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Review of performance, marketing and milk processing of dairy cattle production system in Ethiopia

Abstract

Ethiopia has a huge potential to be one of the key countries in dairy production for various reasons. It includes a large population of milk cows, a huge potential for production of high quality feeds under rain fed and irrigated conditions, existence of a relatively large human population with a long tradition of consumption of milk and milk products and hence a potentially large domestic market. Despite its potential for dairy development, productivity of indigenous livestock genetic resources in general is low, and the direct contribution it makes to the national economy is limited. The main source of milk production in Ethiopia is cattle but small quantities of milk are also obtained from goat and camel in pastoralist areas of the country. Based on the system of production, Milk production can be viewed at three different sources. These include: Pastoral milk Production, The highland smallholder milk production and Urban and peri-urban milk production. Milk and milk products are channeled to consumers through both formal and informal marketing systems. Ethiopia has a low level of milk consumption compared to other countries in the region (Kenya=90lt/cap; Uganda=50lt/cap). Challenges and problems for dairying vary from one production system to another and/or from one location to another. Underdevelopment and lack of market-oriented production, lack of adequate information on livestock resources, inadequate permanent trade routes and other facilities like feeds, water, holding grounds, lack or non-provision of transport, ineffectiveness and inadequate infrastructural and institutional set-ups, prevalence of diseases, illegal trade and inadequate market information (internal and external) are generally mentioned as some of the major reasons for the poor performance of this sector.

Keywords: dairy, value chain, market channel, Ethiopia

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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 45percent, respectively.[1] 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. Furthermore 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.[2] The average milk production capacity of the indigenous cow per head per lactation is estimated at 213kg which is very low.[3] A survey study showed that average daily milk production per cow was 1.2liters and the average calving interval 27months.[4] Per capita consumption of milk in Ethiopia is as low as 17kg per head while the average figure for Africa is 26kg per head.[5] 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. 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.[6] 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. 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.[7] 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.[8] 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.[9] 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.[10] 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.[11] 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.[12] Even less is known about the productivity levels, major husbandry constraints and opportunities for realistic improvements in the prevalent production systems. 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 review were:

i. To characterize dairy cattle production systems/practices in Ethiopia.

ii. To recognize constraints and opportunities of dairy production in Ethiopia.

Performance, marketing and milk processing of dairy cattle production system in Ethiopia

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.[13] Using various approaches, different dairy production system classifications has been made in Ethiopia.[10–14] classified dairy production systems in Ethiopia into four namely, Patoralism, highland small holder, urban and Peri-urban production systems.

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 50-60percent of the total land areas of the country and have altitudes below 1500masl.[15] The productivity of the cattle depends largely on season due to rain fall pattern that influences availability of feed.[16] 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 households 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.[17]

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.[14] 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 53months and calving interval of 25months,[16] 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.[18]

Peri -urban dairy production

According to Zegeye[14] 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 without 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.[19]

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 35million 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.[19]

Management of dairy cattle

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.[20] 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.[21] Non-conventional feed types are mainly utilized as supplement for dairy cows. They are unexploited

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cheep and less competitive feed resources. Traditional brewery and liquor residues and pulse hulls particularly are available throughout 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.[22] According to Ranjhan,[23] 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 13million tones of crop residues are produced annually.[24] 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,[25] 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 0.5–2lt/day.[26] 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. 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.[27]

Breeding

Cattle breed of the tropics are known to have low milk production potentials.[11] In contrast to the temperate breeds that have been selected for specific production traits, tropical breeds mostly have multipurpose 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.[28] 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.[28] However, 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.[29] 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.[30] Bulls should also be tested for venereal diseases like Brucellosis, Trichomoniasis 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.[30] 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.,[31] and Kelay[11] 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.

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.[32] 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,[33] 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.

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.[33] Records are an indispensable component of modern dairy farming, but are usually non-existent on most smallholder farms.[34] 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.[35] 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.[33] 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,[36] 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.

Animal health services

Disease is an important cause of reduced productivity of meat and milk as well as draft, hides and dung fuel.[37] Rodostits[37] 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 somewhat 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.[38] According to Rodostits[37] 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.[39] 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.[36]

Production performance of dairy cattle

Lactation length and milk yield

Lactation length refers to the period between calving and drying off. Lactation yield milk production throughout the lactation period and is very much affected lactation length. Milk yield could be measured in terms of lactation yield, 305days 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.[40] The mean lactation length of Arsi and zebu was 271 and 303days respectively. On the other hand, the lactation length of crossbreed was 334 and greater which varies with the blood level of crosses.[41] The average lactation length of crossbred dairy cows in Agarfa Multi -purpose training center, Bale region estimated was 330.7±2.0days.[42]

Milk yield

The first and most important norm for cattle rearing is to obtain milk for family use and sale. However, milk yield of endogenous cattle is very low. Average daily milk off-take per cow ranges from 1.5 to 2liters over 150-180 day lactation period.[43] Degena et al.,[44] reported that milk yield have remained low with national average of 1.09liters/day/cow. This is mainly because of feed shortage, disease, and limited attempetes at introducing improved breeds. Yitaye[45] reported that in Awassa Woreda Sidama Zone Southern Ethiopia, the average milk produced per cow per day was about 1.5liters with a range of 0.5 to 2liters; the rest is left for direct suckling by calves. The un improved cattle normally have very low milk yield of about 200-300kg per lactation.[46] The report of Gryseels et al.,[47] 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 1769liters per cow during the first lactation and 2347liters in the second lactation length.

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.[48] This can be attributed to a number of factors such as poor nutrition, diseases, management, genotype and other environmental factors.

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.[49] 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.[50,51] Age at first calving in different Ethiopian breeds has been reported to be 35.1 to 53months and 29.8months in cross breed cows in central high lands of Ethiopia.[49–51]

Calving interval (CI)

Calving interval is the period of time between successive calvings.[49–52] 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.[34] The calving interval in cross bred cows in the central highlands of Ethiopia has been reported to be 25.95 months.[50,51]

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.[53] There are basically two milk marketing systems in Ethiopia. These are formal and informal marketing systems.[27] Until 1991, the formal market was

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exclusively dominated by DDE which supplied 12% of the total fresh milk in Addis Ababa area.[54] Currently however, 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.[55] 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.[56] In Tanzania and Uganda the total milk marketed formally is estimated to be <5%[53] and in Kenya it is about 15%.[57] 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.[58] In some parts of Ethiopia, Butter is sold to lorry drivers and bus Passengers enroot to Addis Ababa some 500km away.[59] 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.[19]

Milk processing

Though there are few milk processing plants in Ethiopia much of the milk produced is processed at home using the traditional technologies.[60] 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. Moreover, 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.[61] 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 139minutes to an average of 57minutes (59 churnings) while reducing the fat content of the buttermilk from an average of 1.1% to an average of 0.36%.[62] 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.

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 cannot be readily adopted by small farmers due to their socio-economic and agro ecological conditions that are greatly different from those in industrialized countries.[63] According to Chantalakhana[64] 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.

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 annum). 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.[16] 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.[65]

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.[64] 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.[64] Knowledge concerning dairy herd management such as barn types, feeding methods, waste management, and calf feeding

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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.[64] 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-economic 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. 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.[66] According to Tsehay,[67] 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, however poor even if no practical recording scheme has been used to judge their merit.

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.[64] 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.[81]

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[68] and have impact on the price of milk from local producers.

Marketing system and price policy

Staal et al.,[56] 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.

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%).[69]

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. Furthermore, 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. [70]

Socio- economic constrains

In general, small scale farmers[71–74] 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.[75–76] Therefore technology success full in one location may not be accepted by farmers in another location or even by different farms in the same location.[77–80] It is also found that technologies not adopted by farmers at one time, [81–86] 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.[87–90]

Conclusion and recommendations

The review were undertaken with the objective of to characterize dairy cattle production systems/practices in Ethiopia and to recognize constraints and opportunities of dairy production in Ethiopia.[91–94] the review including about the performance of milk production, performance of reproduction, marketing and milk processing of dairy cattle production system in Ethiopia. Ethiopia possesses the largest livestock population in Africa. Estimates for farmer holding in rural areas indicate that the country has about 50.9 million heads of cattle, 22million goats, 26.0million sheep and 2.3million camels.[95] Dairy production depends mainly on indigenous livestock genetic resources. Despite its potential for dairy development, productivity of indigenous livestock genetic resources in general is low, and the direct contribution it makes to the national economy is limited. The exchange between market oriented and subsistence dairy production is, in the sense that production can respond to external demands from the market or intra-household consumption needs. Dairy farmers"

competitiveness depends also on the transaction between productivity (milk from improved cows) and production quality (butter from local cows). Crossbred cows produce more milk than local cows but are more susceptible to diseases compared to local cows. Local cows produce less milk but quality butter than crossbred cows. Therefore, research should revisit its breeding and advance strategy in line with utilizes the potential of local cows for butter production and the potential of improved cows for milk production.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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