farmers in Ethiopia

Milk is the most complete food item since its great biological value and contains a variety of nutrients. These nutrients in milk make it naturally most nearly perfect food (Kassahun and Fekadu, 2009). On the other hand, milk is the most easily contaminated and perishable product of animal origin (Abebe, 2011). This is mainly due to its high nutritional value, which creates favorable environment for growth and multiplication of pathogenic microorganisms and facilitates spoilage of milk. Thus, the major factors affecting dairy product quality is associated with the hygienic standard of milking and milk handling procedures and equipments.

Asamenew and Eyasu (2009) stated that the majority of dairy cooperatives in Bahir Dar Zuria and Mecha Woredas, Northwestern Ethiopia wash their hands and milk vessels before milking cows. However, washing of udders and use of towel to clean the udder had not been practiced,

furthermore the same author indicated that milkers dip their fingers into the vessel containing milk and moisten teats of the cows while milking.

Similarly, Abebe (2011) reported that not all respondents in Ezha district of Gurage zone, Southern Ethiopia cleaned udder before milking. In the same district (87.5%) of respondents, cleaned milking equipment but the source of water (86.7%) is from river, which may be a source of contamination and increase the microbial load of the milk. In addition, the practice of washing hands after milking was also low in mid land areas of the same region (48.3%).

2.5.2. Milk processing practice in Ethiopia

Milk processing is an important mechanism to the preservation of food constituents as sources of nutrients and cash for many people in the world. Milk processing is usually designed to remove water from milk or reduce the moisture content of the product (Abebe et al., 2013). Butter making is an ancient practice and farmers in Ethiopia have accumulated rich traditional knowledge on possessing milk into butter. The common traditional practice is to accumulate the daily milk in clay pot for few days until a sufficient amount of soured milk is obtained, and then the soured whole milk is churned by shaking the pot for several hours. Butter is used for cash generation, cooking traditional Ethiopian dishes, and medicinal and cosmetic purposes (e.g. application to the braided hair of the women). In almost all traditional Ethiopian societies, women are responsible for butter making and marketing. In general, husbands or men do not decide on the butter. Cows are the main source of milk for butter processing in Ethiopia. The equipment that is used for processing of sour milk is simple and locally available. But the techniques of processing differ from place to place depending on size and type of the churn and various type of materials used in different part of the country (Zelalem and Inger, 2000). The

major milk processed products include yogurt (ergo) skimmed milk, butter, (melted butter ghee and whey (*Aguat*) (Abraha, 2012).

2.5.3. Traditional milk preservation and tree species used to clean and smoke milk utensils

According to Yitaye et al, (2009), farmers use different means of preservation techniques for traditional butter and cottage cheese like spicing, cooling in refrigerator, salting and traditional cooling methods in water bath to mention some. Milk equipments are generally cleaned and fumigated using selected trees, which are traditionally, identified by local people.

Abraha, (2012) from northern part of Ethiopia identified various herbs when smallholder farmers were using to wash and smoke milk utensils. To reduce milk spoilage plants such as Achyranthes aspera (Mechalo), haypoests forskaolii (Gribya), and Cucumis prophertarum) Olea europaea (Awulie) and Rhus glutinosa (Tetalo) were used. These plants were used either for sanitation or fumigation purpose. Similarly, major tree species used for smoking of milk handling and processing utensils identified included Accacia etbaica (Seraw), haypoests forskaolii (Gribya) Dodoneae angustifohia (Tahises) and Olea europaea (Awulee) (Abraha, 2012). Cleaned and smoked containers have been reported to pertain anti-microbial properties and prolong shelf life of cow milk (Ashenafi 1996). Beside to that milk handled and processed in smoked utensils had pleasant flavor and taste. Regular smoking of milk handling utensils slows down fermentation process (Tesfaye, 2007).

Table 1: Tree species used to smoke milk vessel in different parts of Ethiopia

local name of the plant	scientific name of the plant	References

Tid	*Juniperous procera)*	Yitaye et al, 2009
Qega	*Rosa abyssinica ,*	Yitaye et al, 2009
Abbalo	*Terminalia schimperiana*	Tesfaye, 2007
Wenbela	*Terminalia laxiflora*	Tesfay, 2007
Bahrizaf	*Eucalyptus globulus*	Sintayehu et al. 2008

2.5.4. Milk and milk product consumption trend in Ethiopia

Tradtional dairy products are unquiclly processed and consumed differently according to the culture of various regions of Ethiopia. Hiwet (2013) noted that traditional products such as the fermented milk (Ergo) consumption pattern of Arbrgona and and Lokabaya woredas of sidama zone was differ. In Lokabaya Ergo was not consumed because of traditional preferences but gender difference was observed, in Arbrgona woreda. Ergo is given to male member of the family and guests. Abraha, (2012) also documented that the milk consumption pattern of southern Tigray highlands were hindered by insufficient amount of milk production and cultural restriction. However, majority of the dairy owners were intimated with their neighbours and they share animal products like the priceless life saving ǿ*simbahlela and* yoghurt during emergencies. Dairy products play important social and cultural roles. For example, farmers to drink milk products alone, particularly after long fasting periods, for that matter every dairy owner do distribute about 3 to 5 litters of milk for his neighbour as gift just in every holidays like Easter, *Ashenda*, New-year, Christmas and/or Epiphany. Besides ploughing oxen was shared to neighbours in the rural and periurban areas that kept strong social bond.

2.6. History of traditional veterinary practices (Ethno veterinary practices)

Studies of Abubakar, (1999) indicate that veterinary medicine, as practiced today, has its roots in herbal medicine, which has been practiced since ancient times in China, India and the Middle East Asia. The Middle East Asia is the centre of veterinary and other medical knowledge in the early Middle Ages. With the spread of Islam, some of this knowledge made its way into Africa and adopted by stock raisers. Ethno veterinary medicine has been practiced as early as 1800 B.C. At the time of King Hammurabi of Babylon formulated laws on veterinary fees and charged for treating cattle and donkeys. Traditional veterinary practices have been around for a long time and remained the only medicine available until nineteenth century. There are mentions of ethno veterinary medicines in the epic Mahabharata where the two Pandav brothers of Nakul and Sahadev were famed for their knowledge on treatment of horses and elephants, later there are reports where King Ashoka and Kanishka had established veterinary hospitals in their kingdom besides Sher Shah Suri had also established livestock husbandry department in his kingdom. In China, the ancient philosophers Confucius and Shi Tzu had reported the importance of livestock, their husbandry, treatment, and its relationship with the prosperity of the agrarian community. In the same way over the centuries Africa stockowners, through their own methods of trial and error have learnt a great deal about animal diseases and their treatments.

These remedies are now widely used in light of the different Ethno veterinary practices in Africa. So far, several studies on Ethno veterinary medicine (EVM) have been conducted in Africa. Ethno veterinary medicine involves different aspects of traditional animal health techniques and practices. Such aspects include pharmacologyand toxicology, vaccination, surgery, management and magico-religious practices and beliefs. Over the centuries in Africa stockowners, developed their own animal diseases and their treatment by through their own experience method besides, in most sub-Saharan African countries, more than 80% of the

population uses the services of traditional healthcare practitioners in combination with conventional healthcare systems (Soewu and Ayodele, 2009).

Tick and tick born diseases (TBD) are widely distributed parasites throughout the world particularly in tropical and subtropical countries, which cause bacterial diseases and great economic losses in livestock industries (Seyoum, 2001). However, the stockowners use herbals with combination of other modern medicine to control tick invasion in their stock. The result of studies by Gbolahan et al (2012), from logos state, Nigeria noted that Fulani pastoral were unsatisfied control of Tick by only improved technologies. The poor farmersô modern methods of treatment using acaricide, pour-on preparation, slow-release implants, and premunization are viable, only on a small scale, Cost, scarcity, and difficulty of application. Then cattle herdsmen by their own way combined indigenous strategies with conventional strategies to control ticks invasion on cattle. As reported, indigenous strategies adopted by the herdsmen to control ticks were, use of fire with insecticide, use of fire with kerosene, use of kerosene only and use of fire only in order of respective importance.

Similarly, Achenef Melaku, (2013) from north Gonder, Ethiopia, reported that Stockowners use nine potential medicinal herbs to control tick invasion with most commonly used Zikita (*Calpurnia aurea)* and Birbira (*Millettia ferruginea)* that could be used to kill or repel ticks.

Studies of Belay et al (2013) from Ilu Aba Bora Zone, South Western Ethiopia, indicated that farmersô livestock production affected by different type of disease and used different prevention and control measures. Majority (83.3%) of the farmers used traditional treatments to treat their sick animals while the reasons for using traditional treatment were lack of adequate veterinary

services, long distance to animal clinics, lack of transport facilities and they believed that the animal can recover with traditional ethno-veterinary practices.

Ethno veterinary medicine involves different aspects of traditional animal health techniques and practices. Such aspects include pharmacology and toxicology, vaccination, surgery, management and magico-religious practices and beliefs. In Africa, stock raisers, have a wide indigenous knowledge of helminthology. A good example is that of the Fulani people in the north western province of Cameroon who use leaves of *Annonasenegalensis* the bark of *Haruganamadagascariensis*or the leaves of *Vermoniaamygdalina* (Abubakar, 1999).

These diseases not only affect the production and productivity of livestock, but also seriously slow down livestock trade. A number of zoonotic diseases are also a serious threat to human health. Potentially fatal diseases in cattle include wildebeest-derived malignant catarrhal fever (WDMCF), East Coast Fever (ECF), Foot-and-Mouth Disease (FMD), Rift Valley Fever (RVF), Contagious Bovine Pleural Pneumonia (CBPP) and Trypanosomiasis. These diseases recognized to have been the major barriers, which affected the early introduction of cattle-based economies in most of the affected countries (Gofford-Gonzalez, 2004).

Ticks and tick borne diseases as well as, tsetse and trypanosomiasis, are two major parasitic vector borne disease complexes with very serious effects on livestock production and productivity in the sub Saharan Africa (Mattioli et al, 2000).

According to Abubakar (1999), many traditional farmers have their own folk knowledge of immunology. Russian Cossacks, Arabs and Indian camel keepers effectively vaccinate their camels against pox variola using variolation. The Indians use scabs from an infected animal and

suspended in milk. A needle then dipped in this vaccination solution and inoculated into the young camel in the lips. The Arabs use thorns from acacia plants for inoculation.

The Somali pastoralists immunize their animals against rinder-pest by employing a solution of urine, milk and faeces obtained from animal with mild cases of rinderpest while Fulani infuse a piece of infected lung in the muzzle of immunizing against rinder-pest (McCorkle, et al., 1996).

Plants and other substances used as wound dressings. For instance in Sri Lanka, wounds are dressed with crushed fresh turmeric cooked in oil of *Azadiracticaindica leaves*. The Maasai healers cleanse their livestock wounds with hot water and suture with thorns held in place by tendons (Abubakar, 1999).In the same way, Ethiopia has glorious tradition of health care system based on plants, which dates back to several millennia. Medicinal plants and traditional medicine play an important role in the health care system like most developing countries (Regassa, 2013).

Cattle owners in Ethiopia have long been aware of serious diseases such as desta (rinderpest), aftegir (foot and mouth disease), abasenga (anthrax), abagorba (blackleg), gendi (trypanosomosis) and diseases caused by internal and external parasites, and of the zoonotic nature of diseases such as anthrax and rabies. Before the introduction of modern veterinary practice, traditional healers were usually the only people approached to attend to these livestock diseases. The various traditional practices included prevention of diseases, recognition of toxic plants, surgical intervention and crude vaccination methods (Mesfin and Obsa, 1994**).**

It has stated that most of the modern day medicines including the discovery of coffee have attributed to observations made on livestock by the traditional rearers.

Table 2: Some animal disease and plants used for treatments

Name of Disease	Type of plant	Part of Plant	Species Livestock	References
Diarrhea	*Meriandra dianthera*	leaf	cattle	Yirga et al, (2012)
Black leg	*datura stramonium*	leaf	cattele	Yirga et al, (2012)
Wound	*Solanum incanum*	root	livestock	Gebremedhin et al. (2013)
Inflammation of eye	*Achyranthes Aspera*	root	(cattle)	Mirutse andGobena, 2003
Bloat (cattle)	*Aloe sp.*	leaf	cattle	Mirutse andGobena, 2003
Mange mites	*Calpurnia aurea*	leaf	livestock	Mirutse and Gobena, 2003
Bone fraction	*Acacia etbaica*	bark	livestock	Gebremedhin et al. (2013)
Lungworm	*straminispinum*		livestock	Yirga et al, (2012)
Lack of colostrum	*Phaseolus vulgaris*		livestock	Banerjee et al.(2014)

Ethno veterinary medicines are mainly administered to livestock orally as decoctions, liquid in that the plants have been steeped, vaccination, suppositories, through smoke, vapours, massage, intranasal or applied topically on the skin or as a bathe in skin problems (Dilshad et al., 2008). According to Yirga et al, (2012) leaves are frequently used as part of the ethno veterinary medicine evenennn tails roots, rhizomes, bulbs, barks, stems or whole parts have effects on the survival of the mother plants. Similarly, Mirutse and Gobena (2003), from northern Ethiopia noted that leaves and roots are the most commonly used plant parts in the preparation of remedies accounting for 70% and 35% of the total medicinal plants.

Most of the plants are collected from wild. While only few are cultivated in home garden besides the plant parts used for livestock health treatment in western Ethiopia are leaves take upper

hand (57.14%), bark (14.28%), seed and root collectively 14.28%), whole plant (7.14%), root only (7.14%) (Haile and Delenasa, 2007).

The result of studies by Hiwet,(2013)from southern Ethiopia indicates the plant part used in preparation of traditional remedies, leaf only accounts (62.2%) followed by vessel xylem (16.2%) and the route of administration are oral application (55%)followed by dermal and oral (18%). In addition, preparation method of traditional medicine are concoction, squeezing (50%), crushing and pounding (26%) and crushing by hand, only (12%) are the main processes.

Local people use different type of remedy preparation and application to treat livestock disease (Behailu, 2010). The techniques used for preparation includes squeezing, crushing, squeezing followed by concoction and crushing followed by concoction and direct harvesting. However, Endashaw (2007) from west showa of Ethiopia noted that root was the most common part used by the traditional healer.

3. MATERIALS AND METHODOLOGY

3.1. Description of the study area

The study was conducted in the Endamohoni woreda of southern zone of Tigray region located at at 12° 47' N and 39° 32' E. (see Figure 1). The woreda is located 621 km north of Addis Ababa and 121 km south of Mekelle, sit of the Tigray regional state

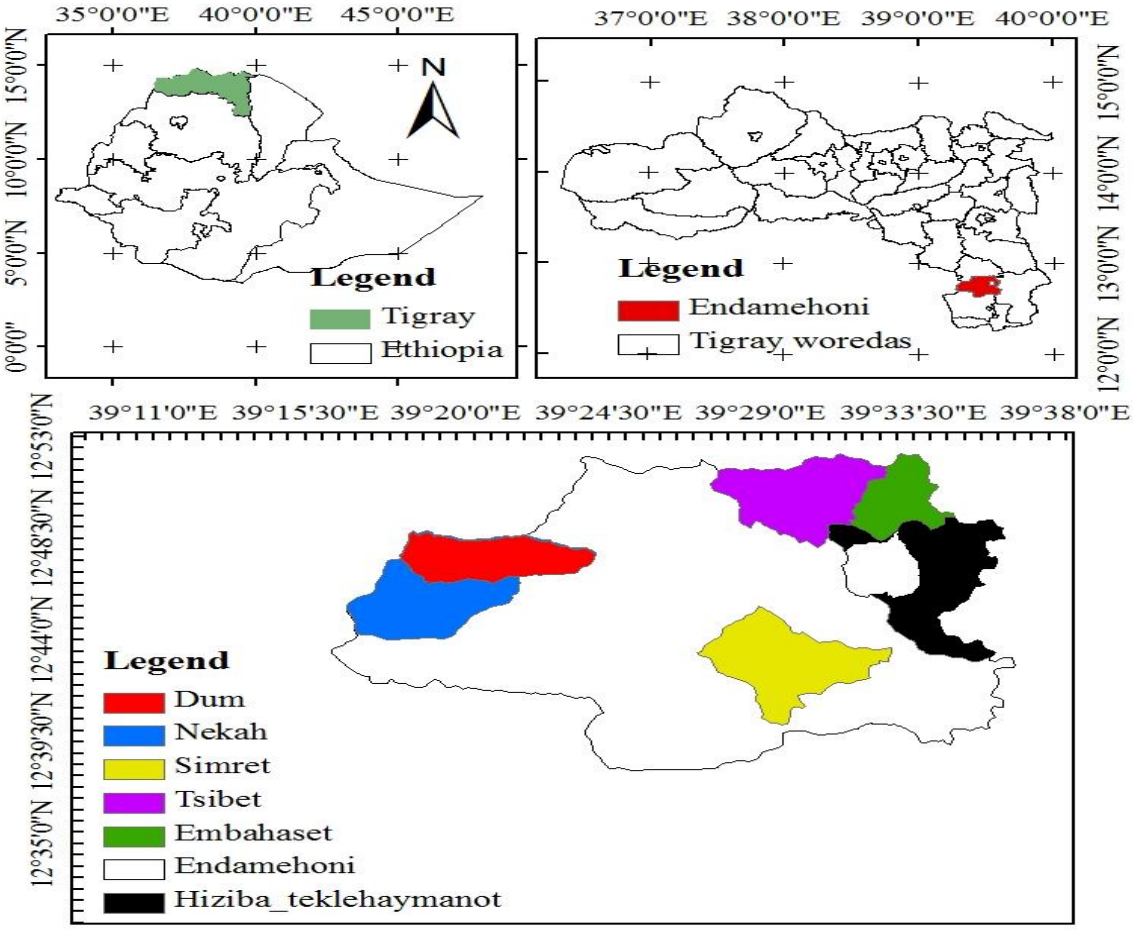

Figure 1: Map of study area

The agro-climatic condition of the area is characterized as kola, woyina dega and dega with average altitude of 2450m above sea level. The topography of the area can be classified as very steep 65%, steep 12%, gentle 15% and valley 8%. The mean annual temperature ranges from 9 ^{0}C to 32 ^{0}C (SZT, 2014).

The rainfall is bimodal that includes the Belg (short rain season) from mid- January to March, and the Kiremt (main rainy season)from mid-June to mid- September. The annual mean rainfall ranges from 650 ï 900 mm. The main crops grown in the Belg season are barley, wheat and peas. Similarly, barley, wheat, sorghum, maize, teff, peas, lentils and fababean are the

maincrops cultivated during the long rainy season. As cited in Abraha (2012) and Hailemichael (2013), wheat and barley are the main food crops while pulses are the main cash crops in the area.

The population of the district is estimated to be 93,521, (47201 males & 46320 females). The district has a total of 615-km^2 area of which the cultivated and grazing land accounts for 29.25% and 23.52% of the district, respectively (SZT, 2014).

According to SZT (2012) report the estimated cattle, sheep, goats, donkey, and chiecken population is 77921 heads, 71333, 64541, 29053 and 92,071, respectively. There exist 17,836 beehives. The major feed resources in the area are natural pasture, crop residues (wheat, barley and, teff straw, sorghum and maize stover), hay and cactus peals (SZT, 2014).

3.2. Household selection

The Woreda was purposively selected based on its contrasting agro-ecologies and potential of being the source of traditionally knowledgeable peoples who for generations have been associated with livestock rearing. Six kebeles were selected based on agroecology and livestock population size. Accordingly, Tsibet and Embahasti from highland agroecology Hizibateklehaymanot and Simret from midland while Nekah and Dum fromlowlandshave been included in the study (see Figure1).

3.3. Data collection

The study was conducted between December 2014 and July 2015. A rapid reconnaissance survey was made prior to the actual survey. This was helpful to have prelimanry information for the structured survey, through which the distribution and population of livestock, major husbandry practices and number of ethno-veternary practitioners were identified. The data were collected from primary and secondary sources. The primary source included questioner survey,

observation, interview and focus group discussion. Secondary sources comprised published and unpublished materials.

Key informants (indigenous knowledge practionars) were identified after preliminary discussion with households in each of the 6 kebeles. From the discussions in general information about livestock production practices in the area such as livestock feeding management, product handling, and production constraints were gathered. Data on indigenous knowledge on livestock husbandry practices were gathered by interviewing key informants of the community using a semi structured open-ended questionnaire. These respondents were mainly male elders above 50 years. From 25 to 30 elders per kebele were selected with a total of 175 respondents for the data collection through the survey questionnaire. Development agents (DAôs) from each kebeles were selected and were trained to support and collect the survey work. In the survey, households were asked to show their feeding method, product handling, breeding strategies, selection criteria for production and reproduction traits, medicinal plants and way of preparation. The group discussion comprised of nine informantsôtwo groups per kebele, each group comprisized twelve-discussion groups in total.Video recorders were used to ensure the reliability of the interviews. The leaf and flower specimens of medicinal plants were collected according to standard procedures and sent to the National Herbarium for species identification and verification. After completing the questionnaires for each kebele, an informal meeting was held with the key informants for triangulation.

3.4. Data analysis

The data was analyzed using statistical package for social science Inc (SPSS, 2007, version 16). Socioeconomic results were analyzed using descriptive statistics such as mean, standard error

of mean. To make comparisons among different groups one way ANOVA were employed. Differences were declared for significance at $P < 0.05$. The highest number of responses or respondents was given the a and the lowest number of the responses (respondents) the c of variables.

The other data being of qualitative type was analzed using non-parametric test- chisquare, the results were tabulated using percentage, also index, and rank is used for reporting purpose.

Indices were calculated to provide ranking for purpose of livestock rearing, livestock production constraints and milk selling differences among agroecologies as the follows:

Index = Ɛ $(R_n \times C_1 + R_{n-1} \times C_2 \ldots + R_1 \times C_n)$/Ɛ $(Rn \times C_1 + R_{n-1} \times C_2 + \ldots + R_1 \times C_n)$

R_n = the last rank (example if the last rank is 5^{th}, then Rn = 5, $R_{n-1} = 4$, $R_1 = 1$).

C_1 = the number of respondents ranked first

C_n = the number of respondents in the last rank, for all as (Endashaw et al., 2012).

4. RESULTS

4.1. Household characteristics of the studied area

The household characteristics of livestock owners in the study area are presented in Table 3. The mean family size of the three agroecologies was 6.5±0.24, 5.8±0.26, 6.6±0.34 in highland, midland and lowland, respectively.

Most of the respondents participating in livestock husbandry practice in all agroecologies were males. The mean age of respondents in the studied site was 60.6±1.23 in the highland, 58.8±0.86 in the midland and 57.93±1.01 in the lowland.

Regarding to educational level, the majority of the respondents 55% in the highland, 50% in the midland, and 74% in the lowland agroecologies were illiterates, whereas 30% in the highland, 18.33% in the midland and 21.82% in the lowland were able to read and write.

About 3.33%, of the respondents in the highland had junior and 1.66% above junior high school education. Similarly 6.66%, and 3.33%, of the respondents from midland had junior and above junior high school education, respectively. However, respondents from lowlands had no regular education. Relatively, educational level is better in midland agroecology compared to rest agroecologies.

Table 3 : Socio-economic characteristics of farm households in the studied areas

Variables	Agroecology		
	Highland	Midland	Lowland
	N (%)	N (%)	N (%)

Sex	Male	53 (88.3)	46 (76.7)	51 (92.7)
	Female	7 (11.7)	14 (23.3)	4 (7.3)
Age range	50_55	19 (31.7)	25 (41.7)	31 (56.4)
	56-65	18 (30)	16 (26.7)	9 (16.3)
	>65	23 (38.3)	19 (31.6)	15 (27.3)
Mean age (± SE)yr		60.65 ± 1.23	58.8 ± 0.86	57.93 ± 1.01
Mean family size (±SE)		6.5±0.24	5.8±0.26	6.6±0.34
Educational level		N=60 (%)	N=60 (%)	N=55 (%)
Illiterate		33 (55)	30 (50)	40(72.73)
Read and write		18 (30)	11 (18.33)	12(21.82
Elementary (1-4)		6 (10)	13 (21.66)	3(5.45)
Junior (5-8)		2 (3.33)	4 (6.66)	
Above junior		1 (1.66)	2 (3.33)	

The land holding and its use pattern in the different agroecologies are shown in Table 4. The land allocated for rain-fed crop production ranged from 0.67 (lowland) to 0.81 (midland), whereas that allocated for irrigated crop production ranged from 0.11 (lowland) to 0.19 (highland). The mean fallow landsize was 0.35 ha in the highland and 0.08 ha in the midland, but none in the lowland. The communal land was about four times higher in the lowland than the highland.

Table 4: Land holding and utilization pattern by study households in ha (Mean ±SE)

	Landaholding by Agro ecology

Land use pattern	Highland	Midland	Lowland
Rain feed crop production	0.8±0.04	0.81±0.04	0.67±0.06
Irrigated crop production	0.19±0.02[a]	0.15±0.02[ab]	0.11±0.02[b]
Fallow land	0.35±0.03[a]	0.08±0.02[b]	
Communal	0.10±0.01[b]	0.43±0.04[b]	1.97±0.18[a]
Other land (Rented in)	0.14 ± 0.02[a]	0.10 ±0.02[a]	

a, b, c means with the different superscripts across rows are significantly different at (P<0.05), SE= standard error Where a>b>c.

4.2. Livestock production practices of the study area

4.2.1. Livestock holding

Table 5 shows the number of livestock holding per household in the study area by agroecology. The composition of livestock holding varied considerably between agroecologies. Sheep and cattle were the dominant ruminants in the highland, while goat and cattle were mainly kept in the lowland. Crossbred cattle, improved chicken and horses were absent from the lowland households.

Table 5: Livestock holding per household in the study area

Livestock holding per household in the study area

	Highland	Midland	Lowland
Livestock Species	Mean± SE	Mean± SE	Mean± SE

Cattle (local)	5.68 ±0.28 [b]	3.52 ±0.22 [c]	9.11±0.55 [a]
Cattle (cross breed)	0.08±0.04 [b]	0.32±0.09 [a]	
Sheep	17.33±2.60 [a]	9.90±2.54 [b]	2.53±0.48 [c]
Goat	2.08±0.47 [c]	3.53±0.52 [b]	20.25±1.88 [a]
Donkey	1.65±0.15	1.27±0.14	1.22±0.14
Local chicken	4.87±0.31 [a]	5.60±0.50 [a]	3.70±0.65 [b]
Exotic chicken	2.88±0.85 [a]	4.50±0.69 [a]	
Honey bee (hive)	1.67±0.41	3.03±1.20	2.95±0.47

A, b, c means with the different superscripts across rows are significantly different at (P<0.05), SE= standard error Where a>b>c.

4.2.2. Purpose of livestock keeping in the study area

Table 6 presents the purpose of livestock keeping by smallholder farmers in the study area. Four major livestock functions, namely draft power, food of animal origin, cash income and social values were listed and prioritized by the respondents. According to the ranking index, draft power was the priority purpose in the highland and midland agroecology followed by animal product for foods and cash income.

However, in the lowland agroecology animal source foods (milk and meat) were ranked first followed by the social value and draft power of livestock .In addition to this, in the highland agroecology livestock served as source of organic manure for soil fertility, hide and skin used for various uses. Oxen were reared mainly for ploughing crop landsand they are often sold when there is feed scarcity and shortage of money for essential household expenditures towards the end of the crop cultivation period. Livestock products specially milk play a major role in daily home consumption as food item sauce (ñwetiò) and furthermore old parents consume milk in coffee.

The study also indicates that livestock in lowland areas serve an important function as a source of gifts/dowry/in marriage. In this community, there is norm that before asking somebodyôs girl for marriage, the boyôs family considers the number of livestock that the girlôs family possesses.

Similarly, when they select their leader, the community focuses on the livestock number that the candidate owned. Respondents explained that there is a saying in the district about the leader whom they want to elect ñIf he wins in his home he can win in his wayò. They assume that anyone who is model in his home by owning a number of livestock, he is model for the village and can lead well.

Respondents assumed that the one who has a good number of livestock in his home works without corruption, transparently, democratically and can serve the community equally as a person in charge. Respondents in the lowland traditionally believe that one who had a better livestock number in his home, if he does a any unfair decision, God will take his wealth.

Table 6: Purpose of livestock rearing in different study area

	Agro ecology					
	Highland		Midland		Lowland	
Purpose of keeping livestock	Index	Rank	Index	Rank	Index	Rank

Draft power	0.38	1st	0.36	1st	0.24	3rd
Consumption(meat,milk)	0.3	2nd	0.29	2nd	0.38	1st
For income/sale	0.2	3rd	0.25	3rd	0.08	4th
Gift or social value	0.12	4th	0.1	4th	0.3	2nd

Index = sum of (4×number of HHs ranked first +3 ×number of HHs ranked second +2×number of HHs ranked third+1× number of HHs ranked fourth) for particular objectives divided by sum of (4× number of HHs ranked first+3 × number of HHs ranked second +2 × number of HHs ranked third+1× number of HHs ranked fourth) for all objectives.

In the group, discussion key informants made it clear that the milk product (butter) is a main source of income besides serving as animal protein by providing regular liquid cash for purchasing home items. It is also a culture in the study area to give milk and milk products (butter) as gifts for neighbors in local ceremonies and holidays.

4.2.3. Livestock production constraints

The results in Table 7 indicate that feed shortage was the number one constraint for livestock production in all the three agroecologies. Land shortage was the second constraints inhighland and midland agroecologies. Livestock disease was ranked the third main constraint in the highland and midland, whereas it was ranked 2nd in the lowland.

Table 7: Livestock production constraints in the study area

	Agro ecology					
	Highland		Midland		Lowland	
Variables	Index	Rank	Index	Rank	Index	Rank

Feed shortage	0.31	1st	0.34	1st	0.28	1st
Land shortage	0.29	2nd	0.26	2nd		
Disease	0.20	3rd	0.20	3rd	0.24	2nd
Labor shortage	0.19	4th	0.15	4th	0.05	5th
Water shortage			0.03	5th	0.2	4th
Predator	0.01	5th	0.02	6th	0.23	3rd

4.2.4 Breeding and breed selection criteria in the study area

Results from the study indicated that in all the three agro-ecologies farmers predominantly used natural mating for breeding of animals (93.14%). Some respondents reported that traditionally they try to select breeding males based on pedigree histrory of the animals. Respondents are traditionally well awared of the negative impact of inbreeding. To control inbreeding, they castrate undeserible male animals, and also purchase and introduce male breeding animals from the market while separating males from the same line during heat period.

During group discussions, key informants in the highland indicated that communal grazing land is being converted in to cropland and households are forced to keep their livestock near the homestead.

Out of 175 farmers interviewed in the three agro-ecologies, 41.7% of the households in highland 38.3%, in the midland and 70% in the lowland kept their own breeding males. Where breeding males were not kept, farmers (30-48%) got the service from neighbours or from free mating on communal grazing lands. In contrast to above, 20% of midland respondents and (6.86% of total) got the servce from artificial inseminetion for cattles.

4.2.4.1. Phenotipic traits used for selection

The common system of livestock trait selection in the study areas are still the age-old phenotypic selection (Table 8). The major criteria for the selection of dairy cows and heifers in the three agro-ecologies were the presence of well-structured udder and long teat. According to the respondents, cows with long teat are easy to milk and reduce milk contamination by reducing spraying of milk in the milkersô hand. Respondents indicated that cows and heifers with, thin slender neck, big udder and good mammary line on cowôs belly denote high milk yields in cattle.

Other important selection criteria stated by the respondents in lowland agroecology were large open nostrils, hair whorl and its position and coat color. Cows with high hair whorls are believed to produce more milk yield, are fast growing and their calves are active than low hair whorl. Respondents have their own belief on position of hair whorl. It must be either on the middle of backbone or preferably near to the hump.

Respondents from highland and midland agro-ecologies consider soft, flexible and finely collapsed udder after milking, and long and thin tail with clean cut and plenty of hair at the end as selection criteria for dairy cows and heifers. In addition to this some key informants mentioned, that small size of horn is better to adapt the environment. Additionally, some key informants stated the nose of dairy cow should be black in color, which farmersô belive helps in grazing because black nose have strong skin than other one.

Table 8: Selection criteria of dairy cows and heifer, draft oxen and breeding bull in the study area

		Agreecologies		
		Highland	Midland	Lowland
	Selection Criteria	%	%	%
Dairy cows	Large udder and long teats	29.7	20.6	21.7

and	Two milk veins clearly visible in udder	5.4	4.9	26.1
Heifers	Soft, flexible and finely collapsed udder	23.5	26.1	7.3
	Long and thin tail with clean cut and plenty of hair at the end point	21.5	14.8	2.9
	Long, lean and smoothly curving neck in to shoulder with clean cut throat	2.3	17.9	2.4
	Medium body size and thin skin	13.6	13.3	
	Red color and big eyes	1.5	2.7	14.1
	Large open nostrish			14.5
	Hair whorl and its position	2.3		12.1
Draft oxen	Active and fast in moving	37.4	33.1	19.7
	Thin, long and unbroken tail	33.	30.3	21.0
	Long legs with strong muscle	1.9	8.6	43.3
	Medium body size easily can move	27.7		
Bulls	Muscular in body with long legs	35.4	31.4	27.2
	Red or brown in color	19.5	22.2	35.1
	Loud and repeatedly giving voices	3.8		19.5
	Large scrotum and long penis	32.3	34	9.2
	Hair whorl near to hump or at the center	8.9		8.7

Hence, animals are preferred based on the physical body size and structure, color and production traits like, udder and teats size and structure, tail and similar appendixes.

Table 9: Selection criteria of fattening cattele, sheep and goat, donkey and chcken

		Agreecologies		
		Highland	Midland	Lowland
	Selection Criteria	%	%	%
Fattening	White and well- arranged small teeth	23.7	2.1	4.3

Cattle	An elongated body with small age	33.0	42	35.2
	Broad neck & long legs wide area b/n two legs	27.2	37.8	30.3
	Thick and short tail	16.13	18.12	3.7
	Regular wear of hooves			26.3
Sheep and goats	Body size (conformation)	35.1	34.2	39.7
	Presence of wattle and large ear in goat	3.5	15.1	25.7
	Long , thin legs and broad ear in goat	28.7	32.9	5.2
	Wide tail in sheep and curve tail with a large amount of hair at the end in goat	32.1	11.3	6.6
	Red goat and red or brown sheep	0.6	6.6	22.8
Donkey	Thin and long legs with strong muscle	35.8	33.7	35.7
	Long and thin tail	31.5	32.5	7.1
	Slightly curved /bended back bone	23.6	14.8	
	Broad hoof	9.1	18.9	32.5
	Low sweating behavior			24.7
Chicken	Double comb	44.3	23.6	30.5
	Clean legs and eyes	21.4	43.3	35.1
	White /red color	17.6	33.1	7.8
	Structure of beak	16.8		26.6

4.2.5. Livestock culling stragtegies in different agro-ecologies of the study area

Culling of livestock is a common practice in the study area. The result in Table 10 indicates that the primary reasons for culling of livestock in the three agro-ecologies were poor body condition. (37.3, 25.7 and 24.1% in highland, midlandand lowland agro-ecologies, respectively) and the second cause was poor productive performance in highland and midland. In lowland agroecology, coat color of livestock was the second reason of culling. Animals with black and white colored are culled out.

Traditional farmers stated that black animals have no acceptance on the market, as well as completelywhite colored animals do not tolerated adverse environment. Respondents also stated that white colored animals were easily attacked by leech and by evil eye.

This study also indicated that respondents from lowland agro-ecology confirmed animal which have hair whorl near hipbone or which have exceptionally seven teeth culled directly. Because the farmers traditionallybelieved that animals which have hair whorl on hipbone decrease the age of the owner. In opposite to the above the animal that has hair whorl near to hump was believed to increase the life of the owner & kept for long period.

Table 10: Reasons of culling of animals in the study area

	Agroecologies		
Criteria	Highland (%)	Midland (%)	Lowland (%)
Poor body condition	37.3	25.7	24.1
Poor productive performance	21.8	21.5	11.4
Poor re productive performance	16.4	20.1	9.6
Old age	7.3	19.4	7.8
Color	12.7	7.6	22.9
Aggressiveness of animal	4.5	5.6	7.8
Animal with hair whorl near hip bone or with have 7 teeth			16.3

4.2.6. Traditional livestock castratition practices in three agro-ecologies

Respondents reported that castration was one of the most important livestock husbandry practice in the study area. Traditional healers do the practice of castration using locally available materials.

The objectives of castration in the study area were indicated in Figure 2. In the lowland agro-ecology, the main goals are to make the animal docile, for fattening purpose, to improve disease resistance, and to control breeding (selection mechanism) in their order of importance. To

control breeding, farmers castrate animals like calves with abnormal testicles, thin calves and black coat colored. Farmers castrated their goats in addition to gain body weight to reduce the smell of the goat meat.

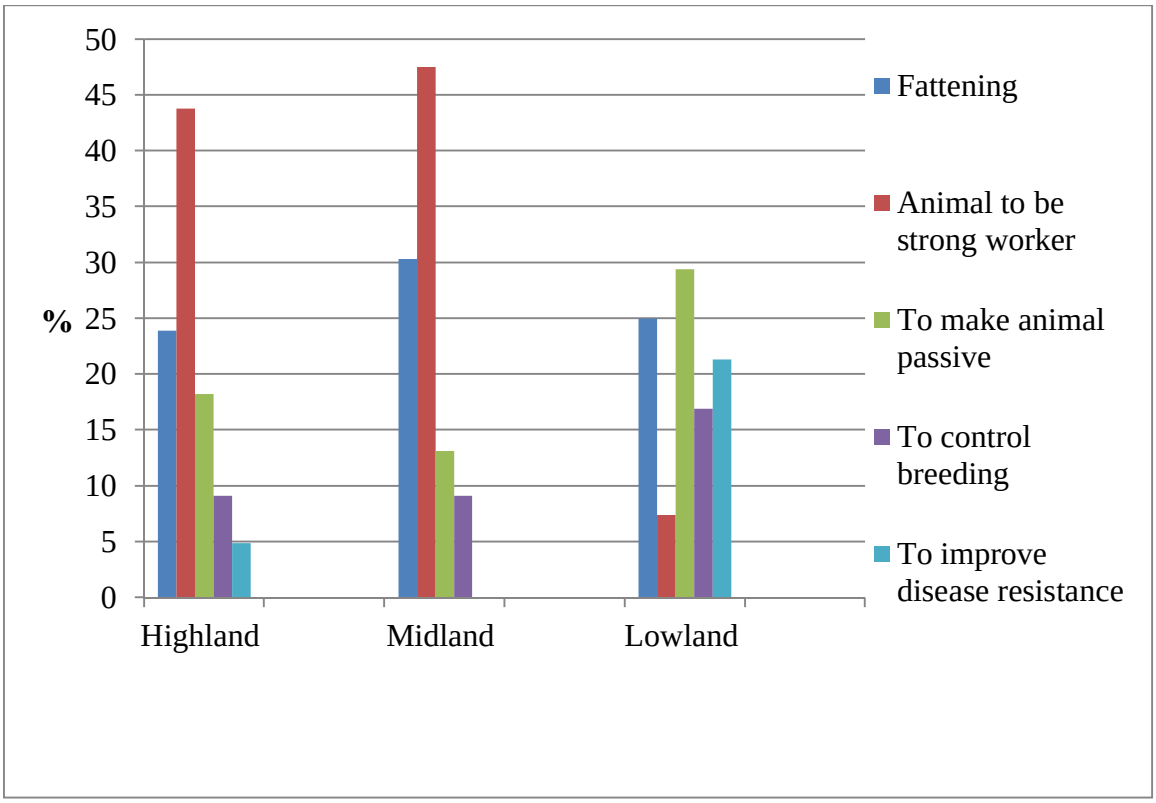

Figure 2: Purpose of livestock castration in the study area

4.3. Ethno veterinary practices

The woreda has only one veterinary clinic. Since the size of the woreda is large and has, many up and doun geographical feature, the veterinary service coverage is limited to city areas. Modern medicine is not accessible in the villages where the huge livestock resource is kept. Therefore, the most important way of treating livestock is use of traditional medicine. The respondents in the woreda identified 17 diseases, which are common in their locality, but

generally, they documented 38 types of animal aliments, which affect livestock production along with traditional treatment mechanisms.

As documented in Appendex 2, the most common disease reported were antrax, blackleg, foot and mouth disease, pnemounic pasteurellosis,foot rot, mastitis, external and internal parasites, tick, leech, and various injures. Key informants from the lowlands reported that to treat black leg they use crushesd *Solanum marginatum, and Justicia schimperiana* and administer through oral routes while others apply Phytolacca *dodecandra* through nasal route. Respondents also reported tick is a serious problem in the study area. To control ticks they used *Calpurnia aurea and Phytolacca dodecandra making* a concoction from leaves of both palnts they wash the whole body until the ticks died.

Therefore, traditional healers of the study area played significant role in the health care system of the animals in the community. They have been treating livestock of resource poor people who had no access of veterinary service or could not pay the cost for modern medications. Farmers have walked a long distance with their sick animals if they have to get veterinary service, which brings additional stress on the animals. In addition, respondents stated that there was deficit of medicine in clinics and some diseases have no treatment at all for example evil eye, hand of man and rabies. However, respondents believed that traditional healers have remedy and preventive approach for most of ailments. The results in Table 11 indicate that ethno veterinary practices are mainly transferred from elders to their children, and to some extent from neighbor.

Table 11: Ways of acquiring knowledge of ethno veterinary medicine in the study area

	Agroecologies		
Source of gaining	Highland	Midland	Lowland

ethno vet knowledge	N	(%)	N	(%)	N	(%)
From parents	50	83.3	45	75	51	92.7
From neighbors	7	11.7	10	16.7	3	5.5
Payment	2	3.3	4	6.7	1	1.8
Others (through migration)	1	1.7	1	1.6	-	-

In the present study, about sixty-five types of plant species (Appendix 1) have been identified as useful plants for ethno veterinary practices. Of the total identified medicinal plants, most of them (81.1%) were found to be growing in wild vegetation; where as a small number of plants are cultivated as home garden and near home farms.

The result of the study also confirmed that leaves are the most commonly used plant parts to make traditional medicine followed by roots. Uses of other plant parts are indicated in Figure 3. Respondents also stated that use of leaves help for sustainable harvesting of plants compared with using roots of medicinal plants.

The respondents also farther stated that the majority of the remedies are prepared from freshly collected plants in the form of concoction or other forms with the use of solvents or diluents. Water is the most common solvents used. Human saliva and urine as well as milk and butter are also reported as solvents or additives in the preparation of remedies.

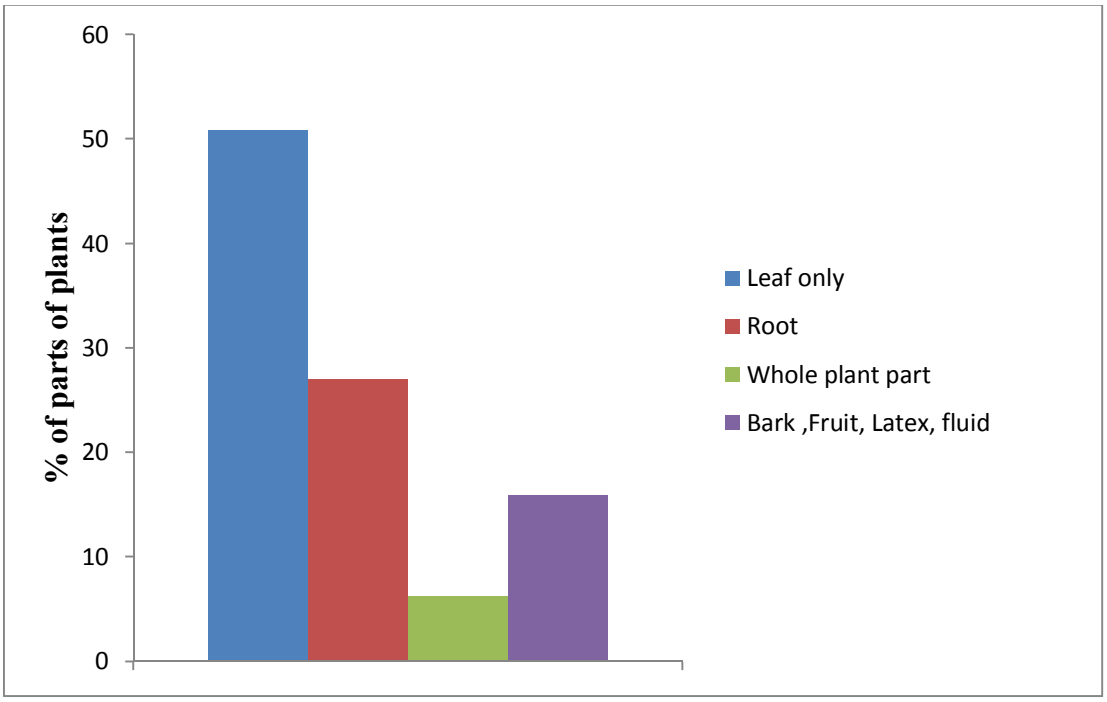

Figure 3: Parts of plants used for tadtional medcines

On the other hand, some medicinal plants are seasonal. These seasonal plants are harvested during peak period and stored in a confined area to utilize during disease outbreak time.

The medicines are prepared either from single plant alone, with combination of plants and by adding other substances like water, butter, honey, milk and local brewery residues Appendix2.

The dosage and proportion of mixtures prepared by the traditional practitioners usually remain secret. According to the healers, when preparing the dosage of concoction for livestock, mostly they focused on livestock species, body condition, physiological status, sex and age. Animals with good body condition and higher age are usually served with higher amount and concentrated concoction than younger and emaciated ones.

The healers reported that they are well aware of toxicity due to over dosage. So that they used locally available materials to measure the dosages before administering for animals like finger length for root, number, for leaf, teaspoon, for powder, coffee cup ,plastic highlands, and bottle

of beer for liquid in addition, minutes for fumigation and deeping. However, in case of any toxicity, healers provide a range of solutions for their animals like, powder of barley mixed with water, yogurt, butter, and skimmed milk. Powder of barley mixed with water (in solution form) offered for animals when treated with Echinops*longisetus (*Hangoro) and*Bersamaabyssinica (*Mirkuzzibee) and similarly milk is provided to animals which are treated with *Solanum marginatum (*Engule),*Cucumisficifolius (*Ramborambo*) and Rhus vulgaris* (Atami).

Traditional healers stated that animals in treatment require rest and quality feed to recover from their illness furthermore the recovery is tested by ability of feed intake, fecal smell, color and concentration, coughing condition, movement of animal, rumination and fever.

4.3.1. Mode of preparation, dosage and route of administration

The respondents reported that crushing and squeezing (45.3%), concoction and squeezing (28.1%) and direct use (10.9%) are the three main methods of preparation of medicine as indicated in Figure 4. Major forms of preparation of the remedy were in liquid forms of single plant or combination of various plants in form of concoction.

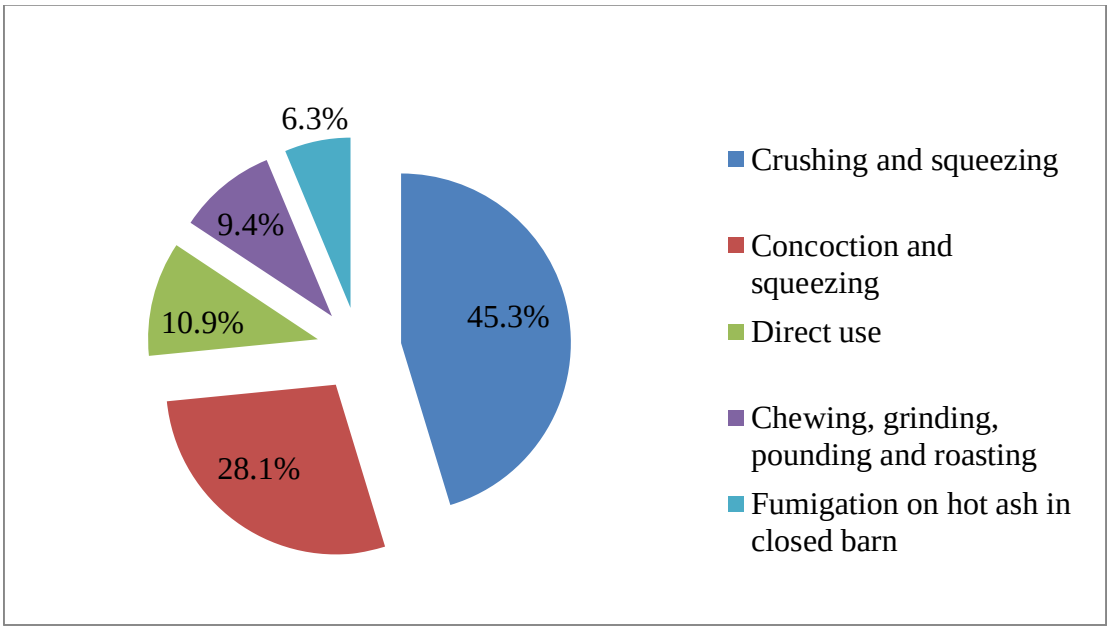

Figure 4: preparation methods of traditional medicines in the study area

The most common administration methods of traditional medicine in the study area is oral (47.1%) followed by dermal, nasal, anal and ocular as indicated in Figure 5.

The respondents in the study area also indicated that use of fresh materials directly harvested are more effective than stored,as it has no chance of deterioration through preservation.

Moreover, concoction made up of many plants has a higher effectiveness than that prepared from a single plant. The respondents reported that the majority of the preparations are made from assortment of plant species with water and different additive substances like honey, butter, salt, local brewery residues, barley powder and milk. These additive substances have functions to reduce poisons, improve flavor and as antidotes during adverse effects like diarrhea.

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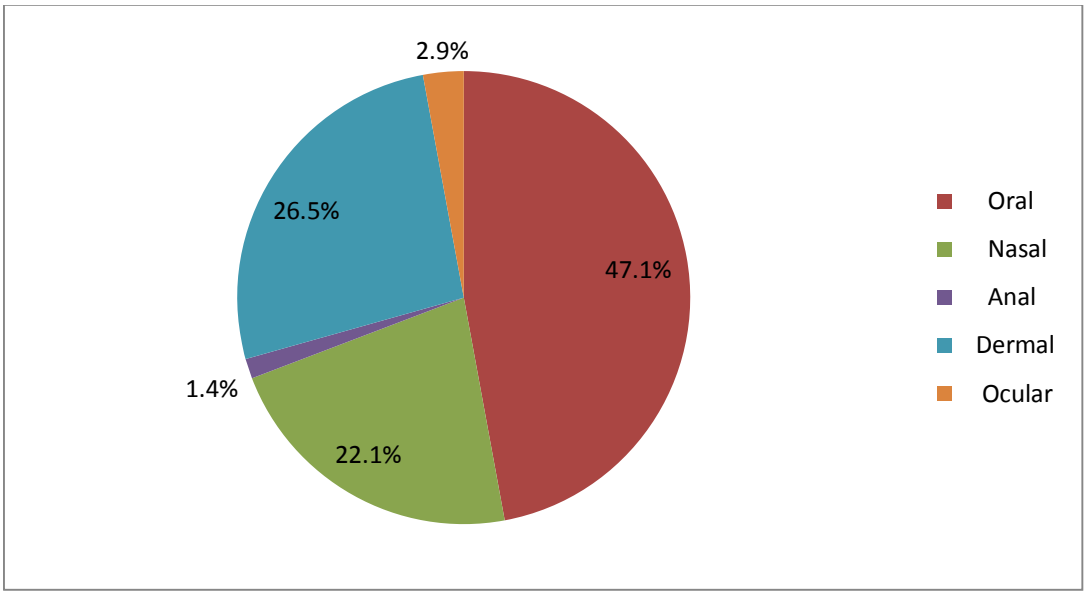

Figure 5: Route of administration of traditional medicines to livestock

4.3.2. Threats for conservation of medicinal plants

The causes of threats to medicinal plants were natural and human induced factors. However, as reported in this study most of the causes for the threats to medicinal plants and associated knowledge are the anthropogenic factors, which threaten the survival of medicinal plant species. These include cutting and burning of plants to create new agricultural lands, prolonged dry season, free grazing and firewood in the three agro ecologies of study site. However, the study also indicated significant difference in the threat to medicinal plant between the three agroecologies.

In the highland and midland agroecologies agricultural expansion is rated as the primary threat to medicinal plants whereas prolonged dry season is the most economical factor in lowland agroecology followed by over grazing by animals. Respondents from highland agroecology also reported, dominance of planting of eucalyptus and juniprusprosera caused some of the medicinal plants to disappear in the areas where they were abundant earlier.

Respondents of the three agroecologies also noted declining of practitioners have a negative impact on medicinal plant conservation especially on midland agroecology.

Table 12: Factors affecting the conservation of medicinal plants in the studied area

Factors affecting medicinal plants	Agroecologies					
	Highland		Midland		Lowland	
	%	Rank	%	Rank	%	Rank
Expansion of agriculture	36.4	1st	30.3	1st	15.8	4th
Prolonged dry season	24.5	2nd	22.9	2nd	36.6	1st
Planting of eucalyptus and juniprus prosera	16.4	3rd	NF	-	NF	-
Over grazing	7.3	5th	15.6	4th	24.4	2nd
Fire wood	11.8	4th	21.1	3rd	19.5	3rd
Declining of practionars	3.6	6th	10.1	5th	3.7	5th

NF = notdestractive factor to medicinal plants destruction

4.4. Livestock feed resources and feeding management

The types of livestock feed resources during dry and wet season in the study area are indicated in Table 13**.** The major feed resources in the studied areas during dry seasons included natural pasture, crop residue, hay, aftermath, improved grasses and legume trees, cactus, home wastes with ñ*atela*ò and supplemental concentrates. The importance of the different feed resources varied across the three agroecologies. Respondents from high land reported that natural pasture, hay, crop residues (barley, wheat, and pulse straw) and aftermath were the basic livestock feed in order of importance. In addition to this, some respondents used improved grasses (elephant

grass) and tree legume (tree lucerne) and home wastes for their animals.Supplementation of salt is common practice in this agroecology to increase intake of crop residues.

In the midland agroecology, respondents mentioned that natural pasture, crop residue (barley, wheat, teff, and pulse straw) with maize and sorghum Stover), cactus and aftermath in their order of significance. In the highland agroecology, next to natural pasture, farmersôutilized hay since there was large area enclosure (watershed) which was protected from animals and used as cut and carry system.

In the midland, next to natural pasture crop residue and cactus are important feed resources.In the same way, there was better utilization of home waste with atella and supplementation of concentrate from Maychew town. In the lowland agroecology, next to natural pasture, livestock relied on cactus, crop residue, hay and aftermath supplementation of salt is less.

Figure 6: use of improved grass and traditional crop residue storage practices in the highland agroecology

The major crops grown by farmers in the high altitude zone were barley, wheat, field pea, and potato. Teff, maize, wheat, millet, and haricot bean are the main crops grown in medium altitude

zone. Maize and sorghum were the dominant crops grown in the low altitude zone. Barley and wheat constituted the largest share of crop residue fed to livestock in highland agroecology in addition to pulse. Teff straw was the first feed resource in mixed farming areas of mid-altitude followed by maize Stover. Sorghum and maize Stover were main feed source with some additionalwheat, barley, teff, field pea, haricot bean straws in lowland. Similarly, source of livestock feed during wet season in the study sites vary in the three agroecologies.In the highland and midlands livestock largely rely on weeds and leaves from crop lands with limited homestead grazing. During the wet season, most of the land was covered with food crop. Highland respondents stated that during this season they use potato vein as feed resource while in the midlands they use cactus leaf to feed to livestock. Lowland stockers mostly relied on natural pasture followed by catus.

Figure 7: Alternative feed resource, thorny cactus treated by flame before shoping and storage in the lowland agro-ecology.

Table 13: Feed source for livestock during dry and wet season in the study areas

Feed resource	Dry season						Wet season					
	Highland		Midland		Lowland		Highland		Midland		Lowland	
	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank	(%)	Rank
Natural pasture	27.8	1st	26.2	1st	41.8	1st	23	2nd	28.5	2nd	83.1	1st
Crop residue	21.1	3rd	22.3	2nd	17.7	3rd	8.8	5th	19.4	3rd	1.4	4th
Hay	24.2	2nd	9.12	5th	7.84	4th	20	3rd	NS	NS	NS	NS
Aftermath	13.9	4th	12.3	4th	6.54	5th	NS	NS	NS	NS	NS	NS
Cactus	NS	NS	17.5	3rd	26.1	2nd	NS	NS	10.3	4th	9.9	2nd
Weeds and leaves	NS	NS	NS	NS	NS	NS	31	1st	35.8	1st	5.2	3rd
Potato veins	NS	NS	NS	NS	NS	NS	13	4th	NS	NS	NS	NS
IG and L trees	8.67	5th	2.84	7th	NS	NS	2. 1	6th	1.2	7th	NS	NS
HH wastes& Atela	4.22	6th	7.36	6th	NS	NS	1.6	7th	2.7	5th	NS	NS
Concentrates	NS	NS	2.37	8th	NS	NS	NS	NS	2.1	6th	NS	NS

NS= It is not feed source at a particular season, **IG** = improved grass L= legume tree

Feed scarcity was reported to be relatively higher during dry season as compared to the wet season in all agroecologies. However, in the highland agroecology the magnitude of feed scarcity during wet season was exceptionally high (45%) compared to the midland (30%), and the lowlands (5.45%). In this agroecology, according to the respondents, feed shortage was a serious problem from June to end of July, during which crop residue reservesare ususally finished and collecting grasses from mountains and hilly sidesbecomes difficult as it is highly slippery and inaccessible when it rains.

This was supported by focus group discussion.Key informants reported that during the wet season, the quantity of weeds and leaves collected from crop lands was not sufficient to fulfil their feed demands. Moreover, the price of straw in local market is highly expensive, as the reserve becomes depleted from most of the households and the supply is low.

In midland agroecology, also there was competition of straw with the construction sector.This is mainly attributed to the farmersô proximity to Maychew town. Weeds, and leaves, natural pasture, crop residue, home waste, cactus fruit residue, traditional brewery residue (*Atela*) and concentrate were other sources utilized. Farmers in the lowland agroecology have large communal grazing land holding in contrast to the other sites, and livestock mainly rely on grazing on natural pasture and cactus.

In lowland agroecology, feeds shortage during wet season was not critical as long as the rain distribution is normal. On the other hand, during the dry season, feed shortage is more common in the lowlands (91%) than the rest, as the availability of natural pasture goes down with the dryness of the soil.

Table 14 shows the indigenous knowledge of farmers to overcoming loss of livestock due to feed shortage in the woreda. In the highland agroecology, purchasing of straw was the main option during the time of feed shortage. Selling of livestock is another measure that the farmers take to cope with the feed shortage. In the midland agroecology, also selling of unproductive livestock was the alternative to purchase of crop residue for prolific livestock species. However, in the lowland agroecology transhumance *(urna*) and sending of livestock to relatives were the mostcommon choice to reduce the impact of feed shortage on livestock.

Table 14: Indigenous knowledge of farmer to overcome feed shortage

Variables	Agro ecology		
	Highland	Midland	Lowland
	%	%	%
Purchasing feed/straw	58.1	42.7	13.6
Destocking /selling animal	32.4	57.3	10.2
Sending to relatives	6.8		15.3
Movement*(urna)*	2.7		61

Results from present study also indicate (Table 15**)** that respondents in the different agroecologies practice a range of treatment mechanism of crop residues to improve feed intake and palatability. Highland and midland agroecologies mainly focus on mixingof crop residues with local brewery (*Atela*), household waste and salts. On the otherhand, lowland agro-ecology respondents stated that to improve intake of crop residue they practice chopping or re-thresh the crop residue.

Table 15: Crop residue treatment practice in the study area

	Agroecologies		
	Highland	Midland	Lowland
Treatment methods	%	%	%
Adding salt only	26	14.8	6.4
Chopping or re-threshing of crop residue	18	27.1	88.74
Mixing of fed with *Atela* , HH waste & salts	55	45.6	5.25
Urea treatment	-	12.6	-

Figure 8: Mixing crop residue with *Atela*, HH waste and salt at midland

4.5. Water resources for livestock in the study area

The result in Table 16 indicates that farmers used diverse water resources for their livestock in the three agroecologies. Highlands (Tsibet Mountains) mostly used spring (54.9%), dugwell (32.3%) and river (12.8%) water. Farmers who live in the midland frequently use river water (38.8%), dug well (25.4%), tape water (16.4%), stream (10.4%) and well water (9%) for their

livestock. While farmers in lowland agroecologies widely relied on well water (56.9%), river (29.3%) and spring water (13.8%) for their livestock.

Watering frequency of livestock differs from season to season as well as from agroecology to agroecology (Table 16). During dry seasons, there was a scarcity of drinking water for livestock in the low land. Generally, livestock accessed drinking water more frequently during the dry season than the wet season. This might be due to cold weather condition and higher moisture content of the green feed during wet season that may reduce the demand of water in highlands. However, in lowlands the accessibility was the main trouble.

Table 16: Source of water and frequency of watering

Water source	Agroecology		
	Highland	Midland	Lowland
	%	%	%
River	12.8	38.8	29.3
Stream	54.9	10.4	13.8
Dug well	32.3	25.4	
Tap water		16.4	
Well		9	56.9
Watering frequency			
Dry season	%	%	%
Twice a day	23.3	40	
Once a day	76.6	58.3	47.3
Every second day		1.7	45.5
Every third day			7.2
Wet season			
Twice a day	5	6.7	16.3
Once a day	60	71.7	78.2
Every second day	35	21.6	5.5

Lowland farmers mentioned traditional mechanisms to minimize the effects of water shortage on livestock as indicated bellow in Table17).

Table 17: Indigenous practice to reduce water stress for livestock

Traditional mechanisms	Agroecology		
	Highland	Midland	Lowland
	%	%	%
Feeding cactus	NW	30	54.54
Reducing animal movement and keeping them in shed		6.7	27.3
Burrowing well in cooperation			18.2

NW= No water shortage

4.6. Housing of livestock in the study area

Respondents in the studied area used different types of shelters for their livestock like Corral/fences with plastic or grass cover, house made up of stone/wood with wood, leaves and soil cover (*Hidmo*), with the family house together and houses with corrugated iron sheet cover as indicated in Table 18.

Feeding and watering facilities are among the basic facilities required in livestock shelter. However, only 3 % of the livestock owners in the midland area had both feeding and watering troughs, while about 33.3 and 12% of the respondents in highland and midland,respectively, had locally made feeding troughs in the shelter. Moreover, in the highland agroecology, with help of African rising project initiative, about 23.3% of the farmers have well-designed feeding troughs for cattle and feed storage shed for straws in Tsibet and Embahasti kebele.

Figure 9: improvrd feeding trough and feedstorage made by African rising in highland

Table 18: Livestock species house type in different agroecologies of the study

	Agroecologies		
	Highlands	Midland	Lowland
Livestock house/shelter type	%	%	%
Cattle housing			
Corral/fences	51.7	40	63.6
Corrugated iron sheet cover	6.7	18.3	
Hidmo	21.7	25	7.2
With family house together	20	16.7	29.1
Sheep and Goat housing			
Corrugated iron sheet cover	16.7	26.7	
Hidmo	56.7	60	52.7
With family house together	26.7	13.3	47.3
Equine housing			
Corral/fences	6.7	2.3	12.7
Corrugated iron sheet cover	8.3	17.6	
Hidmo	85	80	87.3
Chicken housing			
Separated from residence	23.3	43.3	12.7
With family residence	76.7	56.7	87.3

Although in midland agroecology were better than others were, the housing condition in many of the respondents were damp, dirty and generally unhygienic.

4.7. Milking procedures and milk handling practices

This study indicated that respondents mainly focus on cow milk in highland and midland while, cow milk followed by goat milk in low lands. Except in lowland agroecologies, cows were milked twice a day by exercising suckling before milking (Table: 19**)**. Besides, farmers practice milking of cows with die calves (95%, 90% and 81.8%) in highland, midland and lowland respectively. Respondnts reported cows reject milking in the absence of their calves; however, respondents milk their cow by means of creating artificial dolls (*Hubihub*) as indicated below.

Figure 10: Arteficial dolly and milkingutensil (carfo) made by midland tradtional farmers

Respondents from lowland reported that in case cows refused their calves, (*mifinfan*) farmers traditionally used diverse kinds of mechanism to alter the behavior of the cow like using of herbals. Farmers apply leaves of *Urticasimensis*on (*am- ae*) in vulva of the cow and then the fluids from vulva wiping on body of the calves. Respondents reported that when vulva of the cow contact with leaves of am- *ae*, cow irritated and accept her calf. Creating of strong sound

suddenly in night also mentioned to change the behavior of the cow. The results indicated that about 97, 100 and 95% of farmers in the highland, midland and lowland, respectively, reported to washing their hands and milk utensils before milking their cows. However, practice of washing udder and using towel was insignificantin the highland (4%) and in the midland (17%) while not reported in lowlands. In the focus group discussion, key informants reported that suckling of calves serve as cleaning of udder. Farmers believe that washing of udder could cause drying and irritation on udder of cows, and leads to disease of teat in cows, and reduce the amount of milk. About 98%, in the highland, 77% in the midland and 93% in the lowland respondentsin, dip their fingers in the milking utensils(at the time of milking) in order to avoid pain on teats at the time of milking.

Table 19: Tradtiona milking procedures, milking frequency and milking practice of cow

	Agroecologies		
	Highland	Midland	Lowland
	N=60	N=60	N=55
Milking procedure	%	%	%
Wash hand and milking vessels before milking	96.7	100	95
Use towel milking animals	3	15	
Wash udder during milking	5	16.67	
Dipping finger in the milking utensil to moist teat	98	76.67	93
Wash hand after milking	62	87	40
Wash milking utensil with hot water (%)	93	100	82
Milking frequency	%	%	%
Twice a day	100	100	91
Once a day			9
Milking practice of cow with died calves (%)	95	90	83.6

Traditional milking utensils used in study sites were ñ*Carfo*ò made up of wood (Figure 10) in highland and midland Gourd (ñ*Beshay*)ò also in the low land agroecological zones.

These utensils are difficult to clean and sanitize with small size in the entry and wide in body. However, respondents from three agroecologies explained that these utensils are suitable for milking with creating less sound during milking comparing with plastic utensiles. Respondents reported that plastic utensils decrease the comfort of dairy cows by creating strong sound due to that shrieked the udder of the cow and reduce milk amount and lactation length. Most of the respondents used clay pot (kuraee) for storage of milk until the desired volume is collected for processing (butter making). Respondents explained that Clay pot gives good aroma of milk by keeping from rapid change of temperature as compared to plastic and metal utensil as well as facilitating fermentation.

Table 20: Milking and milk storage practice in the study area

	Agroecologies		
	Highland	Midland	Lowland
Milking utensil used	%	%	%
Milking vessel made up of wood (Carfo)	85	33.3	9.1
Plastic jar	15	66.7	
Gourd (Beshay)			90.9
Storing Utensil	%	%	%
clay pot (ñ*kuraee"*)	95	60	94.5
Plastic containers	5	40	5.5

The respondents identified few specific shrubs used to clean the milk and milk product handlingutensils. Some of them are (Haregresha) *Zehneriascarba*, *(*Tsifirir*) Sidaschimperiana,*

*(*Kiliawe)*Euclearacemosaand(Hahot) Rumexnervous)*, *RamboRambo (Cucumisprophertarum) Grbiya* preference of these shrubs are different in the three agroecologies (Table 21**).**

Table 21: Plants used to clean milking and milk product-handling utensiles

Scientific name	Local name	Agroecologies		
		Highland	Midland	Lowland
		%	%	%
Achyranthes aspera	Mechalo	2.0	9.2	-
Haypoests forskaolii	Grbi'ya	17.5	12	14.3
Cucumis prophertarum	Rambo rambo	-	13	13
Olea europaea(cuspidate)	Awulie	18.0	8	5.
Rumex nervosus	Heho't/imbach'o	-	9.8	12.7
Sida schimperiana	Tsifrir	15.2	48.5	-
Zehneria scabra sonder	Hareg rasha	47.0	-	-
Euclea racemosa	Kili awee	-	-	54.8

Respondents in the studied area also practice smoking of milking and milk handling utensils regularly with specific plants (Table 22). The plants identified and used for smoking purpose are (Hasiti) Erica arborea (Awliee) Olea*europaea*, (Tahises) *Dodonea angustifolia* (Chiliaen) *Cadiapurpurea* and (Seraw) *Acacia etbaica.* Smoking was also reported to give a good flavor to the product and disinfect the vessels, thereby reducing the microbial load and therefore extending the shelf life of the product.

Table 22: Plants used to smoke milking, milk storing and milk processing Utensils

	Agroecologies		
Local and scientific name of pants	Highland	Midland	Lowland

	%	%	%
Hasiti (Erica arborea)	53.6	11.2	_
Awliee (Olea europaea)	20.1	12.9	3.3
Tahises (Dodonea angustifolia)	13.7	46.2	17.1
Chiliaen (Cadia purpurea)	4.1	23.3	41.1
Seraw (Acacia etbaica)	1.1	_	21.3
Gribya (Asystasia gangetica L)	5	6	7.6
Hambohambo (Cassia arereh	2		9.4

Respondents from highland explained that smoking milk processing (churning) utnsileôs by (Hasiti) *Erica arborea*) make easy to fat collection, increases the amount, and improve aroma and taste of milk as well as shelf life of milk. The result also shows respondents add root of *Urticasimensis (am-ae)* to facilitate churning process. Respondents used *Cucumisprophertarum* (*ramboramboô*) to speed up fermentation and improve the quality of yoghurt. *Zehneriascabra (hargeresha)* also acts as a disinfectant and cleaning plants.

Olea europaea served both to cleaning and to smoking milk vessels. Respondents from the midland area stated thatsmoking milk processing utensil with *Cadiapurpurea (Chili-aen)* changes the color of butter from gold to reddish color and it is attractive and increase the price of butter in the market when compared with other butter. However, the treatment does not have effect on the quantity of butter produced. Respondents from the lowland agroecology also stated that *Cadiapurpureaan* important tasting and disinfecting agent. During focus group discussions, it was reported that the skill of a women is measured by her abilities to handle milk and milk products properly.

4.7.1. Handling, processing and use pattern of dairy products in the study area

In three-agroecologies, women are involved in processing of dairy products and in highland, they churn milk once a week for extraction of butter and respondents from midlands indicated that, they churn milk twice a week. Although respondent from lowland reported that, they churn milk every second day based on amount of milk collected.

In the study areas, the reason of milk processing is almost similar with some difference in midland agroecology. This is due to cultural restriction, to get income from sell of butter, to get diverse products (fermented milk, butter, skimmed milk, whey, butter oil and dedicated milk (ñ*Hazo"*) traditionally prepared food) and to increase shelf life of dairy products. In the three agroecologies, raw milk processing is a cultural practice since the dairy products consumption has classified. Highland agroecologies, women and adult females are culturally restricted from using of fresh milk, fermented milk and skimmed milk, thus they were limited only using of whey and butter.

In highland respondents (40%) stated that fresh milk and fermented milk, was not recommended to drunk for the reason of butter preference and cultural practice.

Incase fresh milk and fermented milk were allowed for husband and adult males. However, in case of butter, priority is given for women than husband and adult males for smearing of hair. This is very common in all agroecologies of the study site with special attitude of ñRaya cultureò which obligated women and adult females to smear their hair always with butter. In Rayaculture, womenôs and adalt femels practice traditional mokebath (ñ*Maetena"*) with utilization of butter Figure 11.

Figure 11: Womenôs practice of using butter ointment and tradtional smoke bath (left to right)
Source: Field visit photo and Endamohoni Bureau of Tourism, (left to right).

The result also indicated that in midland agroecology, except old parents, majority of family members consume fresh milk and fermented milk. Priority is given to husband and adult males followed by children. While in lowland agro ecology, similar to highland agroecology women and adult females restricted from consuming of fresh milk and fermented milk but they consume skimmed milk, whey and butter too. In this agroecolgy contrary to the highland agroecology, husband and adult males did not consume skimmed milk, as they believe that it is ñdead milkò. In all the three-agroecologies old parents prefere to consume whey or boiled skimmed milk rather than other milk products. Because culturally they believe that old, parents cannot digest fresh milk and fermented milk products (*irgo*).

During focus group discussion key informants supported those believes that the digestive system of old people could be affected easily so every feed given to them should be cooked (skimmed milk) unless, the health of old parent would be influenced.

Table 23: Utilization of dairy products in the three agroecologies

		Agroecologies					
		Highland		Midland		Lowland	
Milk types	Consumers	N=60	%	N=60	%	N=55	%
Fresh milk	Not allowed to drink	24	40				
	Husband and adult boys	36	60	50	46.3	51	53.7
	Wife and adult girls	-		9	8.3	-	-
	Children	-		40	37.04	44	46.3
	Whole family	-		9	8.3	-	-
Yogurt	It is not allowed to drink	24	40				
	Husband and adult boys	36	60	39	46.4	55	84.6
	Wife and adult girls	-	-	9	10.7	-	-
	Children	-	-	26	31.0	10	15.4
	Whole family	-	-	10	11.9	-	-
Skimmed milk	Husband and adult boys	45	42.9	1	1.5	-	
	Wife and adult girls	-	-	8	11.6	53	49.1
	Children	55	52.4	10	14.4	51	47.2

	Old parents	5	4.7	7	10.2	4	3.7
	Whole family	-	-	43	62.3	-	-
Butter	Husband and adult boys	5	5.8	-	-	7	12.73
	Wife and adult girls	32	37.2	23	37.1	20	36.36
	Children	18	20.9	20	3.2	13	23.6
	Old parents	3	3.5	7	11.3	5	9.1
	Whole family	28	32.6	30	48.4	10	18.2
Whey	Wife and adult girls	34	32.4	29	30.5	45	40.9
	Children	11	10.5	6	6.3	28	25.5
	Old parents	57	54.3	34	35.8	35	31.8
	Whole family	3	2.9	26	27.4	2	1.8

4.7.2 Traditional preparation of Hazo and Sihum in study area

Hazo is dedicated buttermilk prepared with spices and powder of roasted barely to extend shelflife and to provide special aroma and flavour for special occasions like religious and socio-cultural festivals. The composition also varies according to household wealth and experience. In holidays, most of dairy owners provide hazo gifts to their neighbours. There were different plant species reported for fermented buttermilk (ôhazoô) making in the study areas like, Red onion (Keyhshinkurti), Garlic (Tsaedashinkurti) green pepper (Qaria), herb of grace (Chena adam), safflower (Suf), roasted barley (Tihini Beso) and fenugreek (Aba'eke).

Similarly, butter oil (ôSihumô) is prepared from cows or goatsômilk was a special ingredient of holiday dish in majority of the traditional farmers in the three agroecologies. Butter oil is used to enrich the taste and nutritional quality of various foods either in cooking or as a spread on the finished food. Besides to its nutritional value, its ease of storage make butter oil more preferred asset as it could be stored for about a year shelf life with minimum spoilage. Its low moisture content and the various spices added served as preservative and provided attractive aroma and flavour. These spice included Cardamom (Korerima), Onion (Keyhshinkurti), Garlic (Tsaedashinkurti), Turmeric (Erdi) and Fenugreek (Aba'eke).

4.7.3. Marketing of milk and milk products in the study area

As observed during the current study, the sale of fresh whole milk was a restricted practice in highland and lowland agroecologies Table 23. Cultural restrictions (taboos) and butter preference were the primary reasons in the highland and in the lowland, whereas low milk production and butter preference was the main marketing problem in midland agroecology.

On the other hand, respondents stated that they sold butter regularly to buy agricultural materials food items and washing detergents.

Table 24: Milk selling difference of farmers across the three agroecologies

Do you sell milk	Highland	Midland	Lowland			
yes		31				
No	60	29	55			
Reasons why not sell milk	Highland		Midland		Lowland	
	Index	Rank	Index	Rank	Index	Rank
Cultural restriction	0.38	1st	0.28	3rd	0.39	1st
Butter preference	0.32	2nd	0.3	2nd	0.33	2nd
Lack of market	0.11	4th	-	-	0.19	3rd
Low milk production	0.19	3rd	0.42	1st	0.09	4th

5. DISCUSSION

5.1. Socio economic characteristics of the households

The results presentd in Table 3 indicated that males are mainly participating on livestock husbandry practice. Females have low participation in indigenous livestock husbandry practice compared to males, female focus on home activities, like food preparation, fetching of water and care of babies. The results observed in this study are in agreement with observations of Yirga et al., (2012; Yaried et al., 2014; Abraha, 2015) from different part of Ethiopia who reported that females are focus in door farming activities. The average age of the respondents, also indicate that the active labor forces are not participating in livestock production and husbandry practice. The present finding is in agreement with the report of Yirga, et al. (2012), and Banerjee et al. (2014) who stated that the younger generations were not interested to continue the traditional agricultural practice.

The study indicated that level of literacy across the three agroecologies differed, being better in the midland compared to highland and lowland agroecologies. This may be due to accessibility of the agroecology to the zonal town of Maychew and educational facilities better in Maychew area. The number of average illiterates observed in this study (59.24%) was higher than that reported for Bure woreda (39.3%) of Northwest Amhara (Fisseha *et al*. 2010a). However, this is lower than that reported for North West Ethiopia (82.1%) Halima, (2007) while it is closely, agrees with reported of Hailemichael (2013) 68.57% of illiteracy from the southern zone of Tigray.

The mean family size of the study area was generally higher than the national average of 4.6 persons (CSA, 2011). Asaminew and Eyassu, (2009), reported higher average family size of 7.7 person per household from northern Ethiopia. Our finding agrees with the Tigray regional state

report of livelihoods in the year 2007, which states that the mean middle wealth (income) household size in southern part of Tigray was 6-7 people per household.

5.2. Livestock production

Respondents in three-agroecologies reared different types of livestock species (cattle, sheep, goat, equines and chickens). This is may be to use variesof feed resourcr and reduce risk of animals drop. In the highland and midland agroecologies sheep and cattle were given priority while in the lowland agroecology goats and cattle were the dominant ones. This is similar with result of Rota and Speradini, (2009) reported that farmer own diversified livestock species reduce risk of livestock loses. Except, the mean number of donkey and honeybee colonies, the livestock holding in the present study area were significantly different across the agoecologies. The mean numbers of sheep in highlands are higher than lowlands owing to the suitability of the environment for sheep rearing. This observation agrees with Fsahatsion et al. (2013) who noted that the sheep number is high in highland than lowland.

Possessing large number of animal is considered as security. The number of animals owned per household is indicative of the ownersô social status. Endashaw et al, (2012) also noted that keeping large number of cattle is believed to contrubting assest accumulations, as livestock are banks on hoof. Respondents from the three agroecologies reported there is an increase in the number of sheep and goats over the years. This may be due to their ability to graze and browse easily in very sloppy and unproductive areas where as cattle could not utilize. In addition, small ruminants require small initial investments to begin herding. These findings are in line with those of Sahana et al (2004) and Fikrete (2008) who reported that sheep and goat have the ability of using diverse feed resources, capacity of adaptation to environment and low risk of diseases.

During focus group discussion, key informants further explained that sheep and goats have advantages over cattle because of their short reproductive cycle (more prolific, less gestation interval), small farm area requirement per head, flexible short-term investment and easy marketability compared to cattle. Helen et al. (2013) stated that small ruminants have a unique niche in smallholder agriculture due to the fact that they require small investments; have shorter production cycles, faster growth rates and greater environmental adaptability as compared to cattle.

5.3. Purpose of livestock keeping

Large number of animals owned by respondents in the study areas is believed to provide guaranty for draft power, family consumption (milk and meat), income as well as fulfilling diverse social functions in the three agroecologies. Asaminew and Eyassu, 2009; FAO, 2009, Tadesse, et al. 2014, Hailemichael, 2013) reported from different part of Ethiopia, livestock were reared for draft power, sources of food (animal protein), cash income and prestige.

The current study also pertain that in the highland and midland agroecologies respondents reared cattle mainly for agriculture purpose. The result of present study is in agreement with the observations of Solomon (2004) and Asaminew (2007) who reported that oxen were reared primarily for agricultural purpose and sold when too old to work. Seid and Berhan (2014) reported that major purpose of cattle rearing were draught power, income source, milk and milk products, social functions as a gift and organic fertilizer in their respective importance.

The results from lowland agroecology also indicated that the main functions of livestock keeping are for family consumption (milk and milk, products, meat and egg), social values/ gifts, draft power and cash income. The finding indicates milk play major role in daily home

consumption as food item (sauce) and furthermore old parents, drink milk in coffee. The results are in line with Abraha, (2012) from southern part of Tigray who noted milk socially ties the community. Banerjee et al, (2014) also reported that livestock products, milk, meat serve as source of animal protein for the nursing mothers, infants, and people with disabilities from southern part of Ethiopia. Solomon, (2010) from arsi zone reported that farmers reared livestock for home consumption of milk and milk product. Whereas sintayehu et al. (2008) reported in rural area of central and western part of Ethiopia farmers cattle were kept to grow male calves that assist the crop production by providing draft power.

Endashaw et al. (2012) indicated that Bodi and Mursi pastoralists reared their cattle primarily for milk production and the second most important purpose for keeping these cattle in Mursi communities was blood as food. Hiwet (2013) from southern part of Ethiopia as well reported the main objectives of livestock keeping were milk and milk products, income source, pride and insurance. Kool and Steenbergen (2014) also reported farmers in lowland focus on selecting of bulls based on the milk productivity of its mother and grandmother.

Endashaw et al, (2012) reported that Bodi community keep livestock mainly for milk production followed by dowry payment, thus a person marrying a wife has to pay large number (between 38 and 40 heads) of cattle for the brideôs family. Different authors reported the importance of butter as a source of immediate cash income for smallholder households (Abraha, 2012; Hiwet, 2013). In the present analysis, butter was also found to be serving the same purpose.

During field observation it was seen that in low land (Nek segel local market), marketing of butter (not ghee) using containers like gourd and natural large leaves, as main source of cash to buy salt, cleaning detergents and kerosene for home use. This is in agreement with the study

conducted by Seid, Berhan (2014) from southern part of Ethiopia stated that sale of animals, and animal products were an important source of household cash income.

5.4. Livestock Production Constraints

In the present study, feed shortage was mentioned as one of the major constraints for livestock production in the three agroecologies. Various scholars in Ethiopian also showed feed shorage as pressing issue in the livestock sector (Adugna and Aster, 2007; Abdi, et al., 2013; Dawit et al., 2013; Hiwet, 2013). The challenge of feed shortage is also mentioned as important problem in other Afrcian. For example, Bakyusa et al., (2012) reported that feed shortage was the primary constraint to livestock improvement programs by smallholders in Uganda.

The study also confirmed that in highland and midland agroecologies the second limiting factor toward livestock development was shortage of space. This is in concurrence with Gebremeskel, (2013) who reported that changes in the farming systems, expantion of crop farm has resulted a negative impact on communal gazing lands and forced the livestock to depend mainly on crop residues and crop aftermath, which does not fullfil the nutritional requirements for optimum production. Abdi, et al., 2013; Dawit et al., 2013 and Hiwet, (2013) reported that water was the second important factor affecting livestock production in the lowland areas, which agrees well with the present study.

The present study results in Table 7 also showed in lowland agroecology, disease outbreak was the the second factor which affects the livestock production and productivity.

This is closely similar with the report of Asaminew and Eyassu, 2009; Solomon, 2010, Abdi et al., 2013 who noted that disease was one of the factor that reduce the livestock improvement.

5.5. Breeding and breed selection criteria

Present study showed that natural mating mating of animals on communal grazing lands is the common breeding practice. This is in agreement with the result of Shiferaw (2006) who indicated that in Fental district of Oromia region, 92.7% respondents are practiced pure breeding system for Kereyu cattle and Agere, (2008) for Horro cattle from the Horro Gudru area as well as Hiwet, (2013) from southern part of Ethiopia.

5.5.1. Livestock trait selection criteria

In the study area, animals are selected based on the physical body structure, color and production traits. These phenotypic selection methods observed in the study have similarity with other reports (FAO, 2003; Kunene & Fossey, 2006; Ouma et al., 2006); Shiferaw, 2006; Endashaw et al. 2012; Shigdaf, 2011; and Hiwet, 2013) from different parts of Africa. Livestock are selected by phenotypic and oral keeping of pedigree. The result in the current study indicated that in selection of dairy animal udder size and its stracture as well as teat, lengeth takes upper hand**.**

Kunene and Fossey, (2006) noted that cows with long teat, big udder, and good milk veins on cow belly as well as large hollow body cavity have high milk yield. Hiwet, (2013) from southern Ethiopia also reported that cows with longer teat facilitate milking. Morse et al, (1988) have indicated that cows with longer teats are less affected by mastitis. The reason being that the teat canal provides as effective barrier to ward any external infections as teat canal closes within a few minutes of milking and thus shifting off the line between external environments and the udder canal. Kshatriya, (2009) in his study concluded that udder and skin thickness were related to milk yield thus could be considered as one of management criteria of dairy cows. Addis and Godadaw, (2014) also reported that udder contains 40% in dairy animal selection traits. Endashaw et al, (2012) indicated that the Mursi and Bodi pastoralists from southern part

of Ethiopia select dairy cows based on their milking yield, coat color, fertility and udder size. Respondents in the present study also confirmed that dairy cow with well-structured udder evenly balanced and cylindrical shape and uniform size have good milk yields. These findings are similarity with Seykora and Hansen, 2000, Addis and Godadaw, 2014)

Large two milk veins clearly visible in udder were also considered as selection criteria. This finding is in accordance with observation of Bonsma (1980, Kunene and Fossey, 2006; and Addis and Godadaw, 2014) who noted that the presence of well-developed milk veins was considered as selection criteria for dairy cows.

With regard to coat color, in the lowland agroecology respondents preferred to red coat colored animals and black coat color is the least preferred with the reason of red coat colored animals are easily adapted to their adverse environment and black colored animals have less acceptance on market. These results are in line with the finding of Edea et al, (2012), black coat color is mostly unwanted color due to market preference.Ths result has closely agreement with Shigdef, (2012) from Washera and Fenta districts reported that white and red colors are the preferred coat colors of sheep and goat whereas black color is the last preferred. Banerjee et al, (2014) reported that native farmersô from southern part of Ethiopia preferred to cows with reddish brown or red color coats for they believe that such cattle are good milk providers.

Finch, (1986) from his study noted that coat color has an important adaptation trait to high temperature and solar radiation. On the other hand, Ouma et al. (2004) documented that farmers from Kenya and Ethiopia prefer dark coat-colored cattle; the dark coated animals are used for slaughtering during ceremonial functions. Gizaw et al (2010) documented that the overall appearance of sheep is an important economic trait that influences price of traditional markets in Ethiopia followed by coat color. Semakula et al, (2010) from Uganda also indicated that smallholder goat breeders select bucks based on body size, growth rate, fertility, temperament.

On the other hand, Yosef et al (2014*)* from pastoral communities of Afar and Somali indicates that trait preference of dromedary camels in Afar was milk production, adaptability, breeding efficiency, growth, ability to give birth to more female and draught capacity. In highland agroecology, respondents also reported white coat colored animalsô could not tolerate the adverse environment and easily attacked by leech. These results are also supported by the result of Edea et al, (2012), who reported white and red head with white body are unwanted colors in both agro-pastoral and pastoral production systems due to less resistance for drought and disease.

Broucek et al, (2007) indicated that dairy heifers, with a high hair whorl significantly had higher body weight and average daily gain. In the present study, cows with high hair whorls were considered to produce more milk yield, fast growing ability and their calves are active in behaviors than low hair whorl. Respondents mentioned thin tail with clean cut; plenty of hairs at the end are taking as selection criteria for dairy cow, which indicating that mothering ability of the cow with good milk yield. Kunene and Fossey (2006) and Banerjee et al (2014) reported fine tail of a cow was one criterion to decide on milk yield related traits (dairy cow and heifer). The respondents from the study area also indicated that selection criteria of bull are based on body muscular strength, scrotum and penis size. These are in agreement with the findings of Bruce (2012) and Bonsma (1980) who reported that the length of penis are correlated with good fertility and may be associated with the proper function of the cremastermuscle which is responsible for the movement of the penile sheath. Kunene and Fossey, (2006) also stated long penis and big neck is related to good fertility in bulls. Respondents also indicated that when they choose bull to meet with their cow or heifer red or brown in coat color was preferred and this is correlated with sequentially to get red or brown calve.

The study also indicated that to select better quality herds, stockowners practice some traditional management practices of castration, culling, as well as keeping the history of pedigree. These results are in accordance with Rollefson, (2000; FAO, 2003; FAO; 2009) reported that traditional livestock breeders have long tradition of animal breeding practices, select better quality herds though management,

5.6. Ethno veterinary Practices

Ethno veterinary practice has been in used for generations. Traditional farmers developed their own animal disease identification and treatment methods using locally available herbs. This is in accordance with the study of Abubakar (1999), and Patel et al. (2013) who stated that local peoples in many parts of the world use their traditional knowledge to prepare herbal medicines to treat various animal diseases and this practice has remained there since time immemorial.

Regassa, (2013) also reported that Ethiopia has glorious tradition of health care system based on plants, which dates back to several millennia and medicinal plants and traditional medicine play an important role in the health care system.

Mathias and McCorkle (1989) clarified that dealing with the folk beliefs, knowledge, skills, methods and practices pertaining to the health care of animals.

The majorities of households in the study area relied on ethno veterinary service to treat their sick animals, because traditional healers are easily accessible to the farmers and are relatively cheaper. From the indigenous knowledge acquired through generations, traditional ethno veterinary practitioners treat a wide range of aliments. This is study has similarity with study of Belay et al (2013) who documented fromIlu Aba Bora Zone, South Western Ethiopia, 83.3%

of farmers used traditional treatments to treat their sick animals because of lack of adequate veterinary services, long distance to animal clinics, lack of transport facilities and they believed that the animal could recover with traditional ethno-veterinary practices. This results are also similar with several other reports (Mirutse and Gobena, 2003; Endalew, 2007;Nurya, 2010; Robinson Zhang, 2011;Yirga et al.,2012; Yibrah,2014)who reported that major portion of the farmers in different parts of Ethiopia, relies on traditional veterinary knowledge, practices and locally available materials primarily medicinal plants to cure and prevent livestock health problems.

Respondents reported anthrax, blackleg, foot and mouth disease, tick leech; external, internal parasites were the main livestock aliments in the study area, and farmers used herbals to treat livestock. Mesfin and Obsa, (1994**)** reported that Ethiopia cattle owners have aware of serious livestock diseases and they were the only people approached by herbal treatment.

The respondents also stated that tick infestation is widespread in all districts and causes reduction in milk as well as emaciation of animals. Seyoum, (2001; Gbolahan et al., 2012; Achenef Melaku, 2013) from different part of Africa reported that tick and tick born diseases are widely distributed parasites particularly in tropical and subtropical countries, which cause bacterial diseases and great economic losses in livestock industries. So that the stockowners use herbals with combination of other modern medicine to control tick invasion in their stock.

The results in the present study indicated that ethno veterinary practices were mainly transferred from elder to their children orally. This finding is in line with observation of Yaried et al, (2014, and, Mirutse and Gobena, 2003, Yibrah, 2014) documented that the majority of traditional healers transfer the knowledge only to the first-born and only some of the traditional healers to their honest and faithful children**.** Gidey yirga, (2010) also from northern Ethiopia reported

that only 33% of traditional healers transfer their indigenous knowledge only to selected family members while some (50%) kept the knowledge and the remaining (16.7%) do not transfer at all.

The study also revealed that younger generations are migrating to cities in searching of better life opportunities, and this appears to have posed a threat to the transfer of indigenous knowledge to the next generation in addition individuals who are knowledgeable in traditional practices in the study area are usually try to keep the knowledge secret. This is due to as they get respect in the community as well as income from the practice. Mesfin and Obsa, (1994) reported that traditional practionars are remain unwilling to freely to teach others is considered as another problem causing a loss of knowledge.

5.6.1 Part of plant used, mode of preparation, dosage and route of administration

The present study showed that leaves (50.8%) are widely used plant parts for a variety of treatments than the other parts followed by roots (27%). Abraha, (2015) from northern part of Ethiopia reported leaves (40.98%), and roots (34.43%) are the widely used plant parts for traditional remedies. Similarly, these results are in line with other studies conducted in different parts of Ethiopia indicated that leaves being used more than the other parts of the plant (Mirutse and Gobena, (2003; Haile and Delensaw,2007; Behailu, 2010; Nurya, 2010 and, Yaried et al. 2014). Yibrah (2014) also further confirmed that leaves appear to contain chemicals that are more active than other plant parts. Sintayehu Tamene. (2011) stated that the preference of leaves to other plant parts due to the easy to preparations compared to remedy preparations from other plant parts.

On other hand, the finding of Endalew (2007) indicated that root was the most common plant part used by traditional healers and which have serious effect on the survival of mother plant.

The common traditional medicine preparation methods in the area are crushing and squeezing, concoction and squeezing and direct use. These findings are in accordance with report of Yibrah, (2014) and Abraha,(2015) noted that traditional medicinal plants were prepared by crushed/chopped, squeezed, and then filtrated to liquid form to administer. However, Hiwet, (2013) from southern Ethiopia indicated concoction, squeezing (50%), crushing and pounding (26%) and crushing by hand, only (12%) are the main processes

The common routes of administration method reported were oral followed by dermal. These findings are closely similar with the finding of Teshal et al. 2004; Dilshad et al., 2008;Yibrah, 2014; and Yaried et al. 2014) from different parts of Ethiopia. The observations are however not in accordance with Abraha (2015) who reported that the frequent applied modes of administration of ethno veterinary medicine include creaming, rubbing and smearing.

Normality and accuracy of dose determination and unit, measurements of the medicinal plants were the troubles of the traditional veterinary healers. Indigenous knowledge practitioners used variety of unit measurements to determine dosage. Getu (2010) also similarly reported normality and accuracy problems.

5.6.2. Threats and conservation of medicinal plants

Even though the value of indigenous knowledge in livestock disease treatment is indispensable, the local communities did not give much attention for management of traditional medicinal plants. The threats of medicinal plants are also differ among the agroecologies. In the highland and midland agroecologies agricultural expansion is rated as the primary threat to medicinal plants. These findings are in accordance with reports of Yirga et al. (2012) and Yibrah, (2014) who noted that agricultural expansion is the major threat for medicinal plants.

On the other hand, Abarah (2015) reported drought as the main thearting factor to medicinal plants, which is in line with responsece of lowland agroecology,stated that prolonged dry season is the most pressing factor followed by over grazing by animals. Respondents from highland agroecology also reported, dominance of Planting of eucalyptus and juniprus prosera caused some of the medicinal plants to disappear or become rare. This is may be dueto comptition of nutrients and sunlight.

The present study also pertained that declining of practionars have a negative impact on medicinal plant conservation especially on midland agroecology which is near to zonal city of southern Tigray farmers mostly relied on clinics . This is also close agreement with studies of Endashaw (2007) who also reported that loss of knowledge, loss of cultural assets besides over harvesting are the most important reasons influencing the population of the medicinal plants in Ethiopia.

5.7. Livestock feeding, watering and housing system

The availability of livestock feed resources varied by seasons with respect to quality, quantity and type of feed in magnitude in the agroecologies. The most important dry season feed resources available to livestock in the study area include natural pasture, crop residue, hay, Cactus pear. These findings are similar with findings of Shitahun (2009, Mesay; 2013; Seid and Berhan, 2014) from different parts of Ethiopia reported that the major dry season feed resources for livestock were natural pasture, crop residues, hay and stubble.

In highland natural pasture, hay, crop residue (barley, wheat, and pulse straw) and aftermath were the basic livestock feed in order of importance. Supplementation of salt was also practiced. This is to increase the feed intake as well as source of minerals. This is in line with the report of Adebabay (2009), and Solomon (2010).

In the midland next to natural pasture, crop residues and cactus appeared to be important feed resources. In the same way, there was better utilization of home waste with *Atella* and supplementation of concentrate from Maychew town. These findings are agreement with finding of Tesfaye, (2007; Asaminew and Eyassu, 2009; Belay et al. 2012) from different parts of Ethiopia. Alemayehu (2005) also reported agro industrial by products and other by-products like food and vegetable refusal are other source of feed types.

In the midland agroecology, cactus pear was an alternative feed resource for all species of livestock. This is in line with report of Shushay (2014) who reviewed that cactus is the main alternative feed source when the crop residue was not present. In the lowland agroecology next to natural pasture livestock mainly relied on cactus. Cactus was more economical for farmers livestock freely rely on cactus pears next to natural grazing during both dry and wet season. Haile et al. (2002) documented the importance of cactus in Southern zone of Tigray. Farmers with no access to cactus do migrate from the nearby districts to the natural cactus plantation areas with their livestock at times of drought.

In the wet season livestock in the highland and midlands largely rely on weeds and leaves from croplands followed by homestead grazing. Approximately every part of lands were covered with food crop. Highland respondents stated during this season used potato vein as feed while midlands allowed livestock to use cactus pear. Lowland stockers mostly relied on natural pasture. This is agree with the results of Dawit et al., (2013; Gebremeskel et al., 2013) noted that shefitning the land use system from grazingland into crop cultivation has decreased the potential of the livestock.

In the three agroecologies, respondents to mitigate lose of livestock by feed shortage, practiced, purchasing of straw, destocking of livestock, sending of livestock to other relatives and movement (urna). Shitahun (2009) reported that farmers indigenously suggested collection and

storing of crop-residues, preparing of hay from farm boundaries, utilizing of browse species, purchasing of straw and selling of older and unproductive livestock as coping mechanism.

On other hand, Bakyusa et al (2012) reported the coping mechanisms of livestock owners in the urban and peri-urban areas of Uganda was major form of herd reduction through selling, relocating livest to the countryside and slaughtering. Similarly, Salem & Smith, (2008), reported when livestock survival is threatened by different stressing factors, farmersô first option is destocking. Abraha (2012) reported traditional farmers in southern part of Tigray practiced *urna* as means of sustaining their livestock during drought period.

Result of study by Seid and Berhan (2014) from Burjiworeda, Segenzuria zone of south Ethiopia also indicated that 24% of the livestock owners relied on stored crop residues during feed scarcity periods and about 55% depend both on migration and natural pasture. Thus, the strategies to cope with feed shortage in dry and wet seasons were feeding on farm residues and on natural pasture. Also 40% in highland, 21.7% in mid-altitude and 25% in lowlands send their animals to others areas of ample natural pasture. About 30% in highland, 10% in mid-altitude and 40% in lowlands resist the condition through relaying on both farm residues and natural pasture.

The present study also showed that farmers used diverse water resource in the three agroecologies. Farmers in highland mostly used spring, dug-well and river water. Midland mostly used river, dug-well and tape. While farmers in lowland agroecologies widely relied on well water, and spring water for their livestock. Sintayehu (2007) reported45.8%of the interviewed producers in crop livestock system of shashemene area used river water, while24.8%tape water. Solomon (2010) from Arsi zone of Oromia region also reported that 72%of interviewed producer depends on river water to provide drinking water for their cattle.

The results presented in Table 18 indicated that housing of livestock is practiced to protect livestock from predator, theft and from extreme weather conditions. The common types of shelters used for livestock are corral/fences with plastic or grass cover, (Hidmo), and sharing the same house with family. This is similar with Adebabay, (2009) who reported most farmers in Bure district; house their cattle in the dry as well as wet seasons. *Hidmo*, was the main shelter for sheep, goats and equine in three agroecologies in order to protect from predators. Chicken share the same house with family in the three agroecologies. This is in line with observations of Hailemichael, (2013) who noted that 79.05% of chicken rearers have no separate house for their chicken.

5.8. Milking procedures and utensils used for milk handling practice

Milking of cow with death calves are practiced in the study area. This result is in accordance with report of Asaminew and Eyassu, (2009) from Bahir Dar Zuria and Mecha Woredas, Northwestern Ethiopia, he noted that the community milk about 95.4% of cows upon death of calves. However, Adebabay, (2009) reported only, 28.8%of calve less cows milked from west Gojjam of Amhara.

Most of respondents in the study area were not followed proper sanitary milking procedures. Practices of washing udders and using towel were insignificant in highland and midland and not reported totally in lowlands .Asaminew and Eyassu, (2009) reported 82% and 89.2 % of dairy cooperatives do not wash udder and use towel respectively. On the other hand, Abebe et al, (2013) from his study documented, there is a practice of washing of udder during milking in Ezha district of the Gurage zone, Southern Ethiopia.

The other weak practice reported were the majority of milkers dip their fingers in the milking utensil in order to facilitating milking. Such practice also may cause microbial contamination

of the milk from the milkerôs hand. The observations are accordance with the report Asaminew and Eyassu, (2009), and Abebe et al, (2013).

Traditional milking utensils used in study sites were milking vessel made up of wood ñ*Carfo*ò in highland and midland while gourd ñ*Beshay*òin low land respectively in the three agroecological zones. Respondents from three agroecologies explained that these utensils are suitable for milking with provides comfort for animals during milking when we compared with plastic utenils. This is because the utensils have less sound during milking the less sound gives comfort to the dairy cows. Plastic utensils disturb milking animal via, generating strong sound during milking. The results are in accordance with Abraha, (2012) who reported that a traditional milking utensil gives less sound and culturally acceptable. But Abebe et al, (2013) reported the most common milking utensil used in Ezha district of the Gurage zone was plastic jar.

Farmers in the three agroecologies practiced cleaning and smoking of milk handling utensils by some shrubs. Respondentsôtraditionally by their own try and error develop specific plant herbs for cleaning and smoking dairy utensils. The use of herbal products for cleaning, fumigation and preservation of dairy products have also reported by Zelalem Yilma and Bernard Faye (2006) and Biruk (2010). The milk handled in cleaned and smoked utensils with these herbs have better flavor as well as long shelf life. These results are in agreement with the result of Ashenafi (1996; Tesfaye, 2007; Sintayehu et al., 2008; Yitaye et al., 2009) who reported that smoking is common practice of smallholder of dairy to improve shelf life of milk and milk products. Clay pot (kuraee) is the most common utensil used for storage of milk until the desired volume is collected for processing (butter making.

Clay pot gives good aroma of milk by keeping from rapid change of temperature as compared to plastic and metal utensil as well asfacilitating fermentation. These results are similar to Abraha, (2012) and Abebe et al. (2013).

The frequency of processing of dairy products was mainly depending up on the temperature and milk amount. Due to this highland, respondents churn milk once a week for extraction of butter and respondents from midlands indicated that, they churn milk twice a week. While respondent from lowland reported that, they churn milk every second day based on amount of milk collected. This finding is in agreement with findings of Abebe, (2011) stated that farmers in low lands churn the milk more frequently than highlands.

5.8.1. Preparation of traditional foods andconsumption pattern of dairy products

Respondents prepare traditional foods from dairy products. The most common traditional foods are dedicated buttermilk (*Hazo*) and butter oil (sihum). Hazo is prepared by fermenting of milk with spices and roasted barely powder to provide special aroma and flavour for special occasions like socio-cultural festivals and extend shelf life. Sihum was similarly prepared from cows or goats milk without grain powder for special ingredient of holiday dish. Majority of the traditional farmers in three agroecologies used to sihum to enrich the taste and nutritional quality of various foods either in cooking or as a spread on the finished food. This finding is in accordance with Abraha, (2012) who noted that inhabitants of south Tigray used different dairy product as holiday saucers.

The results presented in Table 22 pertained that dairy products consumption has culturally restricted. Women and adult females are culturally restricted from using of fresh milk, fermented milk and skimmed milk in highland. They were limited to use only whey and butter. Similarly, lowland males are restricted from utilization of skimmed milk. This is similar with

finding of Abraha, (2012) who reported that milk consumption was culturally restricted in south Tigray.

About 40% of respondents in the highland stated that fresh milk and fermented milk, was not recommended to consuming for the reason of butter preference as well as sale of fresh whole milk was culturally restricted practice. This is in agreement with the report of Fikrineh et al., (2012) from Mid Rift Valley of Ethiopia reported that the majority of milk (95.3%) of the farmer consumed milk after it has been fermented. Lemma (2004) also reported that in most cases fresh milk and fermented milk were not consumed on the daily bases and out of the total milk produced per household per day; about 83.3% was accumulated for further processing. Abebe et al., (2013) from his study also documented that the sale of fresh whole milk was not a common practice in Gurage zone, Southern Ethiopia

In consumption of butter, priority is given for women than husband and adult males for smearing of hair. This is very common in all agroecology with special attitude of ñRaya cultureò (southern Tigray in general) women and adult females obligated to smear their hair always with butter and sometimes to smear their whole body by butter with traditional fumigation. This finding is in line with finding of Abraha, (2012) from southern Tigray.

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6. SUMMARY AND CONCLUSION

The study has investigated the indigenous knowledge and practices of livestock husbandry, ethno veterinary and dairy product handling and consumption pattern in different agroecologies of Endamohoni district, southern Tigray Northern Ethiopia. The results indicate that the primary functionsof rearing livestock in highland and midland agroecologies were inorder of importance draft power, food of animal origin (milk and meat), cash income and gifts. While in the lowland agroecology, include food for household consumption (milk and meat) and social services (gifts during marriage). Livestock are commonly selected by farmers based on their phenotypic characteristics. For cows, the principal criteria are udder size and softness, teat length, tail length

and thickness, coat color, hair whorls, structure of neck and nostrish. In addition, informal pedigree records are also kept orally for large ruminants. Livestock in the study site are mainly relying on natural grazing, crop residue and cactus pear. During feed shortage periods, farmers in the highland purchased crop residues to feed to their animals and midland areas destocking of animal was the mitigation.

Where as in the lowlands farmers they move (*urna*) their livestock to distant locations where there is relatively better grazing pasture. Mixing of crop residue with local brewery residue (*Atela*), household waste and salts was found to be a common practice to increase feed intake and improve performance of livestock in the highland and midland agroecologies, while chopping or re-threshing was mainly used as a crop residue treatment in the lowlands. In the lowland agroecology, drinking water was mentioned as a problem and to reduce water shortage stresses on livestock, farmers feed cactus, reduce livestock movement and keep the animals in sheds.

The use of ethno veterinary practice is deep rooted in the studied three agroecologies and about sixty-five plant species have been identified to be used frequently by ethno veterinary practitioners in the district. Most of these medicinal plants have been growing in wild vegetation, whereas a small number of plants are cultivated in home garden and near home farms. The most common used part of plants are leaves followed by root and the treatments were administered through oral and dermal and few of them are in nasal, ocular and anal. The preparation methods are crushing and squeezing, concoction and squeezing followed by direct use of plant parts.

Practitioners were found to have knowledge on toxicity due to over dosage and they utilize diverse antitoxin (milk, barely soup) at the time of poisoning. Such indigenous knowledge has been transferred from parents to children and largely remain secret in the hands of the elders. In addition to the medicinal plants, farmers commonly use other groups of plants in dairy utensil cleaning, fumigation, milk processing and preservation, and these plants are reported to enhance the shelf life and quality of dairy products.

The consumption pattern of dairy products in the study area are culturally differ with restriction of providing of fresh and fermented milk(ergo) for adult females in highland and lowland as well as offering skimmed milk for adult males in lowland. Traditional foods are prepared from dairy products during holidays or celebrations. These foods have also better life than the fresh dairy products (Hazo and sihum) and they share these products with their neighbors during festival occasions.

The study generally revealed that farmers have acquired various novel indigenous knowledge and practices that are well suited to the local context and needs to be preserved and build up on. These knowledge and practices of livestock husbandry, livestock health and product handling and processing should serve as the basis to develop further interventions to improve livestock productivity in the area. As most of the medicinal plants are grown in wild, it is very important to promote conservation in ex-*situ* and *in-situ* are crucial. And further biological studies should be conducted on the reported medicinal plant species of the study area so as to utilize them in drug development.Promoting transfer of indigenous knowledge from elders to the young population needs to be given due attention not to lose valuable ethno veterinary skills.

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APPENDIX

Appendix 1: Common and scientific name of the plants and parts of the plant used for animal treatment

Local name of plant	Scientific name of plant	Part of plant used	Method of preparation	Ingredients added
Mesaguh	*Meriandra dianthera*	Leaf and steam	Fumigation + Crushing and squeezing	Water in Crushing and squeezing
		Leaf	Concoction and squeezing	Water and salt
Hareg resha	*Zehneria scabra*	Root	Crushing and squeezing	Water
Chergid	*Nicotiana glauca*	leaf	Concoction and squeezing	water
Tarnake	*Verbascum sinaiticum.*	leaf	Crushing and squeezing	Water
Ami ï ae	*Urtica simensis*	leaf	Direct use / Concoction and squeezing	None
Tsiendog	*Otostegia integrifolia.*	Whole part	Fumigation	None
Tumbuako	*Nicotiana tabacum*	Leaf	Crushing and squeezing	Water
Biuak	.	Leaf	Crushing and squeezing	Quality feed
Agam	*Carissa spinarum*	Root	Crushing and squeezing	water
Engule	*Solanum marginatum*	Fluid of the fruit	Concoction and squeezing	Goat milk
Shifiti	*Phytolacca dodecandra*	Leaf	Concoction and squeezing	Water +soap
Saer saero	*Not identified*	Root	Fumigation	None
Chenabarya	*Artemisia abyssinica*	Leaf	Crushing and squeezing	Garlic

Gulee	*Ricinus communis*	Fruit	Concoction and squeezing	None
Chamo	*Not identified*	Leaf	Chewing and emitting to eye	powder of barley
Gurshit	*Impatiens rothii*	Root(rhizome)	Concoction and squeezing	Salt +atela +feed
Mirkuz zibee	*Bersama abyssinica*	Root	Crushing and squeezing	powder of barley
Shihnet	*Myrica salicifolia*	Leaf	Crushing and squeezing	None
Girbia	haypoests forskaolii	Root	Crushing and squeezing	Tsifirr
Tebeb	*Becium grandiflorum*	leaf	Crushing and squeezing	Tahises+tsihd
Tahises	*Dodonea angustifolia*	leaf	Roasted and pounded	Butter
Tsihdi addi	*Juniperus procera*	leaf	Crushed and squeezing	Water
Tsifirir	*Sida schimperiana*	leaf	Direct use	None
Shilean	*Cadia purpurea*	leaf	Concoction and squeezing	Water
Shewa kerni	*Leucas abyssinica*	Leaf	Crushing and squeezing	Water
Eshok bru	*Xanthium spinosum*	Whole plant	Crushing and creaming	None
Dander	*Echinops pappii*	Root	Fumigating	None
Hangoro	*Echinops longisetus.*	Root	Concoction and squeezing	powder of barley
Habi	*Hagenia abyssinica*	flower	Pounding	local beverage
Tsaeda kotslo	*Conyza hypoleuca*	leaf +steam	Tie	None
Shingurti zibee	*Crinum*	Root	Concoction and squeezing	Urine
Shihiko	*Agave sisalana*	Bark	Crushing and squeezing	Water
Dingle	*Rumex nepalensis*	Leaf	Concoction and squeezing	Salt
Kentefitefe	Pterolobium stellatum	Root	Crushing and squeezing	None

Mestenagir	Datura stramonium	Leaf	Concoction and squeezing	Water
Tekuarie	Nuxia congesta	Root	Concoction and squeezing	None
Hitsawts	Calpurnia aurea	Leaf	Concoction and squeezing	Water
Ere	Aloe sp.	Root	Concoction and squeezing/direct use	Tebeb
Etse beles	Polygala abyssinica	Root	Direct use	Wholly water
Shmbra eff	*Indigofera amorphoides*	Leaf	Crushing and squeezing	Muscle frog
Hirtmtimo	*Clutia abyssinica.*	Leaf	Crushing and squeezing	local beverage)
Tseba dimu	*Euphorbia schimperiana*	Latex	Crushing	None
Sentesemhal	*Mentha longifolia*	Root	Crushing and squeezing	Water
Araero	*Kalanchoe marmorata*	Whole plant	Concoction and squeezing	salt
Hahot	*Rumex nervosus*	Leaf	Crushing and squeezing	Water
Endifidif	*Plectranthus ornatus*	Bark	Concoction and squeezing	Honey
Mechalo	*Achyranthes aspera*	Leaf	Chewing and emit into the infected eye	None
Atish	*Verbena bonariensis officinalis*	Leaf	Crushing and squeezing	Chena adam
Agol	*Withania somnifera*	Root	Crushing and squeezing	Water
Shimeja	*Justicia schimperiana*	Leaf	Crushing and squeezing	Water
Kachamo	*Myrsine africana*	Fruit	Grinding	Water
Kega	*Rosa abyssinica*	Fruit	Pounding	local drink
Seraw	*Acacia etbaica*	Bark	Direct use	None
Chena areki	*Foeniculum vulgare*	Whole plant	Crushing and squeezing	Water

Medafe talian	*Argemone mexicana*	Latex	Crushing and squeezing	None
Teta elo	*Rhus glutinosa*	Leaf	Concoction and squeezing	Tsihd+honey
Chena adam	*Ruta chalepensis*	Leaf	Crushing and squeezing	Water
Tsedo	*Rhamnus staddo*	Leaf	Concoction and squeezing	honey
Sarya	*Maesa lanceolata*	Leaf	Crushing and squeezing	Salt +water
Keilew	*Euclea racemosa*	Root	Direct use	Holy water
Atami	*Rhus vulgaris*	Leaf	Crushing and squeezing	Skimmed milk
Awlie	*Olea europaea*	Leaf	Crushing and squeezing	Butter
Ramborambo	*Cucumis ficifolius*	Root	Concoction and squeezing	Milk, honey
Meteri	*Buddlegia sp.*	Leaf	Crushing and squeezing	milk
Keretse	*Osyris quadripertita*	Leaf	Crushing and squeezing	None

Appendix 2: Local and common name of the diseases, type of plant and rout of administration for medication

Local disease name	Common name of disease	Local name of plant used for treatment	Rout of administration	Sites for external application	duration	Remark
Tafi'ya, Megerem	Anthrax	Mirkuz zibee	Dermal	Creaming of swollen area	For a week	Hot branding
		Ramborambo	Dermal	Creaming of affected area	Until recovery	Crushed, fresh leavesof ramborambo and mixed with honey and placed in the infected parts
		Chifit	Nasal		For 9 days	
		Tahises	Oral		For 5 days	
Werchi, Wekiee, Affefita	Black leg	Simeja	*Oral*		For one week	Restrict the animal from drinking water
		Chifit	*Nasal*		For 15 days	
		Engule	*Oral*			
		Kolkual	*Dermal*	Creaming the swollen area by milky	Until the swollen opened	Bleeding using sharp material
Afme'ar, etsilam	Foot and mouth disease	Tsedo	*Oral*	Creaming of mouth by Honey	A week in morning	Water boiled with salt is applied on lesions
Atsmi a'yni	Cataract	Chamo	*Ocular*	Eye	For three days	Bleeding or cutting
		tarnaka	*Ocular*	Eye	For two days	
Sambu'e , tirfa	CBPP	Meter, Hareg resha Engule	*Nasal Oral Nasal*		Until cured	*Crushing of leaves of meter and giving by nasal*
Himam gule (tub)	Mastitis	Mechalo	*Dermal Oral Oral*	Teat and quarter	Two times a day for 5days	Fumigation in gulee Shifi Shinfae
M'nfah kebdi	Bloating	Dingle Ere	*Oral*		During bloating	drinking of oil and soap

		Mestenagir				
Qumal derhu	Lice	*Chifti* *Chergid* *Hitsawits* *Chihiko* *Chilaen* Chiendog	*Dermal*	*Washing a whole body* except teat, muzzle and eye	One times	Farmer used burning of all manure and rotational grazing to prevent infestation. Placing of chiendog in fire and fumigating
Qurdid	Ticks	*Chifit* Hitsawuts	*Dermal*	Smearing of the affected area	Until ticks are died	Wash by detergent soap Manual cutting of tick and smearing with butter
Alekti	Leech	Tombacco	Nasal		For three consecutive days	*Crushing of leaves of Tumbuako*
		Engule	Nasal		For one day	
		Meter	Nasal		For two days	
		Mirkuz zibee	Nasal		For two days	
Aynet	Evil eye	Shewakerni Chena adam Faeces of hyena	*Nasal* *Nasal*		One time When the animal shows sign	Crush leaves of shewa kerni and filter with white gauze The leaf of *chena adam* crushed, powdered, mixed with little amount of water and sniffed by holding with clean cloth
		Agam Ternaka	*Nasal*			Put the root of agam on fire and fumigate Take a piece of root from seven place and divided them in to a small pieces and tie on their teal

Edeseb (tseyki)	Hand of man	Hahot,agam, kileaw,kentefte fe, mestenagri shinfaee holy water	*Dermal Oral*		Wash the whole body with morning water	Root of the plants are crushed and stored in one equipments for seven days and wash the whole body of the animal for 7 days morning
	Jaundice	Smieja	*Oral*		For 7 days	Leaf is crushed and mixed with water, squeezed drink orally and protect from cactus
Dirket	Stomach Constipation	Tsihdi addi	*Oral*		For 3 days looking at dung change	Honey +yoghurt
	Internal parasite ,	Hirtimtimo Gurshit Engule	*Oral*			Crushing of root of engule and giving orally
	Lung worm	gurshit	*Oral*		For a week lungworm	Give nutritional quality feed
Azurite	Tinasis	Engule eucalyptus leaves, tobacco,	*Nasal*	Fumigation	3 day morning	Hot branding Fumigation with birdsô nest
Sa al	Coughing	Mesaguh Saero saero	*Dermal*	*Dried and fumigation in closed house* Whole	For 30 mintutes	
Himam tib	Tuberculosis	Kolkal Tseba dimu	*Oral*			Crushing internal part of the root making solution & adding honey then drinking orally
	Tape worm of dog	Habi	*Oral*			flowers are dried and pounded and provided mixed with food

Witsieet	Salmonellosis	Shimeja Tsihdi addi Kerets	*Oral*		5 days morning 4 days	
Kinbile	Newcastle disease	Mesagugh Nech shinggurt Ere	*Nasal* *Oral* *Oral*		3 days For week	Fumigate in closed home Crush the soft part of ere and add into drinking water
	Strangle	Saero saero Agam Kulkual	*Nasal* *Oral* *Oral*			
Keto	Dermatophilosis	Hitsawits Tsaba dimu chilen	*Dermal*	Washing of the body	For two days	
Shihur	Mange mites	hitsawts mirkuz zibee chilen hahot	*Dermal*	The entire body		
Mifinfan	Un acceptance of calf	Ami- ae	*Anal/ vaginal*		Once	Insert the leaves of ami-ae in to vagina of the cow and dress the fluid contain leaves on the body of calf and allow to go the cow
Meskeb zeymidrbay	Fetal membrane retention	Gulee Mechalo Ramborambo	*Oral*		2 times per day	Circling of the fetal membrane on stick
Gimay /sibar atsimi	Bone fracture of limbs	*Seraw* *Ire* Tifraria	*Dermal* *Tie on teal*	fix the cracked or broken part	For a month	
	Damage of horn	Awlee, Tebeb	*Dermal*	On damaged area of horn		*Crushing Leaves of awlee adding to the injury part*

Zitekefete kosli	Open wound	Kenteftefe Tahises Ami ï ae Ere Dander Eshok birur Honey	*Dermal*	Smear in wound For fresh bleeding wound Wound area	Based on type of wound	Roasting leaves of tahises and grinding and pounding Leaf is crushed and mixed with water
Zeytekefete kosli	Closed wound	Kolkual	*Dermal*	Circling of the wound	Until opened	
Mieta kefiti	Bovine pasteurellosis	Araero Kenteftefe Gulee	*Dermal* *Nasal* *Dermal*			
Zigag	Actinomycosis	Kolkual Gulee Engule	*Dermal* *Oral* *Nasal*	*Creaming of the swollen part of the body*		Give a little amount of engule fluid by a bullet for 5 day with goat milk by nasal
		Tsifrr	*Nasal*	*Crushing of Roots of tsiffri and gribya and store for seven days and giving thorough nasal*		
		Girbya	*Nasal*			
		Araero	*Dermal*	*Open the swollen part and insert it*		
Mugille /haseka gry	Foot rot					Removing by manually
	Heart water	Sarya	*Oral*		For 3 days	

Mibiri ay	Abortion	Shinfae Shift Tifraria	*Oral* *Tie*			Prepare the fruit of shifit and drink it with Yogurt
Himmam ebud kelbi	Rabies	Ramborambo Mestenagir Simeja Gulee	Oral		until progress of health conditions are noticed	Crush and squeeze then Mixing with milk Pounding the leaves of mestenagir giving 1-2 coffee cup for Disease livestock
	Lumpy skin disease	Engule	*Oral*			Prepare root,bark and fruit of endgule in one and give orally
Enffirr telebegiee	Sheep and goat fox	Hitsawits	*Dermal*			
	PPR (pest despiteôs ruminants)	Ire	*Dermal*			
Tsegem welid	Dystocia	Drenching of Honey and egg Barely powder			Creaming of vagina with butter	Handling manually
Kurtset	Colic equine	Engule awile	*Oral*			Grinding and drying then drink it
Minkas teben	Snake bite					
		Chiendog	*Oral*	*Crushing and drinking*		
		Kileaw	*Oral*	*Crushing and drinking*		
		Etsebeles	*Oral*	*Chewing and emit into animal mouth*		

Ebran	Emaciation	Ama ae Gurshit	*Oral*	*Feeding with local beverage*		

Appendix 3: Tradtional knowledge practioners in the study site showing some tradtional plants to my advisor(imageA, and making group disscussion image B and C.



Appendix 4: plant sample preparations for the herbarium with the help of agronomists and DA in Maychew agricultural college


Appendix 5: Sheep production in highland agroecology

Appendix 6: Drinking trophy made up of horn of cattle:

Appendix 7: Indeginous butter selling using packaging materials from the leaves of Gulee (racinus cummunis) in neksegel market of Nekah and dum lowland agroecologies

BIOGRAPHICAL SKETCH

The author was born in 1978 E.C in Erob Woreda, eastern zone of Tigray regional state, Ethiopia. He attended elementary, junior, secondary and high school education in Engal, Lideta lemarriam, Tsinsta lemarriam and Agazi comprehensive Schools, respectively.

The author joined Jimma University in November 1998 and graduated with BSc degree in Animal Sciences on 07 June 2000. He worked in Agriculture and Rural Developments Office of the Mehal saint Woreda, south wollo zone of Amhara regional state as a feed resource expert from December 2001 up to November 2003. He also worked as instructor in Maychew Agriculture Technical and Vocational Education Training (ATVET) College, south Tigray, from December 2003 up to June 2005. Then in July 2005, he joined the School of Graduate Studies at Hawassa University in summer programm to pursue his M.Sc study in Animal production

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