ADDIS ABABA UNIVERSITY
FACULTY OF VETERINARY MEDICINE

CHARACTERIZATION OF DAIRY CATTLE PRODUCTION SYSTEMS IN DEBREMARKOS CITY ADMINSTRATIVE WOREDA OF EAST GOJJAM ZONE, AMHARA REGIONAL STATE

BY
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Dedication

This M.Sc. thesis manuscript is dedicated for my brother Mulugeta Yayeh who helps me to reach this level starting from my child hood and properly guided me to join M.sc. program.

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ABBREVATIONS

%	Percentage
AFC	Age at first calving
CI	Calving interval
AI	Artificial Insemination
ANRS	Amhara National Regional State
CADU	Chilalo Agicultural Development Unit
CSA	Central Statistical Authority
DDD	Dairy Development Agency
DDE	Dairy Development Enterprise
ESAP	Ethiopian Society of Animal Production
FMD	Foot and Mouth Disease
FAO	Food and Agricultural Organization of the United Nation
ILRI	International Livestock Research Institute
ILCA	International Livestock Research for Africa
Ha	Hectare
Km	Kilometer
Kg	Kilogram
lt	Liter
m.a.s.l.	Meter above Sea Level
MOA	Ministry of Agriculture
HH	House Hold
S.D	Standard Deviation
SDDP	Sellale Peasant Dairy Development Project.
S.D	Standard deviation
SPSS	Package for Social Science
TLU	Tropical Livestock Unit
WOARD	Woreda Office of Agriculture and Rural Development.

TABLES OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

LIST OF ANNEX

ABSTRACT

The study was conducted in Debremarkos Woreda, Amhara National Regional State, from October 2007 to may 2008 with a with the objective of characterization of dairy cattle production systems /practices of the Woreda; to get base line data on the status of dairy cattle production levels in the study area and identify the constraints and opportunities of dairy production. All 7 kebeles of Debremarkos were included in the study. A total of 200 house holds were selected randomly based on the proportion of total house holds in each kebele site using random number table. In formations were collected from secondary data, by key informant group discussion, household level questionnaire survey, farm visit and personal observations. The data were analyzed using the SPSS computer soft ware and Ex-cell programs. The mean land holding in rural farms were 1 ha and except 5 persons the rest of urban area farms were landless. The mean livestock holding was 8.36 TLU in rural areas and 5.32 TLU in urban areas. Cattle constituent 98.86 % and 92.44 % of total TLU per household in Urban and rural sites respectively. In urban sites cows constitute 41.20 % of cattle herd and steers 0.60 % and in rural sites steers constitute 20.31 % and cows 29.00 % of cattle herd. The proportion of cross breed and local breed cows in urban areas was 31.10% and 69.90% and for rural areas it was 3.38 % and 96.62% respectively. Main feed resources were crop residues and communal grazing land and most common supplements include hay, atela, wheat bran and noug cake mix as concentrates. For the last two years AI service was not available in the Woreda. During the survey period 72.0% of urban area and 93.2% 0f rural area households used uncontrolled natural mating. Common animal health problems were black leg, anthrax, abortion, foot and mouth disease, ticks, liver fluke. Animal health service (treatment and vaccination) for the last two years was not available in the Woreda. Only 7.5 % of urban area households used private veterinary service. The average daily milk yield was 1.50±0.68 and 7.30±4.65 litters for local and cross bred cows respectively. There was a significant difference in mean daily milk yield, lactation length, AFC and CI, for local breed cattle between urban and rural areas but there was no significant difference for cross breeds except calving interval in between urban and rural areas. Main milk processing milk products include butter, ayib, sour milk, butter milk, whey and "Metata." The main milk market outlet was contractual type of informal marketing either for hotels and restaurants or neighboring consumers. Lack of improved breed cattle, disease, feed shortage, milk market, space and water were

identified in decreasing order of importance as constraints for dairy production. From this study, it was recommended that: Extension service should be improved; dairy cooperatives and bull service should be established.

Key words: Characterization, Dairy cattle, Production systems, Debremarkos

1. INTRODUCTION

Livestock keeping is an ancient tradition of rural areas of Ethiopia. The size and diversity of livestock resources have become vital to sustenance of rural life and in fact the largely agrarian economy of the country. Cattle constitute the predominant element of livestock wealth in Ethiopia both in the agricultural high lands and pastoral and agro- pastoral low lands, and hence the proportional contribution to the national economy is considered to be high. Based on crude assessments, the contribution of cattle to the marketed milk and meat, national wide, is estimated to be 96 and 45 percent, respectively (Tedla *et al.*, 1991).Livestock provide food in the form of meat and milk, non- food items such as draft power, manure and transport services as inputs into food crop production, fuel for cooking. Livestock also serve as a source of income through sale of the items, animals, hides and skins .Further more they act as a store of wealth and determine social status in the community. Because of these important functions livestock play an important role in improving food security and alleviating poverty.

Although the livestock sector has a significant contribution to the national economy and food self sufficiency, animal productivity in Ethiopia is extremely low. This is evidenced by the very low per capita consumption of protein and a very low growth rate of milk and meat production (Sendros and Tesfaye, 1997). The average milk production capacity of the indigenous cow per head per lactation is estimated at 213 kg which is very low (Azage and Alemu, 1997). A survey study showed that average daily milk production per cow was 1.2 liters and the average calving interval 27 months (FAO, 2005). Per capita consumption of milk in Ethiopia is as low as 17 kg per head while the average figure for Africa is 26 kg per head (Gebre wold *et al,*. 2000). With an annual growth rate of 3.5% the human population in Ethiopia will increase to about 139 million by the year 2020, therefore, the demand for animal products is estimated to increase substantially (Azage and Alemu, 1997). To meet the increasing demand for milk and milk products, improvement of the productivity of dairy cattle through appropriate technologies such as breeding programmes, intensification of the dairy production systems and development of market infrastructures are crucial steps (Zumbach and Peters, 2002).

The low productivity is due to a number of factors among which are quantitative and qualitative deficiencies in the feed resource base, diseases, poor animal performance level, in adequate livestock policies with respect to extension services, marketing and infrastructure, and insufficient knowledge on the dynamics of the different types of farming systems existing in the country (Plaizier, 1993). Among all factors emphasis has been given for the improvement of the genetic potential of the local breeds of cattle in the country. Breed improvement programs for dairy production in Ethiopia were started by importing pure temperate breed of cows during the Italian occupation and since then crossbreeding using temperate breeds with indigenous breeds has been practiced by a number of governmental and non-governmental institutions. However, these efforts have been met with little success because of the various technical, organizational and socioeconomic constraints (Tesfaye, 1995). The development of genetic improvement programs for cattle will only be successful when accompanied by a good understanding of the production systems and when simultaneously addressing several constrains for example feeding, health control and management (Baker and Gray, 2003).

To develop appropriate interventions to assist smallholder dairy households, and identifying those which should be targeted requires a clear understanding of the dairy systems. Characterization is the grouping of farmers with similar practices and circumstances for whom a given recommendation would be broadly appropriate (Byerlee *et al.*, 1980).A study on market-oriented urban and peri-urban dairy production systems in the Addis Ababa milk shed developed by ILRI for general characterization of dairy systems characterized Seven, market-oriented, dairy production sub-systems (Yoseph *et al.*, 2003).

Four major systems of dairy production can be distinguished in Ethiopia. These are: Lowland pastoral dairy production systems, rural highland small-holder dairy production system, urban and peri-urban small scale dairy production system and large scale dairy production system (Kelay, 2002).The characteristics of dairy production systems in the high lands of Ethiopia are characterized by mixed crop –livestock production system and vary substantially in terms of intensification, management systems, genotypes used, type and methods of marketing and processing of milk and dairy products (Abegaz,2005). Even less is known about the productivity levels, major husbandry constraints and opportunities for realistic improvements in the prevalent

production systems (Tadesse *et al.*, 2005).This necessitates the need to characterize the smallholder dairy production systems for livestock improvements based on the level of intensification of the farm dairy system, risk management strategies, level of access to output markets and input services, and farm / household resources available etc.

Therefore, the Objectives of this research were:

- To characterize dairy cattle production systems/practices
- To provide baseline data on the status of dairy cattle production levels in the study area.
- To identify constraints and opportunities of dairy production in the study area

2. LITERATURE REVIEW

2.1. Dairy production systems in Ethiopia

Dairy production system in developing countries may be classified based on the combination of characteristics. These include cows or buffalo, small versus large units; urban or rural based production, public versus private sector etc. (Boer, 1999). Using various approaches, different dairy production system classifications has been made in Ethiopia (Kelay, 2002; Azage *et al., 2003;* Zegeye, *2003*). Zegeye, 2003) classified dairy production systems in Ethiopia into four namely, Patoralism, highland small holder, urban and Peri-urban production systems.

2.1.1. Lowland pastoralist dairy production

This is a milk production system in which well-adapted indigenous cattle are herded in arid and semi-arid areas by traditional cattle owners who depends on milk to meet part of their subsistence food requirements. It is estimated that about 30 % of the livestock population in Ethiopia are found in pastoral areas. The pastoral livestock production system which support an estimated 10% of the national human population and covers 50 -60 percent of the total land areas of the country and have altitudes below 1500 m.a.s.l. (Tsehay, 2001).

The productivity of the cattle depends largely on season due to rain fall pattern that influences availability of feed (Ketema and Tsehay, 1995). In this system herds are large and milk production is low and seasonal. Milk produced in this system is a valuable component in the family diet. Milk surplus is rarely sold, except by house holds living close to main roads and urban centers where there is demand for fresh and fermented milk and butter. In this system frequency and amount of dairy products traded depend on herd size and distance to the market and women from households with large herds trading more often, (Holden and Coppock, 1992).

2.2.2. Rural high land small-holder dairy production

In the high lands of Ethiopia, cattle are kept under condition of mixed farming. In most high lands, there is a decline in share of pasture land for grazing. But, with the corresponding increase in the cultivated area, there is a growing need to continuously produce more animal draught power for ploughing (Zegeye, 2003). Farmers incorporate small scale dairy production with crop farming with the objective of producing power (oxen) for tilling the land. The majority of milking cows are indigenous animals which have low production performance; with average age at firs calving of 53 months and calving interval of 25 months (Ketema and Tsehaye, 1995).But also a very small number of crossbred animals are milked to provide the family with milk, butter and cottage cheese.

Work is another "product" in addition to milk. In most crop livestock production systems, animals provide draught power for land cultivation and other agricultural operations. Compared to the Pastoralists, in this production system farmers have more control over feed inputs, and are able to capture complementarities and reduce vulnerability to market shifts (Leeuw, 1996).

2.2.3. Peri -urban dairy production

According to Zegeye (2003) this dairy production system is mainly operational in areas where the population density is high and agricultural land is shrinking due to expanding urbanization or non-existence and labor cost is on the increase. Such producers are mainly found around big cities and small towns. They may or may not have access to cultivable or pasture land and some of them are usually seen grazing the few animals they have by road side. Their main source of animal feed is home produced hay for some, and pastured hay for other with or with out additional supplemental feed. The animals they keep range from 50% cross breeds to high grade Friesians. This sector controls most of the country's improved dairy stock (Mohamed, *et al.,* 2004)

2.2.4. Urban dairy production

Due to their location such producers are not expected to have access to agricultural or pasture land, as their operation tasks place is within cities. As a result, they are forced to buy feed for their animals. The urban milk system consists of 1567 small, medium and large dairy farms producing about 35 million liters of milk annually. Of the total urban milk production 73% is sold, 10% is left for household consumption, 9.4 % goes to calves while 7.6% is processed into butter and ayib. The level of upgrading of crossbred in the herd is among the highest and the annual milk production is high (Mohamed *et al.,* 2004).

2.3. Management Of Dairy Cattle

2.3.1. Feeds and feeding

Feed is the primary factor for milk production. In addition to the amount produced, milk composition can also be affected by feeding. The main feed resources to livestock in Ethiopia are natural pasture, fallow lands, and stubble (crop after math) and crop residues. Natural pasture could be utilized as grazing or green feed in the form of cut and carry system. Green feeding is the most common form of feeding across the production system, however it is restricted to rainy seasons (Bekele, 1991).

The quantity and quality of feeds decline progressively as the dry season advances. Fodder production and conservation is rarely practiced. Forage legumes which are high in protein and mineral contents can be incorporated into cropping system to increase the nutritive values of crop residues (Adugna, 1990).

Non-conventional feed types are mainly utilized as supplement for dairy cows. They are unexploited cheep and less competitive feed resources. Traditional brewery and liquor residues and pulse hulls particularly are available through out the year. A total of ten-non-conventional feed types, commonly utilized in Addis Ababa milk shed, were identified. These were lentil hull,

faba bean hull, field pea hull, rough pea hull, tela atella (local brewery residue), Katicala atella (local liquor residue), cabbage waste, orange peel, banana peel and poultry litter. The feeds could broadly be grouped into pulse hulls, Atella, vegetable and fruit wastes and poultry litter (yoseph, 1999).

According to RanJhan (1999), in many countries, up to 60% of dry matter intake of dairy cows is from crop residues and these residues exhibited low voluntary intake (1.6% of body weight) as a result of high bulk of digesta in the reticulo-rumen and slow rate of digestion. In Ethiopia about 13 million tones of crop residues are produced annually (Seyoum and Zinash, 1998). Improvement in the feed value of straw can be achieved by physical, chemical, physico-chemical and biological treatments. In the chemical treatment, alkalis such as sodium hydro oxide, acids and oxidizing agents are used. According to Leng (1999), urea treatment of straw has been shown to improve digestibility by both breaking down cell wall and providing non- protein, nitrogen. In Ethiopia feeding urea treated straw increased milk production by 0.5 – 2 lt /day (Behrahie, 2001). The main constraints to implement urea treatment as a means of improving milk production in small holder dairy farmers are economic (price of urea and plastic covers) and technical (time constraint during harvesting time, smell of ammonia and difficulty to store).

The sources of animal fed for cattle producers could be home produced, Purchased or both. Grazing is the predominant form of ruminant feeding system in most parts of the extensive and small holder crop livestock farming areas in Ethiopia. Common pasture land is particularly utilized for grazing. How ever, as one goes to intensive type of production system stall feeding is a usual practice. In intensively managed peri-urban dairy producers located in and around cities and towns mainly rely on purchased hay as there is no available land for hay or crop production (Stall and Shapiro, 19996).

2.3.2. Breeding

Cattle breed of the tropics are known to have low milk production potentials (Kelay, 2002).In contrast to the temperate breeds that have been selected for specific production traits, tropical

breeds mostly have multi purpose functions. As a result of low production of potentials of such indigenous breeds most of the attempt is to improve milk production traits through cross breeding.

There are two types of breeding techniques in dairy cattle production. These are natural mating and artificial insemination. The implementation of artificial insemination services in Ethiopia dates back to 1950 and 1960 when teaching institutions and Dairy Development Agency (DDA) started the service using fresh and imported semen. Chilalo Agricultural Development Unit (CADU) expanded the service with establishment of the Asela Artificial Insemination center in 1972. The National Artificial Insemination Center (NAIC) was then established in 1981 with the mandate to serve at country level. Initially, service was based on production and use of fresh semen until the liquid nitrogen plant was installed in 1984(Getachew and Gashaw, 2001).

To date semen collection was based on exotic and local as well as crosses of these breeds namely friesian, jersey, Brahman, Boran, Barkan Fogera, Horo, Sheko and crosses of 50% and 75% Holstein, Friesian and local bulls from the total semen produced the major share is from Friesian. (75.3%) followed by Jersey. (10.5%). Asela dairy farm was used as rearing and training center of bulls with the provision of semen collection and small quality control laboratory. Kaliti is serving as the main semen collection and preservation center, the satellite AI centers to be used for services and the recently acquired Holleta bull dam farm will be the base for nucleus bull producing, testing and rearing farm (Getachew and Gashaw, 2001).

How ever, the use of bulls for natural service remains widespread even in areas where artificial insemination has proven to be very efficient. Many farmers believe that pregnancy rates are higher when a bull is used. The use of natural service may be indicated when personnel are inefficient to perform the tasks associated with heat detection and the techniques of AI,when long term genetic gain is of minor importance and when local conditions do not provide the infrastructure necessary for successful AI (Wattiaux, 1998; Kelay, 2002).

Selecting for breeding soundness of bulls in undertaking natural mating, the bull must be Morphologically and functionally sound. Appropriate attention should be given to factors affecting fertility of bulls that include unbalanced nutrition (under feeding and over feeding) and diseases. Adequate nutrition is vital, since it hastens puberty and body development. It is also

important to keep in mind that overfeeding can lead to reduce libido (Sprott *et a*l., 1998; Kelay, 2002). Bulls should also be tested for venereal diseases like Brucellosis, Trichomonosis and Vibriosis that affect fertility and culled if they react positively. In addition, prevention measures like vaccination and deworming should be undertaken against other diseases that influence fertility indirectly (Sprott *et al.,* 1998; Kelay, 2002).

It is important to undertake a regular fertility test for bulls to verify their external physical soundness, reproductive health (congenital and inflammatory problems) and scrotal circumference and semen quality Lee *et al.* (1998) and Kelay (2002) indicated that up to20% of all bulls have less than optimum fertility. To avoid undesired mating, farmers should castrate all other bulls they have and prevent outside bulls from coming into the herd.

2.3.3. Housing conditions

Good housing improves milk production by reducing stress, disease, hazards and making management easier. In the tropics, climatic and environmental stress, particularly heat stress could affect animal productivity (Mathewan,1993).Signs of stress include loss of appetite, reduced daily milk yield, increased temperature, high respiratory rate, tongue protruding etc. Thus the owners should be able to recognize the signs and try to adjust the environmental and housing to reduce stress and let the animals as comfortable as possible.

According to Aiumlami (1999), Herd management practices in cow handling, nutrition; milking, procedures, sanitation and housing play major roles in predisposing the individual animal as well as herd to disease. Thus, herd management practices combined with a veterinary program can be most effective in optimizing production and profitability through prevention of disease.

2.3.4. Record keeping

An important aid for farm management is the keeping of records of all animals and events related to animals throughout their lives. In some countries record keeping is provided, supported and designed by the government or dairy cooperatives. Records should be kept as individual cow

cards or at the dairy health services or AI service center (Aiumlamai, 1999). Records are an indispensable component of modern dairy farming, but are usually non-existent on most smallholder farms (Perera, 1999).

The animals may be identified only by name and are often confused, even by the farmer. Awareness among farmers about the purpose and value of recording has been minimal. Recording is usually linked with government control on the activities of the farm. The keeping of dairy records can be divided in to the main activities of identification of cattle, breeding records, milk production records, feeding and health records (Risstrom, 1999).
The main purpose of the records is for dairy herd management breeding and progeny testing. The main purpose of the records is for dairy herd management, breeding and progeny testing. Records of insemination, birth date, sire, dam, calving date, vaccination date, health problems, treatment, milk yield and feeding can help farmers to predict future or preventive needs for health care. They also provide beneficial and relevant information for veterinarians to make correct diagnoses. Therefore, it is best to have well-organized records kept for each animal, with the farms designed to allow for easy interpretation.

Smallholder farmers do not seem to pay sufficient attention to keeping good records (Aiumlami, 1999). As part of animal husbandry, record keeping is an important means to monitor progress and identify problems in the dairying operation. According to Sastry and Thomas (1981), it is important that accurate records be kept on a dairy farm. Records must be simple and easy to understand in order to be effective.

2.3.5. Animal health services

Disease are an important cause of reduced productivity of meat and milk as well as draft, hides and dung fuel (Rhodostits, 2001).Rhodostits (2001) indicated that the basic structure of health management program includes scheduled herd visit by the dairy veterinarian, but the actual interval for scheduled herd visit is variable and some what dependent on herd size, the calving

pattern during the year and the number of animals that can be dealt by the farm. Thus for a small herd of less than 60 cows, once every three weeks will be sufficient (Arthur, 2001).

According to Rhodostits (2001) the top five reasons veterinarians visit dairy farms are individual animal diagnosis and treatment, provision of drugs and vaccines; vaccination consultation and services; reproduction consultation and services and herd diagnosis services.External or ectoparasites are major problem in Ethiopia (SDDP, 1998). Ticks, flies, fleas and lice infect dairy cattle with dangerous and often fatal diseases. Regular spraying or dipping is the only reliable methods in external parasite control. Dipping is not practical in most areas, so spraying for ectoparasites is a more appropriate technology because it can be done regularly and at a low cost (Sastry and Thomas, 1981).

2.4. Production Performance Of Dairy Cattle

2.4.1. Lactation length and milk yield

Lactation length refers to the period between calving and drying off. Lactation yield milk production through out the lactation period and is very much affected lactation length. Milk yield could be measured in terms of lactation yield, 305 days lactation or annual yield. Three hundred five days lactation is a reference lactation yield and is indicative of milk production capacity of animals. Breed, level of nutrition, parity, suckling, and other management factors affect lactation length. Therefore, attempts to increase milk yield through cross breeding, selection, better feeding and improved management will extend lactation length (Taneja, 1999).

The mean lactation length of Arsi and zebu was 271 and 303 days respectively. On the other hand, the lactation length of crossbreed was 334 and greater which varies with the blood level of crosses (Kiwuwa *et al.,* 1983). The average lactation length of crossbred dairy cows in Agarfa Multi -purpose training center, Bale region estimated was 330.7+_ 2.0days (Keberu, 2000).

2.4.2. Milk yield

The first and most important norm for cattle rearing is to obtain milk for family use and sale. How ever, milk yield of endogenous cattle is very low. Average daily milk off-take per cow rangesfrom 1.5 to 2 liters over 150-180 day lactation period (FAO,1993).Degena and Adugna (1999) reported that milk yield have remained low with national average of 1.09 liters /day/cow.This is mainly because of feed shortage, disease, and limited attempetes at introducing improved breeds. Yitaye (1999) reported that in Awassa Woreda Sidama Zone Southerrn Ethiopia, the average milk produced per cow per day was about 1.5 liters with a range of 0.5 to 2 liters; the rest is left for direct suckling by calves. The un improved cattle normally have very low milk yield of about 200-300 kg per lactation (Brannang and Persson,1990).The report of Gryseels and Anderson (1983) indicated that there is a significant increase of milk production in the second lactation over the first lactation at Debrezeit small holder dairy farms particularly ILCA participating farmers. The adjusted annual milk yields from crossbred cows averaged 1769 liters per cow during the first lactation and 2347 liters in the second lactation length.

2.5. Reproduction Performance of Dairy Cattle

Reproductive performance is a trait of outstanding importance in dairy cattle enterprises. Size of the calf crop is all important for herd replacement and the production of milk depends heavily on reproductive activity Possible genetic improvement in virtually all traits of economic importance is closely tied to reproductive rate. The reproductive performance of cattle in the tropics is generally low. This include poor estrus signs, high frequency of silent heat, poor fertility, delayed age at puberty and age at first calving, long days open and subsequently long calving interval (Mukessa-Mugerwa, *et al.,* 1989). This can be attributed to a number of factors such as poor nutrition, diseases, management, genotype and other environmental factors.

2.5.1. Age at First Calving (AFC)

Age at first calving marks the beginning of the cows' reproductive life and is closely related to generation interval. In case of heifers, the important indices are the age of attainment of puberty

and the age at first calving (Lobago *et al.*, 2006). Under free ranging conditions with access to bulls, heifers will usually conceive soon after puberty. In confined systems, however, efficiency of heat detection, timing of insemination and other related factors will have important influence on the age at first calving. Puberty is influenced by endogenous factors such as genotype, growth and body weight as well as exogenous factors such as season of birth, rainfall, nutrition, thermal stress, rearing method, parasite and diseases (Shiferaw *et al., 2003, 2005).* Age at first calving in different Ethiopian breeds has been reported to be 35.1 to 53 months and 29.8 months in cross breed cows in central high lands of Ethiopia (Shiferaw *et al., 2003, 2005;* Lobago *et al.*, 2006).

2.5.2. Calving Interval (CI)

Calving interval is the period of time between successive calvings (Hafez, 1993; Shiferaw *et al.*, 2003, 2005; Lobago *et al.*, 2006). In order to maintain optimum economic benefits under modern intensive dairy systems, it is generally accepted that the calving interval should be around one year. However, in many traditional production systems it is common to see cows calving only once every two years. The duration of this period is influenced by nutrition, season, milk yield, parity, suckling and uterine involution (Perera, 1999).The calving interval in cross bred cows in the central highlands of Ethiopia has been reported to be 25.95 months (Shiferaw *et al.*, 2003, 2005).

2.6. Marketing of Milk and Milk Products

Dairy development in Africa has been hindered by marketing constraints including poor access to markets, low availability of products and absence of structural marketing system(International Development Research center (ILRI,2000).

There are basically two milk marketing systems in Ethiopia. These are formal and informal marketing systems (Stall and Shapiro, 1996).Until 1991, the formal market was exclusively dominated by DDE which supplied 12 % of the total fresh milk in Addis Ababa area (Holloway *et al.*, 2000). Currently how ever, private businesses have begun collecting, processing, packing and distributing milk and milk products. These formal milk markets are particularly limited to peri-

urban areas and the proportion of total production being marketed remains small (Muriuki and Thorpe, 2001).

The other formal marketing system in recent years is that of milk marketing groups and diary cooperatives. These milk marketing groups and cooperatives buy milk from both members and non –members, process it and sell products to traders and local consumers.

The informal marketing system includes direct sales of milk or milk products (butter, cheese) to individuals of immediate neighborhood and local markets, institutions (restaurants, hotels, etc.), private raw milk traders, to retail outlets, and to informal dairy processors. The majority of milk produced in Addis Ababa milk shed, about 75%, goes through this channel which avoids taxation and quality control. Direct sales by milk producers to consumers and direct sales milk producers to institutions comprised 44.1% and 26.9%of total milk marketed (Staal and Shapiro, 1996). In Tanzania and Uganda the total milk marketed formally is estimated to be <5% (Kurwijila, 2002) and in Kenya it is about 15% (Omore *et al.,* 1999). Rural areas which distant to big cities have limited or little, if any, markets for liquid milk and milk surplus in such areas will be converted to butter and or ghee and sometimes cheese and sold in local markets (Debrah and Birhan, 1991).In some parts of Ethiopia, Butter is sold to lorry drivers and bus Passengers enroot to Addis Ababa some 500 km away (Coppock, 1994).
It is characterized by no licensing requirements to operate, low cost of operations, high producers price compared to formal market and no regulation of operations (Mohamed *et al.,* 2004).

2.7. Milk Processing

Though there are few milk processing plants in Ethiopia much of the milk produced is processed at home using the traditional technologies (O' Mahoney, 1988). Generally because of the small amount of milk produced for processing on small holder farmers the technique which are different from place to place have remained simple and continued to the house hold levels for a very long time. The traditional technique of processing are generally considered to be time consuming and in efficient in terms of milk fat recovery as butter per unit of milk. More over,

besides low diversity of milk products, the quality of products is poor resulting in a comparatively short shelf life and lower price for the milk producer (ILCa, 1992).

Clay pot, bottle gourd, hollowed wood vessels, stick-having finger like projection at one end, Piece of skin, hide, plastic are the different materials used for milk handling and processing in Ethiopia. Both clay pot and the bottle gourds are used most commonly for souring and churning and wooden vessels are used in Borana area (Southern part of Ethiopia).

In the highlands of Ethiopia, milk produced by smallholders is used for family consumption and the production of butter and a cottage-type cheese. For butter making, milk is collected over a period of three or four days in a clay pot. When the milk has soured and sufficient milk has been collected, the clay pot is shaken back and forth until butter granules are formed. This method of butter manufacture may take from two to three hours, depending on such factors as temperature, the fat content of the milk, the acidity of the milk and the amount of milk in the clay pot.

To reduce the time for processing the milk into butter and to improve the efficiency of the process ILCA has developed and modified a wooden internal agitator that can be fitted to the usual clay pot used by the smallholder. The use of this internal agitator has been shown to reduce churning time from an average of 139 minutes to an average of 57 minutes (59 churnings) while reducing the fat content of the buttermilk from an average of 1.1% to an average of 0.36% (O'Connor, 1990). The buttermilk remaining after the butter has been separated from the whole milk is used to produce a cottage-type cheese (ayib) by heating the buttermilk and separating the coagulated fat and protein from the whey. The price of ayib is about one-seventh that of butter so the monetary advantage of extracting the maximum amount of fat from the milk and converting it into butter is apparent.

2.8. Constraints Of Dairy Production

In spite of long history of dairy farming in developing countries the productivity of smallholder dairying has remained at a relatively low level due to a lack of appropriate dairy technologies. Furthermore the science and technology available in developed countries can not be readily

adopted by small farmers due to their socio-economic and agro ecological conditions that are greatly different from those in industrialized countries (Chantalakhana, 1995).

According to Chantalakhana (1999) factors influencing the success of dairy production are classified into four categories: Technical, institutional, government policies, and farmer's own socio-economic factors. Lack of any of these supportive factors could become a constraint on the level of achievement of any dairy development program.

2.8.1. High human population and livestock composition.

The non-technical constraints of dairy developments generally include a variety of Socio-economic and institutional considerations, which in most cases are common constraints to other Agricultural sector in the country. Human population increases (2.9-3% percent per anum). This high population growth will forces people to cultivate more land at the cost of grazing land and requires more traction power and as a result the herd in particular and the livestock population at large will be composed of more traction animals that create pressure on the grazing land (ketema and Tsehaye,1995).

Many animal health problems result from the interaction among the technical and non technical constraints themselves such as poorly feed animals develop low diseases resistance and have fertility problems. Many of the diseases constraints are also a consequence of the non technical constraints. For example insufficient money to purchase drugs and or vaccines. Even if there are veterinary services delivered by the office of Agriculture, only few farmers take their animals to the veterinary services. This is because of the fact that high cost of the medicine and low productivity of the animal which discourages farmers from use of veterinary services (Getachew, 2002).

2.8.2. Technical constraints

The major technical constraints are appreciate control and prevention of animal disease and parasites, availability of good quality feeds and clean water, appropriates dairy breeds for the environment and good farm management and husbandry practices(Chantalalakhana, 1999).

Disease and parasites are a relatively larger problem for SHD in developing countries. Disease such as foot and mouth (FMD), tuberculosis, and foot rot are more common on SHD farms. Flies and ticks are more prevalent in the tropics as well as internal parasites such as liver fluke, round worm, and others. In relation to animal health problems, methods of disease diagnosis are important area of research. For infectious disease like FMD epidemiological research deserves high priority in order o implement effective control and prevention measures (Chantalalakhana, 1999).

Knowledge concerning dairy herd management such as barn types, feeding methods, waste management, and calf feeding and care, in relation to, tropical conditions is lacking. Western technologies in these areas have been proven to be mostly impractical for developing countries, due to differences in socio-economic and climatic factors. Problems with mastitis and reproduction in dairy cattle are mainly related to animal management, feeding, milking and health care. Improvement of dairy management practices require much research and would prove profitable to SHD farmers (Chantalalakhana, 1999).

Dairy extension services provide artificial insemination, health care, such as vaccination and other services which are constantly required by farmers to improve their farming efficiency. Research on various aspects of dairy production including socio-economics and policy studies is required to isolate constraint to further improvement in SHD. Government departments and universities need to be well equipped with dairy research facilities technical and social research skills to be able to conduct research. The lack of effective dairy extension services and adequate research support appeared to be the two major constraints in dairy production (Chantalakhana, 1995).

Water is scarce resource in many parts of the rural Ethiopia. Limitations on water intake depress animal performance quicker and more drastically than any other nutrient deficiency. Water deprivation affects feed intake metabolism and productivity (Steiger *et al.*, 2001).

According to Tsehay (1997), about 99% of the cattle population in Ethiopia is indigenous breeds that are adapted to feed shortages, diseases challenges and harsh climate. The productivity of indigenous livestock is, how ever poor even if no practical recording scheme has been used to judge their merit.

2.8.3. Institutional constraints

Examples of the institutional support required to facilitate dairy industry growth include credit institutions, farmer training facilities, milk collection centers, processing and marketing facilities, Cooperatives or groups and research and extension services.

Most SHD farmers have limited financial resources and depend mainly on bank loans for farm investment. These farmers have little formal education and limited knowledge of dairy husbandry. At least two to three months of intensive practical training is required to provide farmers with the reasonable technical back ground in dairy farming. A milk collection and cooling center is required, to collect milk from SHD farms, and then transport it to a milk processing plant for processing, packaging and marketing products (Chantalakhana, 1999).

Farmer organizations such as dairy cooperatives are important for SHD development. The milk collection and cooling center, feed mill, AI service, milk processing and marketing all have to be well organized in order to promote SHD. These business enterprises can be operated by a dairy cooperative or a farmer association. In developing countries dairy cooperatives are not usually strong in business operations .It is important to assess of existing farmer organizations and determine methods to strengthen them.

2.8.4. Government policies

Expansions of dairy development could benefit from related government polices conducive to dairy farming.

Dairy import policy: The dairy imports have implications on food availability, over all imports and development of domestic milk production. According to the 1994 report of DDE imported dairy products have a substantial market share in Addis Ababa (Belachew, 1997) and have impact on the price of milk from local producers.

Marketing system and price policy: Staal *et al.* (1998) indicated that most milk and dairy marketing (88%) in Ethiopia occurs through the informal sector. The informal market is scarce especially for the small holder farmers during the fasting seasons of the Ethiopian orthodox Christians when people do not eat animal products (Ruther *e al.*, 1998).

Quality control and public health issues: There are no official rules and regulations to control the quality of milk produced and distributed to consumers. At the DDE milk quality control and pasteurization is practiced routinely for milk entering the processing plant, which is a very small proportion of the total amount of milk produced in the country (13%) (Ruther *et al.*, 1998).

Infrastructure: Partial or complete lack of properly constructed all weather roads in the country affects rural dairy farming in that farmers are not able to deliver dairy products to the open market and buy dairy inputs easily. Further more, most animal feeds are by products of human food production plants with unreliable availability. The small number f state owned and private animal feed production plants do not fulfill the demand of the growing dairy farming sector. (Cateley, 1999).

2.8.5. Socio- economics constrains

In general, small scale farmers in developing countries have many important features in common, for example, limited physical and financial resource, funds, subsistence production and limited education. On the other hand, they differ in many ways, such as culture traditions, beliefs,

farming practices, soils, rainfall and marketing conditions. There fore technology success full in one location may not be accepted by farmers in another location or even by different farms in the same location. It is also found that technologies not adopted by farmers at one time, may become widely used after changes in economic or other conditions.

Certain socio-economic factors such as income from off-farm jobs which may affect farm productivity, availability of capital, milk prices, price of land, farmer education and training and availability of family labor, influence of dairy farmer's decision on whether to expand and improve dairy operations(Chantalakhana, 1999).

3. MATERIALS AND METHODS

3.1. The study area

The study was conducted in Debre-Markos Woreda, which is located in Eastern Gojam Zone of Amhara National Regional State. Debre-Markos is found at $10^{0}20'$N and $37^{0}40'$E and the elevation is 2411 meters above sea level. Debre-Markos is the capital city of Eastern Gojam Zone and is located at a distance of 300 km northwest of Addis Ababa and 265 kilometers from Bahirdar, which is the capital city of the Region. The Woreda has seven (7) kebeles. The climatic condition of Debre-Markos is Woinadega, with mean annual temperature of 14.5^{0}C and a range of 13.2^{0}C in July and August and 17.3^{0}C in March. Mean annual rainfall is 1300 mm. More than 75% of the total rain falls in the months of June, July, August and September locally known as 'kiremt' season. The driest months are November, December, January and February locally known as 'bega' season, when less than 5% of the annual total rainfall occurs. Debre-Markos's economy depends largely on agriculture. Its climate is ideal for cultivating teff, the main ingrediant for injera, the national staple. Considered to be a high potential crop- livestock zone and where dairy activity plays a significant role in the livelyhood of the farming community. The human population of Debre-Markos is 107,684 out of these 101, 983 (54,928 female and 47,055 males) live in the towns while 5, 701 (2,863 female and 2,838 males) live in rural areas.

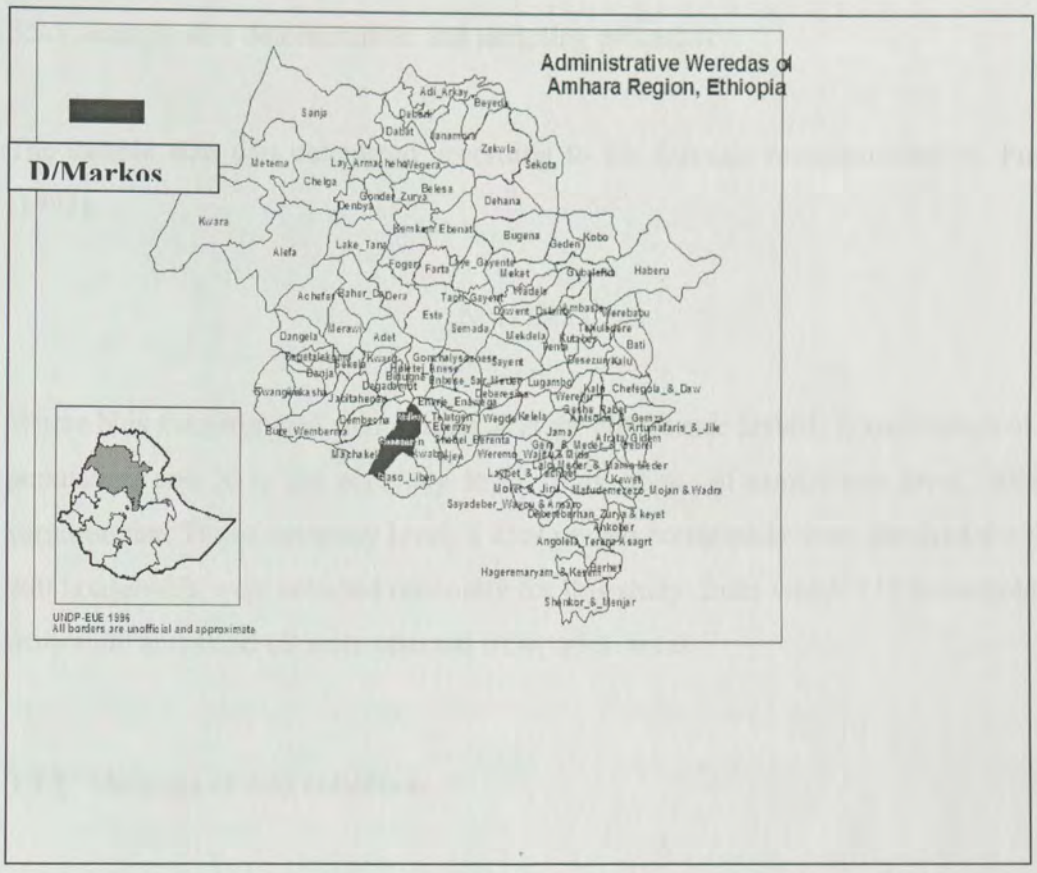

Figure 1: Map of the study area

3.2. The study population

Households possessing dairying cattle in Debre-Markos Woreda and cattle owned by these households represented the study population.

3.3. The Study design

A cross-sectional and retrospective type of studies were conducted using questionnaire survey, participatory methods and observation to collect data on characteristics and practices of smallholder dairy production systems from October 2007 to April 2008.

3.3.1. Sample size determination and sampling procedure

The sample size was calculated according to the formula recommended by Poete and Daplyn (1993):

$$N=(ZC/X)^2$$

Where N is the estimated sample size, Z is the confidence level C is coefficient of variation in the population and X is the accuracy level. With 95% of confidence level, 50% coefficient of variation and 7% of accuracy level, a total of 196 households were required for the study. Thus, 200 households were selected randomly for this study, from which 132 households were selected from rural areas and 68 were selected from urban areas.

3.3.2. Methods of data collection

Questionnaire survey

Detailed structured questionnaire was prepared and used to collect information through interviewing household head or in his/her absence, the most senior member available or the household member responsible for the farm. The questionnaire was pre-tested to check clarity and appropriateness of the questions and corrected when it was necessary. Some of the information collected through interview was supported by observation.

The data collected through interview was divided into sections covering: demographic characteristics, family size and composition, land holding and use pattern, livestock herd size and composition, objectives of dairy farming, division of labor in dairy production, housing condition of dairy cattle, dairy cattle feeds and feeding systems, breeding practices, record keeping, milk marketing and processing, reproductive and productive performance of dairy cattle, dairy cattle health problems and constraints.

Participatory appraisal

A total of five groups were formed, each containing 8-12 individuals. The group constituted both men and women members of the community, community leaders, livestock experts and Kebele development agents.

The information generated thorough the participatory method were constraints of dairy cattle production.

Personal observation

Data collected through observation of the farm environment were assessing housing conditions, feeding and feed storage practices, daily milk yield of dairy cows, livestock number and health status of animals and availability of farm records.

3.3.3. Data analysis

The data collected from the study was entered into Microsoft –Excel- spread sheet computer program and analyzed using SPSS statistical software computer programs (version 15, 2006). Descriptive statistics like percentage, mean, standard deviation and frequency distribution were used to describe the farming system characteristics in the study area. Analysis of variance was used to test mean differences in the different production system.

4. RESULTS

4.1. Demographic characteristics

Table 1 shows the demographic characteristic of the sampled households in Debre-Markos Woreda. The overall average family size in Debre-Markos "Woreda" was 5.89 persons. The average family size was almost the same, 5.87 and 5.90 persons in urban and rural areas, respectively. From the overall sampled households, 83.5 % were male headed households and the rest (16.5 %) were female headed households. The highest percentage of female headed households was found in urban areas (23.53 %) and the lowest percentage was found in rural areas (12.87 %). Among the interviewed households, all urban area dwellers were engaged only in livestock production activity while in rural areas almost all (99.24 %) were engaged in both crop and livestock production activities. Assessments of educational level of household heads indicated that generally, illiterate, junior secondary school, and high school and above constitute 38.0 %, 43.5% and 18.5 % of the respondents, respectively. In the urban area, the proportions for illiterate, junior secondary school, high school and above were 19.12%, 36.76% and 44.12%, respectively and in rural areas it was 47.73 %, 46.97 % and 5.30 %, respectively. The majority (54 %, n=108) of the households were between 41-64 years of age. The higher proportion of households (54.41 %) in urban area had a farming experience of less than 10 years as compared to those in rural areas (20.45 %).

Table 1: Demographic characteristics of dairy farm owners in the study areas

Variables and categories		Urban area (n=68) % (frequency)	Rural area (n=132) % (frequency)	Overall (N=200) % (frequency)
Sex of house hold head	Male	76.47(52)	87.12(115)	83.50(167)
	Female	23.53(16)	12.88(17)	16.50(33)
Type of agriculture	Live stock only	100%(68)	0.76(1)	34.50(69)
	Crop and livestock	-	99.24(131)	65.50(131)
Age of house hold head	Less than 40 years	11.76(8)	31.06(41)	24.50(49)
	41-64 years	58.82(40)	51.52(68)	54.00(108)
	> 64 years	29.42(20)	17.42(23)	21.50(43)
Level of education	Illiterate	19.12(13)	47.73(63)	38.00(76)
	Primary and junior secondary school	36.76(25)	46.97(62)	43.50(87)
	High school and above	44.12(30)	5.30(7)	18.5(37)
Experience of dairy farming	<-10 years	54.41(37)	(21.22)28	65(32.50)
	11-20 years	38.24(26)	(39.39(52)	78(39.00)
	>-21 years	7.35(5)	(39.39)52	57(28.50)

4.2. Land holding and land use pattern

The average land holding in the rural areas was 0.98 hectare with land size ranging from 0.25 hectares to 4 hectares. The land use pattern in the rural area showed that nearly all of (96.96 %) the legally tenured land was used for crop production and the remaining 1.54 % and 1.50 % of land was used for plantation and natural pasture, respectively. The plantation area is mainly covered by eucalyptus tree and Gesho. The major crops produced in the rural areas of the study site were oat (*Avena sativa*), "teff" (*Eragrostis teff*) and wheat which cover 30.29%, 29.26% and 20.22% of the croplands in the rural areas of the study site. The other crops grown in the study

area were maize, barely, "noug" (*Guizotia abbyssinica*), linseed, beans and peas which cover 8.54%, 5.53%, 2.54%, 1.03%, 1.03% and 0.99% of cropland in the study area, respectively.

The majority of the households (92.65 %) of urban area were land less. Only 7.35 % of urban area dairy farms (n= 5) have legally tenured land. The land holding of those households ranged from 1-10 hectares.

4.3. Livestock and cattle herd composition

The average livestock herd size and composition in the study area are indicated in Table 2. The average livestock holding per house hold in Debre-Markos Woreda was 7.32 TLU with an average livestock holding of 5.32 TLU and 8.36 TLU in urban and rural areas, respectively. The average cattle holding per house hold in Debre-Markos Woreda was 6.89 TLU with average cattle holding of 5.26 TLU and 7.73 TLU in urban and rural areas, respectively. In both rural and urban areas, the livestock herd was dominated by cattle. Next to cattle donkeys, sheep and poultry comprised only a small proportion of livestock herd in the study area; their proportion being higher in rural areas. Donkeys were found only in rural areas. The goat population in both urban and rural areas was almost zero and was not included in the calculation.

Table 2: Average livestock holding (in TLU) per household in the study areas

Livestock species	*Urban area (n=68)*		*Rural area (n=132)*		*Overall (N=200)*	
	Mean (SD)	%	Mean (SD)	%	Mean (SD)	%
Cattle	5.26	98.86	7.73	92.44	6.89	94.08
Sheep	0.03	0.55	0.24	2.87	0.16	2.33
Horse	0.02	0.44	0.09	1.09	0.07	0.94
Donkey	-	-	0.27	3.27	0.18	2.49
Poultry	0.01	0.15	0.03	0.33	0.02	0.16
Total	5.32	100	8.36	100	7.32	100

SD=standard deviation, TLU=Tropical LivestockUnit, 1TLU=250kg adopted from Abdinasir (2000)

4.4. Cattle herd composition by breed

The cattle breeds found in Debre-Markos Woreda were local breeds (short horned zebu) and Holstein -Friesian x (short horned zebu) crossbreeds. The cattle herd size and composition in the urban and rural areas is indicated in Table 4. The mean cattle herd size per household was 7.35 and 11.60 in urban and rural areas, respectively. The range was from 2-37 cattle in urban areas and from 2- 45 cattle in rural areas. The cattle herd composition in urban and rural areas was dominated by cows which was 41.20% and 29.00% in urban and rural areas, respectively. Crossbred cows comprised 31.1% and 3.38% in urban and rural areas, respectively. Average cow holding per household was 3.03 and 3.36 in urban and rural areas, respectively. The proportion of steer was higher next to cows in rural areas (20.31%) and extremely few in urban areas (0.6%), which were kept for fattening purpose. Average oxen (steer) holding per house hold was 2.36 in rural areas 0.02 in urban areas.

Table 3: Cattle herd size and composition in the study areas

Variable	Urban Area (n=68)		Rural Area (n=132)	
	Mean	%	Mean	%
Herd size	7.35	100%	11.60	100%
Cows	3.03	41.20	3.36	29.00
Local	2.12	69.90	3.25	96.62
Cross	0.91	31.10	0.11	3.38
Heifers	1.41	19.20	2.22	19.20
Bulls	1.30	17.60	1.93	16.65
Calves	1.59	21.60	1.72	14.83
Steers	0.02	0.60	2.36	20..31

4.5. Division of labor in dairy production.

Family labor was involved in 91.18 % of urban dairy farms and in all rural dairy farms in dairy activities. Cattle herding was done by hired laborer in 48.53% of urban dairy farms and 29.55% of rural dairy farms for whom 2 birr per cow is paid monthly for herding cattle in communal areas in both rural and urban area farms. As reported by farmers during group discussion, individual interview, and field observation, the allocation of labor in the area is usually determined by the composition of the household. Livestock herding mostly was undertaken by the children and whose age was between 6 to 14 years of age. And adult males and females also herd cattle during the absence of children. Feed collection, milking, health monitoring, selling animals were done by both adult males and females. Other activities such milk processing, cleaning cattle shed, selling of milk and milk products, cow dung making aand calf management were performed mostly by females.

4.6. Dairy cattle production objectives

In the rural areas the main objective of keeping cattle was for drought power, home consumption of milk and milk products, income from sale of animals, income from sale of milk and milk products (butter) and manure in decreasing order of importance (Table 4). In urban areas, the objective of keeping dairy cattle was for home consumption of milk and milk products, income from sale of animals, income from sale of milk and milk products (butter, cheese, fermented milk) and manure in decreasing order of importance.

Table 4: Dairy cattle production objectives and ranks in the study areas

Production objectives	***Urban area***				***Urban area***				
	Ranks				Ranks				
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	5th
Drought power	0	0	0	0	88.6	3.0	3.8	0.8	0
Home consumption of milk and milk products	75.0	23.5	0	1.5	10.6	87.1	2.3	0	0
Income from sale of animal	2.9	60.3	36.8	0	0.8	9.1	73.3	12.9	0
Income from sale of milk and milk products	22.1	16.2	42.6	10.3	0	0.8	15.2	63.6	15.9
Source of manure	0	0	20.6	73.5	0	0	1.5	22.3	76.2

4.7. Dairy cattle management

4.7.1. Dairy cattle housing

Table 5 shows different cattle housing conditions in the study area. In rural areas animals were housed in open barn in 81.8%of the farms, in separate enclosures in14.4% of the farms and together with family house in only 3.8% of the farms. The floor types were found to be 86.4 % hardened soil and 13.6% stone slab. Based on the presence and size of air inlets and outlets, 94 % of the farm housings allow good air exchange but in 6 % of the households housing systems did not allow adequate ventilation.

In urban areas, animals were housed in open barn in 25 % of the farms and in separate enclosures in 75% of the farms. The floor types were found to be 10.3% concrete, 60.3 % stone slab and 29.4 % hardened soil. Based on the presence and size of air inlets and outlets, 97 % of the farm

housings allow good air exchange but in 3 % of the households housing systems did not allow adequate ventilation.

Table 5: Percent (frequencies) of dairy cattle housing conditions in the study areas

Parameters and their categories		*Urban area % (frequency)*	*Rural area % (frequency)*	*Over all % (frequency)*
Type of house	Open barn(only fence)	25.0(17)	81.8 (108)	62.5(125)
	Separate enclosure	75.0(51)	14.4(19)	35.0(70)
	Within family house	0.0(0)	3.8(5)	2.5(5)
Floor type	Concrete	10.3(7)	0.0(0)	3.5(7)
	Stone slab	60.3(41)	13.6(18)	29.5(59)
	Hardened soil	29.4(20)	86.4(114)	67.0(134)
Ventilation	Good	97.0(66)	93.9(124)	95.0(190)
	Poor	2.94(2)	6.0(8)	5.0(10)

4.7.2. Dairy cattle feeds and feeding systems

All the farms in the rural areas and most of the farms in the urban area (77.9 %) practiced full day free grazing. The remaining 13.0 % of urban dairy farms practiced 2-4 hours grazing per day and 9.1% of them practiced zero grazing. But, in the case of crossbred cattle, rural area farms graze their animals for 2-4 hours per day in the morning and evenings when sun light drops.

The common feeds utilized in urban area farms were crop residues, grazing, hay, concentrate and non-conventional feed (atela) utilized by 92.6%, 88.2%, 70.6%, 56% and 51.5% of respondents, respectively. The common feeds utilized in rural area farms were crop residues, grazing, hay, concentrate and non-conventional feed (atela) utilized by 100%, 100%, 18.2 %, 6% and 3.8 % of respondents, respectively.

The majority (80%) of the farmers in the rural areas depended only on farm produced fodder while the remaining 12 % depend on both purchased and produced feeds. In urban areas, 82.35 %

used only purchased feed while the remaining 17.6% used both farm produced and purchased feeds. Conservation of feed was practiced in 96.96% of the rural area and 23.52 % of urban area dairy farms. Forage development was practiced in none of the farms except two farms having sesbania trees and the other having Elephant grass seedlings in urban and rural areas, respectively.

Sources of water for dairy cattle in urban areas were river, pond, and pipe water utilized by 82%, 42.6%, and 27.9% of respondents, respectively. While in rural areas river and ponds were the water sources utilized by 100% and 1.55% of respondents, respectively.

Two types pre-weaning calf feeding systems were identified. In the study area all households having local calves used partial suckling until lactation is completed. However, out of 29 interviewed households having crossbred calves 55.2% (n=16) used bucket feeding method while the remaining 44.83 % (13) used partial suckling until lactation is completed. In addition to milk, calves were supplemented with "lit" (lenquata) mucilage (which serves as a milk replacer) and coarsely ground oat floors mixed with water. Bucket feeding methods were almost equally practiced in urban and rural areas 58% and 50%, respectively. Whereas, lenquata is commonly utilized in rural areas as a milk replacer in early age of calves.

Table 6: Major feeding systems practiced and proportional utilization of feed resources in dairy farms in the study area

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Parameters and their categories	*Urban area n=68*	*Rural area n=132*	*Over all N=200*
	Percentage (Frequencies)	Percentage (Frequencies)	Percentage (Frequencies)
Feeding systems			
Free grazing(fulltime)	77.9(53)	100(132)	92.5(185)
Stall feeding	13.2(9)	0(0)	4.5(9)
Stall feeding with limited grazing	8.8(6)	4.5(6)	6(12)
Main feed types			
Grazing	88.2(60)	100(132)	96.0(192)
Crop residues	92.6(63)	100(132)	97.5(195)
Hay	70.6(48)	18.0(24)	36.0(72)
Concentrate	55.9(38)	6 (8)	23.0(46)
Non conventional feeds	51.5(35)	3.8(5)	20.0(40)
Feed conservation practice% farms	23.5(16)	97.0(128)	72.0(144)
Source of feed			
Farm produced	0 (0)	87.1(115)	57.5(115)
Purchased	82.4(56)	0.7(1)	28.5(57)
Both farm produced and purchased	17.6(12)	12.1(16)	14.0(28)
Sources of water			
River	82.4(56)	100(132)	94.0(188)
Well	27.9(19)	1.5(2)	10.5(21)
Pipe	42.6(29)	0(0)	14.5(29)

4.7.3. Breeding practices

All of the interviewed households in urban and rural areas used natural mating. Out of these 27.9 % (n=19) of urban farms used crossbred bull service while only 6.8% (n=9) of the rural farms used crossbred bulls. The rest 72.0% of urban farms and 93.2% of rural farms used uncontrolled natural mating with local bulls. The source of crossbred bull in the urban and rural areas were neighbors in 84.2% (n=16) and 88.9% (n=8) of the households, respectively.

4.7.4. Record keeping

There was no any sort of record system in the rural areas nd only 7.3% of the urban farms practiced keeping records about input cots and output prices.

4.8. Production and reproductive performance of dairy cattle

Table 7 shows the production and reproductive performance of crossbred and local breed cattle in Debre-Markos Woreda. Based on farmers report, the overall average daily milk yield for local and crossbred cows' was 1.50 ±0.68 liters and 7.3±4.65 liters, respectively. For urban and rural areas, average daily milk yield for local cows was 2.00±0.52 and 1.30±63 liters and for crossbred was a 7.81±4.27 and 6.14±5.6 liter, respectively. The difference in milk yield between crossbred and local cows and between indigenous cows in urban and rural areas was statistically significant ($p<0.05$). The milk yield for crossbred cows in urban and rural areas was not statistically significant ($p>0.05$).

The mean lactation length for local and crossbred cows was found to be 8.87±1.55 month and 8.56±1.75 months, respectively. For urban and rural areas, average lactation length for local cows was 8.26±1.68 and 9.12±1.43 months and for crossbred cows was 8.41±1.90 and 9.00±1.26 months, respectively. As indicated in Table 7, daily milk yield of cross bred cows was greater than that of local bred cows nearly by five fold.

The overall mean age at first calving in the study area for local and cross bred cattle was 56.28±5.29 and 35.44±11.15 months, respectively. For urban and rural areas, average age at first calving for local cows was 54.15±6.79 and 57.16±4.26 months and for crossbred was a 33.20±10.25 and 40.85±12.15 month, respectively.

The overall reported average calving interval for cross bred and local cows were 13.94 and 20.74 months, respectively. For urban and rural areas, average calving interval for local cows was 18.81±3.06 and 21.52±4.73, respectively and for crossbred cows was 13.26±1.2 and 15.57±2.76, respectively.

In general, crossbred animals performed better than the local ones in daily milk yield, age at first difference between calving and calving interval. There was statistically significant difference in all the above mentioned parameters except lactation length between local cows in rural and urban areas ($p<0.05$). The performance of local breeds in daily milk yield, age at first calving and calving interval was better in urban areas than in rural areas while lactation length was extended in rural areas. In the case of crossbred cattle, there was statistically difference only in calving interval of cows in rural urban areas ($p<0.05$). Crossbred cows in the urban area had shorter calving interval than those in the rural areas (Table 8).

Table 7: Production and reproductive performance of dairy cattle in the study areas

Variables	Urban area	Rural area	Overall	P value
	Mean (SD)	Mean (SD)	Mean(SD)	
Milk yield per day (liter)				
Locals breeds	2.00± (0.52	1.30± 0.63	1.50±0.68	0.000
Cross breeds	7.81±4.27	6.14±5.61)	7.30±4.65	0.442
Lactation length(months)				
Locals breeds	8.26± (1.68	9.12±1.43)	8.87± 1.55	0.001
Cross breeds	8.41± (1.90	9.00± (1.26	8.56±1.75	0.493
Age at first calving (months)				
Locals breeds	54.15±6.79	57.16±4.26	56.28±5.29	0.000
Cross breeds	33.20±10.25	40.85±12.15	35.44±11.15	0.129
Calving interval(months)				
Locals breeds	18.81(3.06)	21.52(4.73)	20.74(4.48)	0.000
Cross breeds	13.26(1.20)	15.57(2.76)	13.94(2.03)	0.008

SD=standard deviation

4.9. Milk production, marketing and processing practices

Milking was two times per day during morning and evening except 4 farms in urban areas and 2 farms in rural areas, which practiced three times per day. Detailed information of milk marketing and processing is shown in Table 8 below. Results indicated that four types of milk and milk products were sold to consumers. These were milk, butter, fermented milk (yoghurt) and cheese. Butter was the most commonly sold milk product in the study area (93%) of the farms followed by raw milk (36%). In urban area 85.29%, 45.58%, 5.88%, and 4.41% of dairy farm owner practiced butter, raw milk, fermented milk and cheese, respectively. In the rural areas only butter and raw milk selling was practiced by 96.96% and 31% of the dairy farms, respectively.

Among households selling raw milk, 93 % and 8% of the households sold directly to consumers and hotel (restaurants), respectively. The price of whole milk varied in urban and rural areas. In

rural areas whole milk was sold at 3 birr per liter and in urban areas it was sold at 4.5 birr per liter. One kg of local cheese was sold at 8 birr per kg. About 92 % of farm households practiced milk processing. Among milk processing households 99 % use traditional milk processing equipment (clay pot). Most (92%) of farm the households processed raw milk at least to sour milk, butter, ghee, cheese and butter milk. And small proportion of households processed also local cheese into a product locally known as 'metata" which stays for a long time (one year) without spoilage specially during the long fasting period. Metata, ghee and buttermilk were used only for home consumption in the area.

Table 8: Types of milk and milk product marketed and milk processing practice in the study areas

Milk products sold	Urban area %(frequency)	Rural area %(frequency)	Over all %(frequency)
Raw milk	45.58 (31)	31.00 (41)	36.00 (72)
Fermented milk(yoghurt)	5.88 (4)	-	2.00 (4)
Butter	85.29 (58)	96.96 (128)	93.00 (186)
Cheese	4.41 (3)	-	1.5 (3)
Raw milk sellers to consumers	83.87 (26)	97.56 (40)	93.05 (67)
Raw milk sellers to Hotels and Rest.	16.12 (5)	2.43 (1)	8.33 (6)
Milk processing house holds	82.35 (56)	96.96 (128)	92.00 (184)
Use modern processing equipment	3.57 (2)	-	1.08 (2)
Use traditional pot clay	96.24 (54)	100 (128)	98.91 (182)

4.10. Dairy cattle diseases

Based on the symptoms given by interviewed farmers, the most commonly encountered animal health problems in the study area were liver fluke, foot and mouth disease (FMD), external parasites, black leg, anthrax and abortion. Dermatophilosis and lumpy skin disease were also other health problems. Only 7.5 % (n=15) of the interviewed households used modern health service from private clinics. The rest 92.5% use traditional method of treatment. Two hundred

forty four (10%) cattle (106 caves, 72 cows, 24 bulls, 26 steer and 16 heifers) died within the last 12 months of the study period. The causes of cattle mortality were disease, plastics, feed shortage, injury and calving difficulty for 60%, 17.7%, 11.5%, 5.7% and 4.5% of died cattle respectively.

Table 9: Common dairy cattle health problems in the study areas as reported by interviewed households

Common health problems	Urban area % (frequencies)	Rural area % (frequencies)	Overall % (frequencies)
Black leg	29.4(20)	46.2(61)	40.5(81)
Anthrax	29.4(20)	39.4(52)	36.0(72)
External parasites	16.2(11)	53.0(70)	42.(84)
Dermatophilosis	4.4(3)	18.2(24)	13.5(27)
Liver fluke	57.3(39)	53.8(71)	55.0(110)
Foot and mouth disease	36.76(25)	47.0(62)	43.5(87)
Abortion	19.1(13)	16(21)	17.0(34)
Lumpy skin disease	17.6(12)	16(12)	12.0(24)

4.11. Constraints of dairy production

Identification of major dairy production constraints was the other important part of this study, using group discussion and individual interview. Table 11 presents the six major constraints identified by the respondents during individual interview. These were animal disease (88%), scarcity of improved genotype (82.5%), feed shortage (71%), milk market (32%), lack of space (23%) and water shortage (20.5%).

In the rural areas, livestock disease was mentioned as the most important constraint by most of cattle owners (95.5%) followed by scarcity of improved genotype (90 %), feed shortage by (65.5%), milk market (28.8%) and water shortage (28.0%). In contrast, in the urban areas, feed shortage was mentioned as the most important constraint (82.3%) followed by animal

disease(73.5%), scarcity of improved genotypes (67.6%), lack of space (60%) and milk market (38%) and water shortage (6%). Group discussion conducted at five sites also identified the same constraints forwarded during the individual interview.

Table 10: Constraints of dairy production as identified by selected households

Constraints	Urban area %(frequency)	Rural area %(frequency)	Overall %(frequency)
Scarcity of improved genotype	67.6 (46)	90.15 (119)	82.5 (165)
Disease	73.5 (50)	95.5 (126)	88.0 (176)
Water shortage	6 (4)	28.0 (37)	20.5 (41)
Milk market	38.2 (26)	28.78 (38)	32 (64)
Feed shortage	82.35 (56)	65.15 (86)	71 (142)
Lack of space	60.3 (46)	0 (0)	23 (46)

5. DISCUSSION

The mean value of family size in Debremarkos Woreda (5.89 persons) was higher than what was reported by CSA (2002) which was 4.77 persons for East Gojjam Zone. This difference might be the reflection of the steady growth of the population; the CSA survey was done some five years back. However, our result is closer to the family size that indicated for the whole country (5.15) by CSA (2005).

Female headed dairy farms were only 16.5 % of the total. This percentage which is higher (23.53 %) in urban areas as compared to (12.87%) in rural areas was in agreement with the observation of increased proportion of female headed dairy owners in the urban and peri-urban areas by Yoseph *et al.* (2003). Crossbreed cows were not available in female headed farms. Local breed cow number was also smaller in female headed farms. The low technology uptake might be due to shortage of family labour in female headed households. This result differs from the findings of Mekonnen *et al* (2006) who stated for Addis Ababa area that women owned 38% of smallholder farms and had more cows (median = 3) than men - owned ones.

Most dairy farm activities in 91% of urban area farms and all rural area farms are done by family labour. This shows the higher role of family labour in small holder dairy production as reported by (FAO, 1997).A considerable proportion of farm activities were performed by females which shows the role of women in dairy production activities.

The higher proportion of house holds (54.41%) in urban area had a farming experience of less than 10 years as compared to the proportion of rural area house holds (20.45%) show there has been a dramatic increase in the number of farms in the last 10 years, which means the dairy production activity is becoming attractive to more people especially in the urban areas.

Land, which is a key asset, was scarce in the area. The average individual household land holding of rural areas was 0.98 ha .This result is lower than what was reported by Jayne *et al.* (2003) for the whole country as 1.17 ha per household. This shows population density and agricultural land shrinkage due to expanding urbanization.

The average livestock holding per household in urban areas (8.36 TLU) was higher than those reported by Solomon (2006) for Dejen Woreda which was 5.45 TLU but lower than those reported by Abdinasir (2000) for Arsi area which was 11.86 TLU. The proportion of cattle (92.44%) in this study was higher than the report of Solomon (2006) for Dejen Woreda Eastern Gojjam in which cattle constituted 88% of animals. It was also higher than the report of kelay (2002) for Sellale area in which cattle constituted 54.6% of all animals kept. The probable reason for higher proportion of cattle as compared to Dejen and Sellale areas could be in the later areas the grazing site is generally swampy, which affects susceptible animals more. On the other hand in the present study area there is higher need of cattle for traction of crop lands especially of teff which needs more number of ploughing and seed beds leveling to kill the seedlings of future weeds. The population of goats which is almost zero in this study is similar with the report of Solomon (2006) for Dejen Woreda who reported that the goats' proportions are extremely few. This might be due to an availability of favorable grazing area.

Donkeys were found only in rural areas which indicated that people in rural distant areas use them for transportation of grains and other inputs to markets or from market to their home and from the field to home. Horses in rural areas were used only for riding purposes and in the urban areas for pulling carts.

The average livestock holding per household in urban areas (5.32 TLU) was significantly ($p<0.05$) lower than live stock holding in rural areas (8.36TLU).This difference is due to the purpose of animals. More number of male animals are kept in rural areas for draught purpose. In urban areas, the majority are female cattle kept for milk production except those of young bulls kept before being sold. Lack of grazing land, feed shortage and lack of space for housing animals and fed production in urban areas as compared to rural areas could also be probable reason for the low livestock number in the former.

The cattle herd composition in urban areas was dominated by cows (41.20%) with a significant proportion of crossbred cows (31.10 % of the cows).This finding is partly in agreement with what has been reported by Gashaw *et.al.* (1991) for Sellale where cows comprised 51.8% of cattle herd, 62% of which were indigenous. The high proportion of cows in the cattle herd and

increasing proportion of crossbred cows in urban areas indicate the importance of dairying in urban areas of Debremarkos Woreda.

In the rural areas of Debremarkos Woreda oxen (steers) comprised 20.31 % of cattle herd which was next to cows in number. Abdinasir (2000) and Getachew *et al.* (1993) also indicated that a considerable proportion of the cattle herd was also composed of oxen at Arsi area (43.23%) and Inewari (38%), respectively. The high proportion of oxen and almost all of cows are indigenous breeds, in the rural areas of Debremarkos, is a reflection of the importance of oxen for traction power in the area and cows are needed for oxen replacement and for very small amount of milk. The lower proportion of steers in this study as compared to others might be that in this area bulls stay many years as unsaturated bulls (5 – 7 years) according to the farmers report during group discussion.

The housing condition of animals was variable. In rural areas, almost all (86.4%) floors were hardened soil and only 13.6% of the houses are with stone slab floors. Muddy floors are difficult to clean and creating drainage problem. This condition predisposes animals to disease (Chamberlain, 1989). In rural areas animals spent the rainy summer season tethered in communal Pasture land to fertilize the land. This predisposed animals for foot rot and cold stress and production decrement. This might be due to the need of farmers to fertilize the grazing land and improve the forage production. Farmers supposed lacking awareness on the importance of housing situation for the productivity of cattle.

In contrast, in urban areas most of the houses (60.3%) and 10% were stone slab and concrete respectively. only 29.4% of the houses were hardened soil floor. In urban areas of Debremarkos animals in most farms (75%) were housed in separate closed yards. This protects animals from rain, cold and heat stress. All these show that there is greater awareness of the urban people in improving the housing conditions than the rural area farmers. In almost all (94 %) of the rural farmers and 97 % urban housings allow good air exchange.

There were three types of feeding systems which were practiced by the dairy owners to feed their cattle. In rural areas of Debremarkos, all farms practiced free grazing system except 4.5% (6

farms) that were using limited grazing with stall feeding system for their crossbred cattle. The major feed sources were farm produced crop residues and communal grazing pasture utilized by all farms. Commonly used crop residues were oat straw, "teff" straw, and rarely wheat straw and barely straw, maize Stover was also used. Conservation of feed is common and mostly crop residues are conserved and rarely hay. In urban farms, most of the farms (77.9%) are land less. They use communal pasture free grazing system with limited supplementation. The later were purchased crop residues, hay, concentrate and non-conventional feeds. Non- conventional feeds like "tella atela"(traditional brewery by product) were used by a significant number of farms (51.5%). This result is in agreement with Yoseph *et al.* (1999) who reported that non-conventional feeds contribute a lot as animal feed resource in urban areas.

Thirteen percent of the farms who were landless and having crossbred cattle used stall feeding system with purchased feed and the rest 8.8% graze their own land and use limited grazing system together with purchased and farm produced concentrates and hay. Stall and Shapiro (1996) also reported that free grazing is the predominant form of ruminant feeding system in most parts of the extensive and smallholder crop livestock farming areas in Ethiopia. Common pasture land is particularly utilized for grazing. However, as one goes to intensive type of production system stall feeding is a usual practice In intensively managed peri- urban dairy producers located in and around cities and towns mainly rely on purchased hay as there is no available land for hay or crop production.

A considerable number of landless dairy producers do not keep enough stock of feed. This might be lack of feed stocking space and lack of capital to purchase more feed. The absence of record keeping in all rural farms and in almost all (92.7%) urban area farms is indicative of lack of awareness of farm owners on the benefits of record keeping in dairy farm operations.

The AI service even before two years of the survey period when AI service was available was very minimal where only 10.3 % of urban farms and only 2 persons in rural areas. This result is by far less than that reported by Solomon (2006) for Dejen Woreda who indicated that 30.9 % of farmers used cross bred bull or AI service depending on availability. But partially in agreement with the report of Belete (2006) who reported that only 9.4% of households in Fogera Woreda of

South Gonder used AI techniques. During the survey period 72.0% of urban farms and 93.2% of rural farms depend on natural uncontrolled mating with local bulls. Both of these results show that the breeding practices in Debremarkos Woreda were highly traditional. There was no AI service for the last three years in the study Woreda. This was due to change in administrative structure of Woreda. Previously it was administered together with Gozamen Woreda that gave attention for dairy production.

Most urban and rural farm owners during the group discussion and individual interview reported that, though there were higher preference of natural mating with cross breed bulls than AI and local bulls, there is limited cross breed bull in nearby and heat detection in local cows to serve at the proper time is difficult due to their silent and short heat period. They also mentioned that the reason for lack of AI utilization were an availability at the time of need; lack of attention for dairy production improvement; heat detection difficulty in local cows; suspicion of calving difficulty of local cows and preference of cross bred bull service than AI due to the perception that the chance of male calves being born is higher in AI service than bull service. This is partially in agreement with the report of Solomon (2006) who reported that farmers prefer natural mating with cross breed bulls than AI due to unavailability of AI technicians, poor performance of AI and need for repeated services and insufficient services as a result of shortage of semen.

Average daily milk yield of 1.50±0.68 liters and average lactation length of 8.87 ± 1.55 in this study for local breed cows was with in the range of the report of (FAO, 1993) who reported that average daily milk yield of per cow from indigenous cattle ranges from 1.5 to 2 liters over 150-180 day lactation length. But it was slightly higher than the national average of 1.09 liters per day as reported by Dagena and Adugna (1999).This slight variation could be the relatively better management of animals and better feed availability and supplementation in the study area as compared to other areas. The average daily milk yield of local breed cows in urban areas was significantly ($p<0.05$) higher than that of rural areas. The difference in milk yield may be due to difference in management and plane of nutrition between urban and rural areas Average daily milk yield of cross bred cows in this study 7.30±4.65 liter was higher than the report of Solomon (2006) who reported in Dejen Woreda the average daily milk yield for cross bred cows is 4.6

liters. This variation may be due to better management and the suitability of environmental temperature for cross breed cattle in the study area as compared to Dejen Woreda.

Average lactation length 8.87± 1.55 months for local breed cattle was higher than the report of Solomon (2006) who reported 6.6 months in Dejen Woreda but lower than the report of Fekadu (1994) which was reported 11 months for local breed cattle. The average lactation length of local breeds in urban areas is significantly ($p<0.05$) lower than rural area. The average lactation length for cross bred cattle 8.56±1.75 months in this study was slightly lower than 9.8 months reported by Yoseph *et.al* (2003) for urban and peri-urban dairy production systems around Addis Ababa and.

The average Calving interval of 20.74± 4.48 months for local breed cattle in this study was with in the range of the report of Taneja (1999) who reported 334-730 days of average calving interval for African breeds. And the result was slightly shorter than 790 days of average calving interval for local breed cows as reported by Perera (1999) in the Ethiopian highlands. This shows that in the study area local breed cattle have relatively better reproductive performance.The average Calving interval of cross breed cows in this study 13.94± 2.03 months was slightly shorter than the studies indicated by Gashaw (1992) that the mean calving interval for cross bred dairy cows in Sellale area was 15.4 months or 464 days.

The average age at first calving for local breed cows was 56.28±5.29 months. Age at first calving in different Ethiopian breeds has been reported to be 35.1 to 53 months (Shiferaw *et al.*, 2003, 2005; Lobago *et al.*, 2006).This might be the liver fluke burden in the area which retards the growth performance of calves in the early age when they are susceptible. Age at first calving and calving interval for local breed cattle in Urban areas were significantly ($p<0.05$)lower than the rural areas which might be due better management applied for local bred cattle in urban areas than in rural areas The mean age at first calving for cross breed cows in this study was 35.44±11.15 months. Age at first calving in the central highlands of Ethiopia for cross breed cattle has been reported to be 29.8 months (Shiferaw *et al.*, 2003, 2005; Lobago *et al.*, 2006).The age at first calving in case of cross breed cows was higher than the average of other parts of

Ethiopia. This shows the slow growth rate of calves which needs attention on the management of calves and heifers.

The slight better performance of cross bred cattle in the urban areas than in rural areas might be higher exotic blood level of cross bred cattle and /or better management in urban areas than rural areas. Even though there is slight difference in all above mentioned reproductive and productive performance of cross breed cows between urban and rural areas the difference was not significant ($P \geq 0.05$)

In general, fermented milk and cheese were sold at farm gate, while butter is sold in market places to licensed local butter merchants. Raw milk was sold at farm gate to contractual consumers or delivered to hotels and restaurants. Raw milk selling is contractual type in which the owner transports the milk to hotels and restaurants or the consumers receive the milk from the farm. The marketing system is different from what was reported by Somda *et al.*, (2003) the latter reported that in 37.8 % of the cases milk are sold directly to consumers and to others (collectors, resellers) in 54.4 % of the cases. Tadele (2007) reported that milk producers sold their milk to intermediate traders. The lack of participation of intermediate traders in this study shows that the participation of people in milk marketing is very low. More over, in Debremarkos Woreda most of the habitants (97%) are followers of orthodox religion. During the fasting days they abstain from consuming livestock products. Thus during the fasting periods, milk producers are forced to process the milk and dispose the products at very low prices and face great loss especially those producing large volume of milk (15-80 liters per day) in urban areas.

Many cattle disease were reported to occur in both urban and rural areas of Debremarkos Woreda. Blackleg, anthrax, and Foot and mouth disease (FMD) are top important killer disease in both rural and urban areas of the Woreda. Liver fluke and external parasites (ticks) are highly prevalent health problems affecting cattle productivity. Diarrhea and Coughing were the two commonly encountered disease symptoms of animals in the study areas. This result is in agreement with Solomon (2006) who reported that In Dejen Woreda the major diseases were Blackleg, FMD, Anthrax and mastitis. Tadesse *et al.* (2005) also reported that that in South and North Wollo Zones the major disease were infestation of ticks, lice, mange mites, warts and

Dermatophilosis are common in mid altitude and lowland areas during dry season. Fascioliasis and foot rot are important disease in the highlands during the wet season. Anthrax, black leg and FMD are also important contagious disease.

In the study area almost all the interviewed farmers (92.5%) reported that veterinary service and vaccination from government Agriculture and development offices was not available starting from 2005-2008 G.C in the Woreda. Only 7.5 %(n=15) of the interviewed house holds used animal health service from private clinics .The rest 92.5% apply traditional practices of disease management. As reported by the farmers the reason of inclining to the traditional disease treatment method were the high costs and less effectiveness of private veterinary services.

The over all mortality rates of cattle (10%) in this study was higher than the mortality rate in the nearby area, Dejen Woreda (6.4%) as reported by Solomon (2006).This higher mortality might be the lack of veterinary service in the study area.

Identification of major dairy production constraints was the other important part of this study, using group discussion and individual interview. Animal disease, lack of crossbred genotype and feed shortage milk market space shortage, water shortage were the major problems in the study area in decreasing order of importance. Despite variations in their importance (rank) constraints identified were in agreement with the report of Mohamed *et al.* (2004) in general for Ethiopia and with the finding of Zelalem and Ledin (1999) and Survey report of ILCA (1992) in particular for the highland areas of central Ethiopia.Group discussions conducted in the study area identified the same constraints forwarded during the individual interview with minor ranking deviations the constraints.

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6. CONCLUSION AND RECOMMENDATION

The study was conducted to characterize dairy cattle production systems /practices/,to provide baseline data and identify constraints and opportunities for dairy cattle production in the study area The results from this study reveal that :

In both urban and rural areas of Debremarkos the livestock composition is highly dominated by cattle which show the greater contribution of cattle through better management, feeding, and genetic improvement and improvement of market infrastructures. Dairy cattle production systems in the study area can be grouped as rural crop livestock mixed farming system, land less intra urban dairy farms and urban specialized dairy arms. The legally tenured land holding in the rural areas was almost one hectare and from this 96.96 % was used for crop production and only 1.5 % was used for natural pasture which shows that crop residues are the major animal feeds in the study area. All rural people used communal grazing land as a source of animal feed which is the other source of animal feed The communal grazing land was utilized with differed grazing system for the wet season and free grazing system in the dry season but due to the swampy nature of the grazing lands and free grazing utilization during the driest periods tramping of forage and less productivity of the communal gazing land was identified as the major cause for feed shortage which shows the need for improvement of communal grazing land utilization. Urea treatment of crop residues and forage production are not practiced in the study area. In urban areas most of the farms used communal grazing land as a major source of animal feed in which animals were also supplemented with purchased crop residues, hay, concentrates and non-conventional feeds. This shows better feeding system of animals in urban areas as compared to rural areas.

Most of the farms 69% of rural area and 54.42 % of urban area do not have raw milk selling practices due to lack of market access and small volume of milk produced and lack of milk market. Milk marketing system in the study area was contractual type of informal marketing system which lasts only to the non-fasting periods and milk marketing was stressed as a primary constraint by specialized dairy producers in urban areas who produce more milk (15-80 liter) per day and also mentioned as a constraint by rural far distant farm households due to the long distant to transport milk on foot to urban areas for sell. This shows the need to improve milk market

infrastructures for the improvement of dairy production in the study area. The majority of cows in the urban area 69.90 % and almost all (96.62 %) dairy cows in rural areas were local cows. The productivity of local cows was very low. The overall mean daily milk yield for local and cross bred cows' were 1.50 ±0.68 liter and 7.3±4.65 liter per day respectively. The overall mean lactation length, for local and cross bred cows was found to be 8.87±1.55 month and 8.56±1.75 months respectively. The over all mean age at first calving in the study area for local and cross breed cattle was 56.28±5.29 and 35.44±11.15 months respectively. The overall reported average calving interval for cross bred and local cows were13.94 and 20.74 months respectively. The performance of cross breed cattle was better than local breed cattle in daily milk yield, age at first calving, and calving interval in both rural and urban areas. It was found that milk yield of cross bred cows was greater than that of local bred cows nearly by five fold. This means that five local cows are one cross bred cow in terms of daily milk yield. The performance of local breed cattle in the urban areas was significantly higher than the daily milk yield of local cows in the rural areas which shows better management also can improve the daily milk yield of dairy cattle. Natural mating was the only method used for dairy cattle breeding. Avery small proportion of house holds used cross breed bull service. Farmers reported that though there was higher preference of natural mating with cross breed bulls there is limited cross breed bull in nearby. They also mentioned that the reason for lack of AI utilization were an availability at the time of heat; lack of attention for dairy production improvement; heat detection difficulty in local cows; suspicion of calving difficulty of local cows. In the study area there were no public veterinary services. Only 7.5 % households used modern health treatment. But the rest 92.5% of the households used traditional method of health treatment and animal disease was mentioned as the first constraint for dairy cattle production in the area. Farmers reported that veterinary services from private sectors were not effective and costy.

There fore from this study the following suggested recommendations should be undertaken to improve the dairy production as well as the food self sufficiency of the area:

- Extension services especially of veterinary and AI service should be improved and private veterinary services should be controlled for their effectiveness.
- Establishment of Dairy cooperatives should be encouraged by the government and non - governmental organizations.
- Market infrastructures should be improved by governmental and non-governmental organizations.
- Bull service should be established in the Woreda.

Future research areas:

- Detailed milk demand Analysis of the Woreda.
- Evaluate the economic viability of dairy production in the Woreda
- The potential of "lit "as a milk replacer for calves.
- The exact cause of cattle abortions in the area.

7. REFERENCES

Abdinasir, I.B. (2000): Smallholder dairy production and dairy technology adoption in the mixed farming system in Arsi highland, Ethiopia. PhD. Thesis, Humboldt University of Berlin, Berlin, Germany.

Abegaz, A.Y. (2005): Farm management in mixed crop –livestock systems in the Northern high lands of Ethiopia. PhD Thesis. Wageningen University, The Netherlands.

Adugna Tolera (1990): Animal production and feed resource constraints in Wolayta Sodo and the supplementary value of Desmodium intortum, Stylosanthes guanances and Macrotyloma axilaries when fed to growing sheep feeding on a basal diet of maize stover. M.Sc.Thesis, Agricultural University of Norway, AAS-NLH.

Aiumlami, S. (1999): Dairy management and Animal health. In: Falvey L., and Chantalkhana (eds). Smallholder dairying in the tropics. Institute of Land and Food Resource (ILFR).The University of Melbourne, Thailand, .international livestock research institutes (ILRI), Nairobi, Kenya, Pp 227-235.

Arthur, H.G. (2001): Veterinary reproduction and obstetrics.8th ed W B.Sounders Company, Philadelphia, Pp35-40.

Azage, T.and Alemu, G. (1997): Prospects of peri-urban dairy development in Ethiopia. In: Proceedings of the Fifth National Conference of the Ethiopian Society of Animal Production,15-17 May, 1997, Addis Ababa, Ethiopia, Pp 28-39.

Azage, Tegegne, Million Tadesse, Yoseph Mekasha and Alemu Yami (2003): Market-oriented urban and peri-urban dairy systems.ILRI. Debrezeit,research station, Addis Ababa, Ethiopia.

Baker, R.L. and Gray, G.D. (2003): Appropriate breeds and breeding schemes for sheep and goats in the tropics: The importance of characterizing and utilizing disease resistance and adaptation to tropical stresses. PhD. Thesis, Wageningen University, Netherland.

Behrahie Mesfin (2001): Biological and economical evolution of feeding urea treated teff and barely straw based diets to crossbred dairy cows in the highlands of Etiopia. .M.Sc.Thesis, Swedish University of Agricultural Science, Uppsala, Sweeden.

Bekele shiferaw (1991): Crop livestock interactions in the Ethiopian high lands and effects on Sustainability of mixed farming .A case study from Ada district. M.Sc. Thesis. Agricultural University of Norway.

Belachew, H. (1997): Milk sales outlet options in Addis Ababa and the surrounding peri-urban areas. In: Proceeding of The fifth National Conference of The Ethiopian Society of Animal Production.15-17 may, 1997, Addis Ababa, Ethiopia. Pp.72-81.

Belete, Anteneh(2006)studies on cattle milk and meat production in Fogera Woreda :production systems,constraints and opportunities for development.M.Sc.Thesis,Hawassa University,Awassa,Ethiopia.

Berg, J.C.T.Vanden (1990): Strategy for dairy development in the tropics and sub tropics. Center for Agricultural publishing and documentation Wageningn. The Netherl;ands.

Boer, A. J. (1999): Socio-economic aspects of Small holder dairy farmers. In: Falvey L.and Chantalakahana C.1999.Smallholder dairying in the tropics. Institute of land and food resource (ILFR).The university of Melbourne, Thailand. International Livestock research institutes (ILRI), Nairobi, and Kenya.Pp.45-57.

Brannang, E., and Persson S. (1990): Ethiopian animal husbandry. A hand books, Swedish, University of Agricultural Science, Uppsala, Sweden, Pp127.

Byerlee, D., Collinson, M., Perrin, R., Winkleman, D., Biggs, S., Moscardi, E., Martinez, J., Arrington, L. and Benjamin, A. (1980): Planning technologies appropriate to farmers: Concepts and procedures. CIMMYTEI Batan, Mexico, Pp 71.

Cataley, A. (1999): A review of veterinary uses of participatory approaches and methods focusing on experiences in dry land Africa. participatory approaches to Veterinary epidimology,Pp.5-10.

Chantalalakhahana C. (1995): Dairy development in Thailand. In: Proceedings of WAAP/KSASS International Syposuim on Supply of Livestock product to rapidly expanding Urban populations. Seoul, Korea.Pp, 282-292.

Chantalalakhana C. (1999): Research priorities for Smallholder dairying .In: Flavey, Lindsay, Chantalalakhana, charan (eds). Smallholder dairy in the tropics .ILRI (International livestock research institute) Nairobi, Kenya.Pp, .403-416.

Coppock, D.L. (1994): The Boran platau of Southern Ethiopia. Synthesis of pastural research, development and change, 1980-91, ILCA (international livestock center for Africa), Addis Ababa, Ethiopia, Pp 418.

CSA (Central Statistical Authority)(2005): Report on land utilization agricultural sample survey, statistical bulletin 331, volume IV, Addis Ababa.

CSA (Central Statistical Authority) (2002: Ethiopian agricultural sample enumeration result for Amhara Region Statistical Report on livestock and farm implements, part IV, Addis Ababa, Ethiopia.

Debrah, S. and Birhan, Anteneh (1991): Dairy marketing in Ethiopia. Markets of first sale and producers market patterns, ILCA research report 19, ILCA (international livestock research center for Africa), Addis Ababa, Ethiopia.

Degena, Arado and Adugna, Lemi (1999): The crop livestock systems and contributions to the economy. A review of empirical evidence. .Economics of integrated crop and livestock system in Ethiopia. In: Proc.of the Third Conference of AESE (Agricultural Economic society of Ethiopia),Pp 1-34.

FAO (Food and Agriculture Organization) of the United Nations (1997): Crop and food supply assessment mission to Ethiopia report No.26, .FAO, Rome, Italy.

FAO Food and Agriculture Organization of the United Nations (1993): .The state of food and Agriculture .FAO, Rome, Italy.

FAO (2001): FAO/ WFP. Crop and food supply assessment Mission to Ethiopia. Special report.

Fekadu, Beyene(1994): Present situation and future aspects of milk production, milk handling and processing of dairy products in southern Ethiopia. PhD Thesis, Agricultural University of Norway,Norway, Pp 1-20.

Gashaw, G., Vervikko, T. and Khalili, F. (1991): Smallholder dairy production in Northern Shoa Province, Central highland of Ethiopia. Assessment of feed resources in relation to the requirements on a smallholder. In: Development of appropriate feeding system for dairy cattle in the Ethiopian highlands. Final Report. ILCA and MOA Addis Ababa, Ethiopia.

Gashaw Geda (1992):Aseesment of feed resource base and performance of cross bred dairy cows distributed to smallholder in the Sellale dairy development project area. M.Sc.Thesis, Alemaya University of Agriculture, Diredawa, Ethiopia.

Gebrewold, A., M., Alemayehu, S., Demeke and A., Tadesse (2000): Status of dairy research in Ethiopia. In: The role of village dairy –Co-operatives in dairy development. Smallholder dairy development project (SDDP) Proceeding. Ministry of Agriculture (MOA).Addis Ababa, Ethiopia.

Getachew, A., Hailu, B., Workneh, N., and Gezaheng, A. (1993): A Survey of the farming systems of Vertisols for sustainable crop-livestock production in the Ethiopian highlands: Synthesis report. Addis Abba, Ethiopia.

Getachew, Eshete (2002): Assessment of feed resources, their management and impact on livestock productivity in Ginchi water shed .M.Sc.Thesis,Alemaya university ,Diredawa, Ethiopia.

Getachew, F., and Gashaw, G. (2001): The Ethiopian dairy development, policy: Draft Policy Document Ministry of Agriculture/AFRDRD/AFRDT/Food and Agriculture Organization/SSFFF, Addis, Ababa, Ethiopia. Pp, 1-60.

Gryseels, G. and Anderson, F.M. (1983): Research on farm and livestock productivity in the central Ethiopian high lands. Initial results, 1977-1980.ILCA Research report, No. 4, Adddis Ababa, Ethiopia.

Hafez, E.S.E. (1993): Reproduction in farm animals 6th. ed. Lea and Febiger Philadelphia, Philadelphia, Pp.315-329.

Holden, S.J. and Coppock, D.L. (1992): Effect of Distance to Market, Season and family wealth on Pastoral dairy marketing in Ethiopia. *Journal of Arid environments,* **23**: 321-334.

Holloway, G., C., Nicholson, C., Delgago and S., Ehui (200): Agro-industrialization through institutional innovation. Transaction costs, Cooperatives and milk market development and in the East African highlands. Agricultural economics, Pp 279-288.

Ike A. (2002): Urban dairying in Awassa, Ethiopia .M.Sc. Thesis, University of Hohenhem, Germany.

ILCA International Livestock Center for Africa (1992): Annual program report (1991):.Addis Ababa, Ethiopia.

International Livestock Research Institute (2000): Hand book of Livestock statistics for developing countries, Nairobi, Kenya, .Pp 299.

Jayne, T.S., Yamano, T., Weber, M., Tschirley, D., Benfica, R. Chapoto, and Zulu, B. (2003): Smallholder income and land distribution in Africa. Implications for poverty reduction strategies. *Food policy,* **28**:253-275.

Keberu, Belaynesh (2000): Milk production and lactation performance of crossbred (FresianXArsi) Cattle at Agarfa multi purpose training center, Bale, Ethiopia. M..Sc.Thesis, Alemaya University of Agriculture, Diredawa, Ethioppia.

Getachew, A., Hailu, B., Workneh, N., and Gezaheng, A. (1993): A Survey of the farming systems of Vertisols for sustainable crop-livestock production in the Ethiopian highlands: Synthesis report. Addis Abba, Ethiopia.

Getachew, Eshete (2002): Assessment of feed resources, their management and impact on livestock productivity in Ginchi water shed .M.Sc.Thesis,Alemaya university ,Diredawa, Ethiopia.

Getachew, F., and Gashaw, G. (2001): The Ethiopian dairy development, policy: Draft Policy Document Ministry of Agriculture/AFRDRD/AFRDT/Food and Agriculture Organization/SSFFF, Addis, Ababa, Ethiopia. Pp, 1-60.

Gryseels, G. and Anderson, F.M. (1983): Research on farm and livestock productivity in the central Ethiopian high lands. Initial results, 1977-1980.ILCA Research report, No. 4, Adddis Ababa, Ethiopia.

Hafez, E.S.E. (1993): Reproduction in farm animals 6th. ed. Lea and Febiger Philadelphia, Philadelphia, Pp.315-329.

Holden, S.J. and Coppock, D.L. (1992): Effect of Distance to Market, Season and family wealth on Pastoral dairy marketing in Ethiopia. *Journal of Arid environments,* **23**: 321-334.

Holloway, G., C., Nicholson, C., Delgago and S., Ehui (200): Agro-industrialization through institutional innovation. Transaction costs, Cooperatives and milk market development and in the East African highlands. Agricultural economics, Pp 279-288.

Ike A. (2002): Urban dairying in Awassa, Ethiopia .M.Sc. Thesis, University of Hohenhem, Germany.

ILCA International Livestock Center for Africa (1992): Annual program report (1991):.Addis Ababa, Ethiopia.

International Livestock Research Institute (2000): Hand book of Livestock statistics for developing countries, Nairobi, Kenya, .Pp 299.

Jayne, T.S., Yamano, T., Weber, M., Tschirley, D., Benfica, R. Chapoto, and Zulu, B. (2003): Smallholder income and land distribution in Africa. Implications for poverty reduction strategies. *Food policy,* **28**:253-275.

Keberu, Belaynesh (2000): Milk production and lactation performance of crossbred (FresianXArsi) Cattle at Agarfa multi purpose training center, Bale, Ethiopia. M..Sc.Thesis, Alemaya University of Agriculture, Diredawa, Ethioppia.

Getachew, A., Hailu, B., Workneh, N., and Gezaheng, A. (1993): A Survey of the farming systems of Vertisols for sustainable crop-livestock production in the Ethiopian highlands: Synthesis report. Addis Abba, Ethiopia.

Getachew, Eshete (2002): Assessment of feed resources, their management and impact on livestock productivity in Ginchi water shed .M.Sc.Thesis,Alemaya university ,Diredawa, Ethiopia.

Getachew, F., and Gashaw, G. (2001): The Ethiopian dairy development, policy: Draft Policy Document Ministry of Agriculture/AFRDRD/AFRDT/Food and Agriculture Organization/SSFFF, Addis, Ababa, Ethiopia. Pp, 1-60.

Gryseels, G. and Anderson, F.M. (1983): Research on farm and livestock productivity in the central Ethiopian high lands. Initial results, 1977-1980.ILCA Research report, No. 4, Adddis Ababa, Ethiopia.

Hafez, E.S.E. (1993): Reproduction in farm animals 6th. ed. Lea and Febiger Philadelphia, Philadelphia, Pp.315-329.

Holden, S.J. and Coppock, D.L. (1992): Effect of Distance to Market, Season and family wealth on Pastoral dairy marketing in Ethiopia. *Journal of Arid environments,* **23**: 321-334.

Holloway, G., C., Nicholson, C., Delgago and S., Ehui (200): Agro-industrialization through institutional innovation. Transaction costs, Cooperatives and milk market development and in the East African highlands. Agricultural economics, Pp 279-288.

Ike A. (2002): Urban dairying in Awassa, Ethiopia .M.Sc. Thesis, University of Hohenhem, Germany.

ILCA International Livestock Center for Africa (1992): Annual program report (1991):.Addis Ababa, Ethiopia.

International Livestock Research Institute (2000): Hand book of Livestock statistics for developing countries, Nairobi, Kenya, .Pp 299.

Jayne, T.S., Yamano, T., Weber, M., Tschirley, D., Benfica, R. Chapoto, and Zulu, B. (2003): Smallholder income and land distribution in Africa. Implications for poverty reduction strategies. *Food policy,* **28**:253-275.

Keberu, Belaynesh (2000): Milk production and lactation performance of crossbred (FresianXArsi) Cattle at Agarfa multi purpose training center, Bale, Ethiopia. M..Sc.Thesis, Alemaya University of Agriculture, Diredawa, Ethioppia.

Ketema, H., and Teshay, R. (1995): Dairy production Sytems in Ethiopia. In: Proceedings entitled Strategies for market orientation of small scale milk producers and their organizations.20-24 March, 1995, Morogoro, and Tanzania.

Kiwuwa, G.H., Trail, J.C.M., Kurtu, M.Y.G. Worku, F., Anderson and Durkin, J.(1983): Crossbred dairy cattle productivity in Arsi region, Ethiopia, ILCA Research report II, International Livestock Center For Africa, Pp 1-29.

Kurwijila, L.R. (2002): An overview of dairy development in Tanzania. In: Rangnekar, D., and Thorpe, W. (eds). Smallholder dairy production and marketing opportunities and constraints. Proceedings of A South -Workshop held at NDDB, Anand, India, 13-16 March, 2001,NDDB (National Dairy Development Board), Anand, India, and ILRI (International Livestock Research Institute),Nairobi, Kenya, Pp174-184.

Lee, S.D., Kennard, R.O. and Kayouli, C. (1998): Manual of Smallholder milk production in the South pacific, Food and Agricultural Organizational (FAO).

Leeuw,de (1996): Specific features of dairying .In: Falvey L., and Chantalakhana (eds). Smallholder dairying in the tropics. Institute of Land and Food Resource (IlFR). The Melbourne, Thailand. International Livestock Research Institutes. ILRI, Nairobi, kenya.

Leng, R. (1999): Dairy management and animal health In: Falvey L., and Chantalakhana C. (eds). Smallholder dairying in tropics. Institute of Land and Food Resource (ILFR). The University of Melbourne, Thailand. International Livestock Research Institutes. ILRI, Nairobi, Kenya, Pp 207-222.

Lobago, F., Bekana, M., Gustafson H., and Kindahl, K. (2006): Reproductive Performance of dairy cows In a small holder production system in Selalle Central Ethiopia. *British J. of trop .Amim. Health and Prod.*, **38:** 333-342.

Matthewman, M (1993):.Dairying. The tropical agriculturalist. CTA, the Netherlands.

Mekonen, Hailemariam, Asmamaw K.and Courreau J.F.(2006):Husbandry practices and health in small holder dairy farms in Addis Ababa, Addis Ababa University Faculty of Veterinary Medicine, Debrezeit, Ethiopia.

Mohammed Ahmed, Simeion, Ehui and Yemesrach Assefa (2004): Dairy development in Ethiopia. EOTD Discussion paper No.123. International food policy research institute .Washington D.C.

Mukessa-Mugerwa, E.D., Ephraim, B. and Tadesse, T. (1989): Type and productivity of local cattle in central Ethiopia.. *Trop.Anim.Health.*, **21**:99-120.

Muriuki, H.G. and Thorpe, W. (2001): Small holder dairy production and marketing in Eastern and Southern Africa. In: Proceedings of the South Work shop on Small holder Dairy production and marketing Constraints and opportunities. March 12-16.Annuand, India.

O' Mahony, F.(1988): Rural dairy technology-experience in Ethiopia, ILCA manual No. 4.Dairy technology unit, international livestock center for Africa (ILCA), Addis Ababa, Ethiopia. Pp 64.

O'Connor, C.B and Zenash, Z. (1990): The Production and utilization of milk and milk products by smallholder farmers in the Eastern Region of Shewa, Ethiopia. In brief communications and abstracts of posters of the 23rd international dairy congress, Montreal, October, 8-12 Brussels, Belgium. *International Dairy Federation,* **1**:1-12.

Omore, A., Muriuki, H., Kenyanjui, M., Owango, M. and Staal, S. (1999): The Kenyan dairy sub-sector. A rapid appraisal, smallholder dairy research and development project repot. Ministry of Agriculture/Kenya Agricultural Research Institute/Internationl Livestock Research Institute, Nairobi, Kenya, Pp 51.

Perera, O. (1999): Management of Reproduction. In: Flavey, Lindsay, Chantalakhana, Charan (eds), Small holder dairy in the tropics. ILRI (International Livestock Research Institute) Nairobi, Kenya, PP241-264.

Phuket S, R. (1999): Successful smallholder dairy project. In: Falvey L., and Chantalakhana (eds). Smallholder dairying in the tropics. Institute of Land and Food Resource (ILFR). The University of Melbourne, Thailand. International livestock research institutes. ILRI, Nairobi, Kenya, Pp 377-385.

Plazier, J.C.B. (1993): African Agriculture and the contribution of ruminant livestock, constraints to and opportunities for increased ruminant livestock productivity and strategies for research. In: Improving the productivity of Indigenous African Livestock. IAEA-TECDOC 708, Vietnam, Austria, Pp.7-12.

Poet, C.D. and Daplyn, P.F. (1993): Data for Agrarian Development, Cambridge University press, Cambridge, Great Britain.

Ranjhan, S.K. (1999): Dairy feeding system. In:Falvey L, and Chantalakhana C.(eds). Small holder dairying in the tropics. Institute of land and food resource (ILFR). The University of Melbourne, Thailand, International livestock research institute. ILRI, Nairobi Kenya, Pp117-1342.

Risstrom, I. (1999): Herd recording. In: Falvey L. and Chantalakhana C. (eds.), Smallholder dairying in the tropics. ILRI (International Livestock Institute), Nairobi, Kenya, Pp 269-274.

Rodostits, O.M. (2001): Herd health: Food animal production. Mediline 3rd ed. W.B.soundars Company, USA, Pp211-219,236-239,397.

Ruther, U., Walther, H., Schmidt, B., Mosch, S., Engelbrechten, T.V., Ndayishimiye, Flerchinger, H., Spee, S.v., Berg, C.,Gewalter, G. and Gayl, C.V (1998): Urban and peri-urban dairy production systems in Ethiopia.

Sastry, N.S.R. and Thomas, C.K. (1981): Farm animal management, Vikas publishing House, Pvt. Ltd. India, Pp 46-115.

SDDP (Smallholder dairy Development Project) (1998): The role of village dairy cooperatives in dairy development: prospects for improving dairy in Ethiopia, organized by small holder dairy development project, Addis Ababa, Ethiopia.

Sendros, D., and Tesfaye, K. (1997): Factors to be considered in the formulation of livestock breeding policy. In: Proceedings of the Fifth National Conference of ESAP.15-17, May, 1997, Addis Ababa, Ethiopia, Pp13-27.

Seyoum, Bedeye and Zinash, Seleshi (1998): Utilization of teff straw as livestock feed. Research review. Proceedings of Sixth Annual Conference of the Ethiopian Society for Animal production, Adddis Ababa,, Ethiopia, Pp 173-185.

Shiferaw, Y., Tenhagen, B.A., Bekana, M., and Kassa, T. (2003): Reproductive performance of cross bred dairy cows managed under different production systems in central high lands of Ethiopia. *J.of Trop. Ani. Helth and prod.*, **35:** 241-214.

Shiferaw, Y., Tenhagen, B.A., Bekana, M., and Kassa, T. (2005): Reproductive disorders of cross breed dairy cows managed under different production systems in central high lands of Ethiopia. *J.of. Trop. Anim. Helth and prod.*, **37**:427-441.

Sintayehu, Gebremariam (2003): Historical development of systemic marketing of livestock products in Ethiopia. In: Procedings of The Ethiopia Society of Animal production, August, 22-24, pp15-16,Addis Ababa, Ethiopia.

Solomon, Legese (2006): Characterization of market oriented small holder dairying and performance evaluation of dairy cooperatives in Dejen Woreda Amhara Region. Msc..Thesis. Hawassa University, Awassa, Ethiopia.

Somda, J., Kamuanga, M., Munstermann, S., Bittaye, A., (2003): Socio-economic characterization of smallholder dairy systems in the Gambia: Milk Production, marketing and consumption. Socio-economic research Working Paper 1. IT (Internatinal Trypanotolerance Centre), Banjul, Gambia, Pp 61.

Sprott, L.R., Thrift, T.A. and Carpenter, B. (1998): Breeding soundness of bulls. Agricultural Communications, the Texas A& M University System, Pp 203-243.

Staal, S., Delgado, C. and Nicholsin, C (1998): Smallholder dairying under transaction costs in East Africa. Livestock Policy Analyses brief: No. 6.

Stall S.J. and Shapiro, B.I (1996): The economic impacts of public policy on smallholder peri-urban dairy producers in and around Addis Ababa, ESAP publication. No. 2, Adis Ababa, Ethiopia.

Strieger, B., Sennm, Sutter, M., Kreuzer F.M., and Langhans W. (2001): Effect of water restriction on feeding and metabolism in dairy cows. *American Journal of physiology* **280:**R418-R227.

Tadele, Gashaw (2007): Milk production and marketing at smallholder dairy farms in and around Awassa. M.Sc.Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debrezeit, Ethiopia.

Tadese, D., Ayalew, W.and Hegde, B.P. (2005): Survey on traditional cattle production systems and preferred cattle functions in North South Wollo Zones, Ethiopia. *Ethiopian Veterinary Joournal*, Pp 91-108.

Taneja, V.K (1999): Dairy breeds and selection. Smallholder dairying in the tropics, Pp 71-99.

Tedla, A., Tefera, G., Alemu, G.W.,Beruk and Philip, C.(1991): Status of dairying in Ethiopia and strategy for future development. In: Proceedings of. Third National Livestock Improvement Conference, May, 24-26, 1989, institute of agricultural research, Addis Ababa, Ethiopia.

Tesfaye, K. (1995): Smallholder dairy in Ethiopia. In: Future of livestock industries in East and Southern Africa. Proceedings of a work shop, July, 20-23, Kadoma Ranch Hotel, Zimbabwe.

Tsehay, Redda (2001): Small scale milk marketing and processing in Ethiopia. In: Proceedings of South-South Work shop on smallholder dairy production and marketing constraints and opportunities, March, 12-16, Anand, India

Tsehay, R. (1997): Milk processing and marketing options for rural small scale producers. In: Proceedings of the Fifth National Conference of the Ethiopian Society of Amimal Production, May, 15-17, Addis Ababa, Ethiopia, Pp 28 -39.

Wattiaux, M.A. (1998): Heat hetection, natural service and artificial insemination, reproduction and genetic selection, Babcock Institute for international dairy research and development, Pp, 121-130.

Yitaye, Alemayehu. (1999): A study on livestock production systems, feed resources and feed allocation practices in Awassa Woreda Sidama Zone, Southern Ethiopia. M.sc.Thesis, Almaya University, Diredawa, Ethiopia.

Yoseph Mekasha (1999): Impact of feed resource on productive and reproductive performance of dry cows in the urban and peri-urban dairy production system in the Addis Ababa Milk shed and evaluation of non-conventional feed resources using sheep. M.sc. Thesis, Alemaya University, Diredawa, Ethiopia.

Yoseph, Mekasha, Azage, Tegegne and Alemu,Yami (2003): Evaluation of the general farm characteristics and dairy herd structure in urban and peri-urban dairy production system in Addis Ababa milk shed. Proceedings of the Tenth Annual Conference of the Ethiopian Society of Animal Production (ESAP), Addis Ababa, Ethiopia. Pp, 144-153.

Zegeye, Yigezu. (2003): Imperative and challenges of dairy production, processing and marketing in Ethiopia. In: ESAP Proceedings of 10th annual conference of Ethiopian society of animal production held in Addis Ababa, Ethiopia August 22-24, Addis Ababa,Ethiopia, Pp 61-67.

Zelalem, Yilma and Ledin Inger (1998): Milk production systems, processing techniques and the role of milk and milk products on small holder farms in the central highlands of Ethiopia. M.Sc. Thesis, Uplasa, Sweden..

Zumbach, B., and Peters, K. J. (2002): Sustainable breeding programs for small holder dairy production in the tropics .7th World congress on Genetics applied to livestock production, August, 19-23, Montpellier, France.

ANNEX

Annex 1: Check list and guide line questions used for group discussion

No of farmers in the interview----------Male----------female---------

Kebele----------Area (urban, rural) ----------Check list no. ----------

1.Among the house hold members (husband,,wife,son,daughterhiredlabor,)who is responsible in livestock production activities like herding, cleaning dairy cattle shades, animal selling, and purchase, taking care of calves, milking, milk processing, selling milk and milk products etc in this area ?

2. What are the crops types grown in this area? From highest to least in terms of area coverage?

3. What is the crop yielding per hectare each crop grown in this area?

4. What are the objectives of keeping dairy cattle in this area in order of importance?

5. What types of houses are used for dairy cattle in this area?

6. What are the common animal feeds in this area used for dairy cattle? Mention the number of months per year you feed each type of feed for the dairy cattle?

7. What methods of feeding systems (free grazing, stall feeding, and stall feeding with limited grazing) are practiced in this area?

8. At what age do you normally wean calves? What additional feeds do you commonly provide for dairy calves?

9. What are common sources of water for dairy cattle in the area?

10. What is the most common breeding method9natural mating, AI) in the area? Estimate the proportion of each breeding methods used in the area?

11. Which breeding method preferred most in the area?

12. Is record keeping practiced in the area? What record types are available?

13. What is the average milk yield per day, lactation length, caving interval, age at first calving and calving interval of cross breed and indigenous cattle in the area?

14. For whom do you sell your dairy products?

15. What are the milk processing products produced in the area?

16. What are the major dairy cattle health problems in the area in the order of importance? What measures do you use to control these health problems?

17. What are the constraints of dairy cattle production in the area in the order of importance?

18. What do you think be the rout causes of these problems? And what do you think be the possible solutions for these problems?

19. What are the opportunities of dairy cattle production in the area?

Annex 2: Questionnaire Survey

Structured questionnaire for characterization of dairy cattle production systems in the study area.

Questionnaire No. ------- Name of enumerator----------Date_----------

1. Household resource characteristics:

1. Name of farm owner (household head).....

1.1. Address: District... …Kebele (PA)..... Village 1.urban 2.rural Farmer No.....

1.2. Level of education? 1. Illiterate 2. Writing and reading 3.primary school 4. Junior secondary school 5. High school 6.Diploma and above.

1.3. Age in years? 1. < 30 years 2. 31-40 3. 41-64 4. >64

1.4. Sex: 1. Male 2. Female

1.5. Marital status: 1. Unmarried 2.Married 3.Divorced 4.Widowed

1.6. What kind of agricultural activities you are undertaking?

1. Crop and livestock 2.only livestock production 3.crop only

1.7. When did you start the dairy farming?

2. Family size: ----------

Family members	Sex	
	male	female
Age <10 years		
Age 10-14 years		
Age15-64 years		
Age > 64 years		

3. Labor distribution in dairy cattle production:

3.1. Write the responsibility of the household members for the following activities. (1=participate, 0=not participate).

Dairy activities	Husband	wife	Sons	Daughter	Hired laborer
Herding					
Cleaning barn					
Taking care of suckling calves					
Feeding and watering of cattle					
Milking					
Milk processing					
Selling milk products					
Others					

4. Livestock type and number (Completed after observation)

4.1. What type of animals are you keeping?

Type of animals	Amount in number
cattle	
Sheep	
Goats	
Donkeys	
Horses	
Mules	
Poultry	
beehive	

4.2. How many of each of the following cattle types do you have in your herd?

Cattle type	Breed and number	
	number of local breeds	Number of Cross breeds
Cows		
Bulls(un castrated males)		
Heifers		
Calves		
steer(ox)		
Milking cows		
Pregnant cows		

5. Land holding and use pattern

5.1. Legally tenured land--hectares, rented land-- hectares, Land with share cropping----hectares.

5.2. Land use pattern

Land use category	Area sown	Last year's grain yield(for annual crops only)
	ha	quintals
Annual crops		
1.Teff		
2.Oat		
3.Wheat		
4.Barely		
5.Maiz		
6.lentil		
7.Nug		
8.Beans		
9.Peas		
Plantation		

natural pasture		
Cultivated pasture		

6. Livestock Production objectives:

6.1. Rank the objectives of dairy production according to priority from1 to 5, 1 representing highest and5 representing least use.

Production objectives	rank
Income from sale of milk and milk products	
Milk for home-consumption	
Income from sale of animal	
Drought(traction, Seed bed preparation and threshing)	
Manure for fuel or fertilizer	

Dairy cattle Management

7. Housing condition and waste management of dairy cattle: (Completed after observation).

7.1. The type of house you have for your dairy cattle is: 1. Open barn (only fence) 2.separete closed 3.Together with family house 4.Attached with family house

What is the house made from? 1. Corrugated iron 2. Tufled grass 3. Wood Plastered with mud 4. Concrete 5. Stone slab 6.Hardened soil 7. Wood only 8.oteher, 0=open

7.2. Roof----------

7.3. Wall----------

7.4. Floor ----------

7.5. Housing ventilation 1. Good 2. Poor

7.6. Frequency of cleaning the barn? 1. Once per day 2 twice per day 3. Three times per day

7.7. How are you utilizing cattle dung most of the time? 1. It is done in to cow dung cake 2. It is used for farmland fertilization 3. Both

7.8. Do you sell the cow dung cake? 1. Yes 2. No

8. Dairy cattle feeds and feeding systems:

8.1. What are the major dairy cattle feeding system you are using?

1. Free grazing (full time). 2. Stall feeding 3. Stall feeding with limited grazing

8.2. How long animals graze per day (hours) ----------

8.3. Do you use communal grazing land? 1. Yes 2. No.

8.4. Mention the common types of feeds you are using for dairy cattle.

Classes of feeds	Type of feed	No of feeding months / year
Grazing		
Crop residues		
Supplements (concentrates)		
Hay		
Cultivate(improved) forage		
Non- conventional feeds		
Minerals		

8.5 .What is the source of your cattle feed? 1. Farm produced 2. Purchased 3.Both.

8.6. Do you grow fodder crops? 1. Yes 2.No

8.7. What is your major reason for not growing fodder crops?

8.8. Do you conserve feeds to provide in times of dairy feed shortage? 1. Yes 2. No

8.9. If yes, mention the type of feed you conserve? 1. Hay 2. Crop residues

3. Both

8.10. Is it difficult to get agro industrial by products? 1. Yes 2. No

8.11. Do you use urea treatment to improve the nutritive value of crop residues? 1. Yes 2. No

8.12. What is the source of water for dairy cattle? 1. River 2.well 3.pipe 4. 1&3 5.1&2 6. 2&3

8.13. What is the frequency of watering your milking cows? 1. Once per day 2. Twice per day 3. Three times per day 4.Freee access (adlibtum).

9. Feeding of calves

9.1. What additional feeds do you provide for pre-weaning calves?

9.2. At what age do you start providing additional fed to suckling calves?

At what age do you normally wean your calves on average (age in months)? ----------

9.3. Local breeds----------

9.4. Cross breeds----------

Which methods do you use for pre-weaning milk feeding?

1. Bucket feeding (amount of milk) ----------

2. Partial suckling

9.5. Local breeds ----------

9.6. Crossbreeds---------

9.7. Who weans calves mostly 1.the cow refusal 2.the calf refusal 3.The owner.

10. Breeding practices:

10.1. What type of mating system do you use for your dairy cows?

1. Natural service 2.Artificial insemination 3. Both

10.2. If you use cross breed bull, source: 1.own bull 2.Neighbours' 3.Do not use cross breed bull service

10.3. Which method of breeding do you prefer and why?

1. Natural (service) ----------

2. Artificial insemination) ----------

10.4. What method of heat detection do you use in your dairy herd?

1. Observation by farmer or farm attendants

2. Using bull

3. Using teaser bull

4. Doing nothing

10.5. What is the source of your initial crossbred cattle?

1. Crossing locals with cross bred bull

2. Purchasing crossbreds from local market

3. Gift from the government or NGOs.

4. crossing local breeds with AI

5. No cross bred cattle in the herd

10.6. Is mating seasonal? 1. Yes 2. No

11. Record keeping

11.1. Is there any practice of record keeping? 1. Yes 2.No

"11.2. If yes, 1.Breeding record 1.Feeding record 2.Financial record 3.Health record 4.Production record 5.Others specify

12. Production and reproduction performance of dairy cattle

12.1 Fill in the following table based on the performance of your dairy herd.

Breed	Average Lactation length(month)	Average Age at first calving(months)	Average Calving interval(months)	Average milk yield (liter) per cow/day
Local				
Cross				

13. Milk marketing

13.1. How frequent do you milk your cows per day? 1. Once 2.twice 3.Thrice

13.2. On average how much milk do you produce per day? ----------

13.3. Which milk products do you sell when they are available? 1. Whole milk 2.butter 3.Fermented milk 4. Cheese

13.4. On average how much whole milk (milk in litter) do you sell per day? ------

13.5. What is the price (in birr) of the following milk and milk products per kg or litter?

1. Whole milk ---------- 2. Fermented milk (ergo) --------- 3. Butter ----4.Cheese----------

13.6. For whom do you sell your whole milk?)

1. To consumers 2. To retailers 3.To restaurants and hotels 4.1&3

5. 1&2. 6.2&3 7.No selling practice of whole milk

13.7. Which method are you using for the delivery of your milk /milk products?

1. Me or another family deliver it 2. Collected by consumers /.purchasers. 3. Taking to the local market

13.8. Is there any period you have problem of marketing your milk and milk products?

1. Yes 2. No

13.9. If yes in which months? 1. Fasting months 2. In any months in the year. 3 .Any other (specify)

14. Milk processing

14.1. Do you process milk? 1 Yes 2.No

14.2. If yes what milk products do you get by processing? 1. Fermented milk 2.butter 3.butter milk 4.Cheese 5.Whey 6.Ghee 7.Cheese fermented with spices (metata).

14.3. What materials do you use for processing milk? 1. Clay pot 2.clay pot fitted with internal agitator 4.wooden material fitted with internal agitator 5.Cream separators

14.4. Why do you process milk?

15. Dairy cattle diseases and health service:

15.1. When your animals are sick is veterinary service available? 1. Yes 2. No

15.2. If yes from where do you get veterinary service? 1. Government institutions 2.privates 3. Both

15.3. Have you got Vaccination for your dairy cattle during the last two years? 1. Yes 2.No

15.4. Do you use any traditional or herbal medicine for your dairy cattle1.ye 2.no?

15.5. What are the major animal health problems you have experienced in your dairy cattle during last year? (Rank in decreasing order of importance).

Health problem	Rank of importance	Health problem	Rank of importance
Anthrax		Foot problems	
Black leg		liches	
Ticks		Abortion	
Dermatophilosis		Mastitis	
Bloat		Trypanosomiasis	
Liver fluke		other specify	

15.6. How many animals have been died during the last one year?

Cause of death? 1. Predator 2.disease 3.accident 4.poison 5. Any other

Type of dairy herd	Number died	1	2	3	4	5
Calves						
Cows						
Steers						
Heifer						
Bulls						

15.7. Was there any incidence of abortion in your herd? 1.) Yes 2.) No

!5.8.How many no of animals aborted in the last one year?

15.9. At what time of pregnancy did it occur? 1.1-3 months of pregnancy 2.4-6 months of pregnancy 6- 9 months of pregnancy

15.10. What measures do you take to control the animal health problems?

16. Constraints of dairy production

16.1. What are the major constraints of dairy production in your dairy farm? (Put priority in ranking order).

Constraints	rank
Shortage of feed and feeding system	
Animal disease and poor veterinary service	
Space shortage	
Scarcity of water	
Milk market Problem	
Lack of Genetic improvement activities	
Others specify	

16.2. What are the route causes of these problems?

16.3. What solutions do you suggest for these problems?

16.4 What are the opportunities that you thin for dairy production improvement in the area?

Annex 3: Table of conversion factors used to calculate TLU

Livestock Type	TLU
ox/bull	1.10
cow/ local	0.80
cow/cross	1.20
Heifer	0.50
Steers	0.6
calves	0.20
sheep	0.09
Goat	0.09
Horse	0.80
Ass/mule	0.36
Poultry	0.01

Source: Abdinasir(2000); Ibrahim(2000)

CURRICULUM VITAE

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SIGNED DECLARATION

This thesis is my original work; it has not been presented for a degree in any University that all sources of material used for thesis have been duly acknowledged.

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This thesis has been submitted for examination with our approval as University advisors:

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