

Review Article

Dairy Farm in Ethiopia: Overview

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Introduction

Ethiopia has a tremendous dairy growth potential due to its vast animal population, which includes 59.5 million cattle, 30.70 million sheep, and 30.20 million goats [13]. It is one of Sub-Saharan Africa's developing countries with a big livestock potential, ranking first among African countries and ninth globally. However, meat and milk production are predicted to be 246,000 tones and 960,000 tones, respectively, with per capita consumption of 17.1 kg milk and 5.6 kg meat in 1983-1985 [7]. In many developing countries, livestock production is one of the primary strategies for raising living standards. Ethiopia has a cattle population of 49.3 million head. These are highly suited to the tropical climate, producing and reproducing under the stress of high temperatures, disease prevalence, and low nutritional requirements [36].

The livestock subsector contributes significantly to the Ethiopian national economy, and it plays critical roles in generating income for farmers, creating job opportunities, ensuring food security, providing services, contributing to the asset, social, cultural, and environmental values, and sustaining livelihoods

Abstract

Ethiopia has a huge livestock population, a relatively suitable habitat for developed, high-yielding dairy cattle breeds, and places with a minimal animal disease burden, all of which contribute to the country's significant dairy growth potential. In the early part of the twentieth century, Ethiopian dairy production was mostly traditional. Dairy production in Ethiopia is largely a subsistence small-holder enterprise, with just a few small and medium-sized commercial dairy farms. Taking that into consideration, the objectives of this paper is to give an overview of Ethiopian dairy farms and their economic contributions to the country. Although four basic types of dairy production systems that are based on climate, land ownership, and integration with crop yields are presented, namely pastoral, high-land small-holder milk production, urban and peri-urban, and intensive farming systems, making investments in policy initiatives on the dairy farm would help to alleviate poverty by increasing the income of smallholder dairy farmers, providing jobs, and upgrading the current main dairy production system. Productivity, on the other hand, is quite minimal; high-quality feed is difficult to obtain, and support services are inadequate. Because the milk marketing system is underdeveloped, the majority of smallholder milk farmers have limited access to the market. A review of Ethiopia's dairy sector reveals a need to focus on specific initiatives more clearly. Interventions in development should focus on overcoming technology gaps and addressing marketing issues. The government needs to take action in this sector, including developmental initiatives in breeding, animal health, feeding, milk collection, stockpiling, processing, and delivery.

Keywords: Dairy cattle; Dairy farms; Ethiopia

for a large group of people. The sector accounts for around 16.5 percent of national GDP, 35.6 percent of agricultural GDP [35], and 30 percent of agricultural employment [5]. Dairy farming is one of the animal production sub-sectors that contribute to Ethiopians' livelihoods by providing vital sources of food and income [52]. The dairy industry accounts for around 13.7 percent of overall agricultural output and 39.4 percent of total livestock output [20].

Despite its dairy development potential, the productivity of livestock genetic resources, in general, is poor, and direct contributions to the national economy are restricted. In 2009, the average cow milk output per cow was 1.86 liters per day [12], and per capita milk consumption was only approximately 16 kg/year, which is much lower than the African and global per capita averages of 27 kg/year and 100 kg/year, respectively [20]. The overall milk output from dairy cows in the country was around 4.06 billion liters, [15]. The country's total milk output from dairy cows was around 4.06 billion liters [15]. Furthermore, the yearly rate of increase in milk output [estimated at 1.2 percent]

lags behind the annual rate of rising in the human population [estimated at roughly 2.7 percent per annum] [9], owing to the mismatch between supply and demand for fresh milk [37].

Ethiopia's population is expected to grow to 149.3 million by 2040 [19], resulting in increased demand for animal products. To address the ever-increasing need for milk and milk products, as well as their contribution to economic growth, genetic upgrading of indigenous cattle has been advocated as one solution. The number of crossbred cows in Ethiopia is expected to expand by 793 percent between 2015 and 2020, according to the country's growth and the transformation road map [43].

For the previous five decades, genetic development of indigenous cattle has been performed, with an emphasis on crossbreeding and the introduction of pure Holstein Friesian cattle, notably in large and medium-scale dairy farms. The country's large and diverse livestock genetic resources, rising domestic demand for milk and milk products, improved market opportunities, the presence of diverse agro-ecologies suitable for dairy production, and proximity to international markets all point to the country's dairy development potential and opportunities [30]. However, dairy development has been hampered by a variety of multidimensional, production system-specific constraints such as poor infrastructure and breeding programs, genotype, feed resources and feeding systems, access to services and inputs, low adoption of improved technologies, marketing issues, and a lack of a clear policy to support the livestock sector [39,48].

Henceforth, to mitigate difficulties that limit productivity and thus exploit the unused potential, it is important to illustrate and evaluate the current dairy production systems, identify the main limitations along with the dairy production, forward relevant and applied tactics to lessen the problem and advance the dairy sector in the country. So, this paper was prepared to give an insight into dairy farming in Ethiopia.

Dairy Farming in Ethiopia

Historical Events of Dairy Farm Development in Ethiopia

Before the beginnings of organized dairy production in the early 1950s, Ethiopian dairy production in the first half of the twentieth century was primarily conventional [1]. The United Nations Relief and Rehabilitation Administration donated 300 Friesian and Brown Swiss dairy cattle to the country in 1947 [21] to test modern dairy production. Commercial liquid milk production began on large farms in Addis Abeba and Asmera with the introduction of these animals, [28], and a small milk processing facility was installed in Addis Abeba to promote commercial dairy production [54]. Due to demand and large private dairy farms, as well as milk collection from dairy farmers, dairy production around Addis Abeba began to increase significantly in the second half of the 1960s [1].

The government formed a Dairy Development Agency (DDA) in 1971 to manage and coordinate the collection, processing, and distribution of locally produced milk, and it promoted the formation of dairy cooperatives to assist the supply of capital and technical and extension services to dairy producers [46]. Exotic dairy cattle, mainly Holstein Friesian, were distributed through government-owned large-scale production facilities such as WADU, ARDU, and CADU. In addition, to feed production and marketing, these units produced and distributed crossbred heifers, offered AI and animal health services, and produced and distributed crossbred heifers [49]. To construct the Dairy

Development Enterprise (DDE), multiple nationalized dairy farms [including large dairy farms, milk collecting networks, and a processing factory] were integrated in 1979 [54]. The development of the dairy sub-sector is a collaborative effort by all stakeholders that participate in the various dairy development initiatives, both openly and implicitly [51].

Nowadays, the private sector has begun to join the dairy sector and market as an essential force in the country's policy reform to bring about a market-oriented economic structure. Many private investors have invested in both small and large dairy farms. This commercial farm uses grade and crossbred animals capable of producing 1120-2500 liters throughout 279-day lactation. This production technique is currently increasing in the highlands among mixed crop-livestock producers like those found in Selale, Ada'a, and Holetta, and serves as the primary milk supplier to the urban market. In addition, one cooperative union and ten private investors have built milk-processing plants to supply Dire Dawa, Addis Abeba, and Dessie towns with fresh processed milk and dairy products. The majority of interventions during this period were centered on urban production and marketing. Dairy production in the Addis Ababa area began to grow significantly in the second half of the 1960s as a result of the establishment of large private dairy farms and the engagement of smallholder farmers [46].

Agriculture dominates the economy of most African countries, generating employment, revenue, and exports. The industry employs around 60% of the population and accounts for 20% of the continent's agricultural export revenues. For Africa's overall economic growth, a better agricultural sector is critical. Hunger, poverty, and inequality may all be alleviated with a continually expanding agricultural industry. Rural regions are home to more than 70% of the population, as well as the bulk of the impoverished and malnourished. More employment, more revenue, and more food for the needy are all benefits of a robust agriculture industry [18].

Agricultural performance that is both enlightening and profitable provides money in both rural and urban communities. Households save and spend more as their wages rise, boosting growth and investment in other industries. Agriculture generates tax income and offers a diverse variety of raw materials to agriculturally oriented local enterprises [18].

In the late 1980s, agriculture in Ethiopia made a substantial contribution of 45 percent of national GDP, with the livestock sector accounting for nearly 40 percent of agricultural GDP [18 percent of national GDP] and 30 percent of agricultural employment. Dairy output account for nearly half of the livestock sector [22].

The national and per capita output and consumption of cattle products have decreased during the previous 30 years. Between 1993 to 2001, per capita income remained at about \$100. Livestock output expanded at a slower rate than the agricultural sector as a whole, resulting in a decrease in livestock's percentage of agricultural GDP. Livestock output per capita declined by 5% during this time, whereas crop, food, and agricultural output climbed by 14, 7, and 6%, respectively [25].

Current Status, Constraints, and Importance of Dairy Farms in Ethiopia

Livestock is an essential component of agriculture, contributing to household livelihoods and developing-country economies [26]. More than one billion people in Africa and Asia rely

on livestock production and selling of its products for a living [33]. Livestock contributes to poverty reduction, nutrition, food security, and increased income and job development, all of which are Sustainable Development Goals set by the United Nations [45]. Livestock investment has the potential to have a multiplier impact. For every dollar spent on livestock, USD2.9 is generated in primary livestock production, and USD5.9 is generated in value-added goods [2].

Dairy production in the tropics is mostly subsistence, with poor output and productivity, reliance on native breeds, and management practices that include extensive grazing and unregulated breeding. Milk produced in these systems is mostly from indigenous breeds, with local breeds accounting for around 95 percent of milk produced in Ethiopia [16]. Demography, rising economies, underdeveloped markets, favorable policy and enabling environment, globalization, and market possibilities are driving changes in the dairy sector [42].

The key impediments to livestock intensification in general and dairy expansion, in particular, include a lack of adaptive high-yielding better genes, a shortage of feed, animal illnesses, and poor animal health, extension, and market services. In Ethiopia, genetic enhancement of indigenous breeds by crossbreeding and upgrading, as well as expedited production of crossbred cows from farmers' indigenous breeds using artificial insemination (AI), began more than 40 years ago with the founding of the National Artificial Insemination Center (NAIC). However, the number of improved breeds in the nation is still insufficient to transition the country's present subsistence-based smallholder dairy system to market-oriented commercial dairy products and increase milk output to satisfy current and projected future domestic demand [16].

In Ethiopia, dairy production is mostly a subsistence smallholder enterprise, with just a few small and medium commercial dairy farms. In 2019, an estimated 3.6 billion liters of milk were generated by about 6.7 million dairy cows across the country, with the majority [over 95 percent] coming from native breeds [16]. For the period 2003 to 2012, Ethiopia's per capita milk consumption varied from 32.8 to 36.5 liters per head/year [53], which is less than the 110 liters per head/year in neighboring Kenya [8]. Furthermore, the application of AI to improve indigenous breeds through crossbreeding began 40 years ago. To date, nonetheless, the number of improved breeds [crossbred and exotic cows] is claimed to be just 2.34 percent of the entire national cattle population [14,16].

Types of Dairy Farms in Ethiopia

Dairy farming is practiced almost everywhere in Ethiopia, with a considerable number of small, medium, and large-scale subsistence or market-oriented farms. In Ethiopia, there are four basic types of dairy production systems based on climate, land ownership, and integration with crop yields. Pastoral, highland small-holder milk production, urban and peri-urban, and intensive farming systems are among them [4].

Extensive Dairy Farm

Highland smallholder milk production: This technique is located in Ethiopia's central region, where milk production is based on subsistence and mixed crop-livestock farming. The majority of milking cows are indigenous breeds with low productivity performance. The average cow lactation milk output is 524 liters throughout a 239-day lactation period [6]. The typical first calving age is 25 months. Cows are kept primarily to give

milk for domestic use and to breed to replace draught oxen and heifers. Women sell excess milk to cover family expenses. The whole feed needs in this farming strategy are met by pasture, crop leftovers, and grazing [41].

Pastoral milk production: The pastoral system is generally used in the lowlands, where livestock production is quite frequent to support pastoral society's livelihood in the absence of crop cultivation. The population occupies 50-60% of the entire area, with the majority of the inhabitants living at altitudes below 1500 m a.s.l [29]. Milk is typically consumed fresh in the home, with sales to metropolitan areas following. Pastoralists mostly rear indigenous breeds, which account for around 30% of the cattle population. It contributes to the major milk production system in the lowland areas, which account for around 10% of the country's human population. Milk production has a poor yield and is seasonally dependent [6].

Semi-Intensive Production System

Urban and peri-urban milk production system: Urban dairy production systems are placed close to or near Addis Abeba and regional towns, taking advantage of the urban market. This industry owns the majority of the country's enhanced dairy stock. The production, processing, and sale of milk and milk products in urban and peri-urban areas comprise the urban and peri-urban milk production system [50]. It is primarily motivated by the availability of a competitive market for animal goods, and it benefits urban farmers by improving income, food, and nutrition, as well as providing employment possibilities [Livestock Research for Rural Development] [31]. Informal raw milk marketing provides a direct daily stream of income for urban dairy farmers through sales of milk and milk products. Dairy producers in suburban areas have little grazing pasture, so they must rely on commercial feeds like grass hay and agricultural wastes [31]. As a consequence, dairy cows receive appropriate nutrition during dry seasons. The total milk output from this system is 34.64 percent of a million liters each year, with 73 percent sold, 10% maintained for personal use, 9.4 percent sent to calves, and 7.6 percent included in the country's overall production [4].

Intensive Dairy Farming

History of intensive dairy and its developments: Intensive animal farming is often known as "factory farming" [32]. Agribusiness, including micro-farms, is a sort of intensive agriculture, especially a technique of animal husbandry meant to increase productivity while decreasing expenses [27]. Intensive animal husbandry is a relatively new trend in agricultural history, the product of scientific discoveries and technical improvements. Late nineteenth-century innovations often paralleled improvements in mass production in other sectors during the latter half of the Industrial Revolution. The discovery of vitamins and their importance in animal nutrition in the first two decades of the twentieth century resulted in vitamin supplements, which allowed hens to be kept indoors. By reducing disease, antibiotics and vaccinations enabled more animals to be raised in greater numbers. Synthetic insecticides were created as a result of chemicals developed for usage during WWII. Long-distance distribution of agricultural goods is now possible because of advancements in transportation networks and technology. Agribusinesses do this by keeping animals such as cattle, poultry, and fish at high stocking densities, on a huge scale, and with modern machinery, biotechnology, and global commerce. This industry's principal products are meat, milk, and eggs for human consumption [40,17].

Types of intensive farms: Generally, intensive farms house enormous numbers of animals, often cows, pigs, turkeys, geese, or chickens, frequently inside and at great densities. The goal is to produce a significant amount of meat, eggs, or milk at the lowest feasible cost. On-site food is provided. Disinfectants, antibacterial agents, anthelmintics, hormones, and vaccinations; protein, mineral, and vitamin supplements; regular health inspections; biosecurity; and climate-controlled facilities are some of the methods used to preserve health and boost output. Physical restrictions, such as fences or creeps, are used to restrain unwanted movement or behaviors. Breeding programs are utilized to create animals that are more adapted to the restricted surroundings and can generate a consistent food product [23].

Intensive dairy farming: It is a much more specialized dairy farming conducted commercially by a sector and a small number of individuals. These are mostly concentrated in and around Addis Abeba and are based on exotic pure-bred stock. Urban and peri-urban areas, as well as intensive farming, provide 2% of the country's overall output [44]. The animals in this method are kept in feedlots or pens and are fed a perfectly balanced ration of forage, concentrate feed, or various agro-industrial by-products through a trough. These approaches should see significant growth in all places where agricultural operations take place [39]. When compared to other dairy cow production systems, urban dairy cattle production systems have superior access to inputs and services offered by the public and private sectors when using an intensive management approach [3,24]. They also have access to animal health services and employ more intensive methods. Informal marketplaces are used to sell milk to consumers and processing factories. However, due to the small number of dairy cattle populations managed under this technique, milk supply is limited [24].

Dairy Cattle Feeding

Grazing and browsing are the primary means of feeding livestock. Grazing on community grounds is a typical activity in the highlands. This form of feeding is supplemented with natural grass hay, agricultural residues such as cereal straws and chaffs, and agro-industrial by-products mostly from the flour/oil industries and brewery leftovers. Dairy farmers that preserve enhanced dairy cows also grow improved fodder crops including elephant grass, oats, vetch, and alfalfa to augment grazing [10]. The overall agricultural land area is estimated to be around 16 million hectares, occupied by 12.9 million families, with an average of 1.23 ha per family. According to the same source, 75% of total agricultural land is used for temporary crops and 7% for permanent crops, while grazing land accounts for 9%, fallow land 4%, woodland 1%, and the remaining 4% is used for other purposes, such as land occupied by the holders' houses and/or buildings, gardens, barns, wells, and ponds [11].

Natural grazing contributes 73 percent of the feed, agricultural leftovers 14 percent, modified forages 0.2 percent, and other feed sources the remaining 12.08 percent. The quantity of dry matter required by animals is 7% less than what is necessary. Poor soil fertility and significantly reduced seasonal rainfall have a significant impact on feed supplies, resulting in swings in quantity and quality. The main restrictions to livestock output are periodic deficits in feed supply, particularly during the dry season. Even if the animals have reasonably ample and high-quality food during the rainy season [three to five months], this condition can quickly change during the dry season. Feed shortfalls develop in many regions of the highlands around De-

cember–to January, when natural pastures are at their lowest quantity in terms of dry matter, nutrients, and digestibility, and the availability of stored crop leftovers begins to dwindle. Before the brief rains begin, there is normally a four-to-five-month dry period. The difference in fodder availability between short and long rains is not as severe as the gap between short and long rains. The second dry season, which lasts around 150 days between October and March, is thus the important phase in a feeding system that is primarily reliant on natural grazing pasture [22].

Crop leftovers may be the only source of nutrition for dairy cows for one to two months [at the end of the long rains after harvests] when natural pasture is severely depleted. Teff, beans, and wheat straws are the most often utilized agricultural byproducts. The roadside grazing is done by 6.7 percent of intra-urban dairies and 33 percent of large peri-urban dairy producers in a study of feed resources and nutritional management of dairy animals in peri-urban and urban dairy production systems [34]. Hay is used by all production systems, except for 40% of secondary town dairy farms. Various feed mills prepare and supply balanced dairy cow concentrate feeds [mainly in and around Addis Abeba, but also in other parts of the nation]. However, most small-scale rural and peri-urban dairy producers cannot afford them. Concentrate feeds, according to [47], are mostly utilized by urban dairies. Atella [a typical home brewery byproduct] and pulp hulls are used by 80 and 47 percent of farmers, respectively, among non-traditional feeds. Atella contains a lot of crude protein (20%) and organic matter (97%). Water is a vital element that makes up 50 to 80 percent of an animal's living weight. Whereas an animal may survive after losing practically all of its fat and 50% of its body protein, losing 10% of its body water can be deadly. A 'good' supply of water (both amount and quality) is thus essential for an animal to maximize feed intake and output. A dairy cow's complete water demands are met by free water intake, which accounts for 80 to 90 percent of her total water requirements. A cow's water consumption is determined by her size, milk production, dry matter consumed, ambient temperature and relative humidity, water temperature, quality, and availability [34].

Conclusion and Recommendations

Ethiopia has a large and diversified livestock production base, as well as several prospects for improving dairy animals' output. The dairy cattle were raised by the whole shareholder in diversified agricultural techniques. The availability of huge and diversified dairy animal genetic resources that are adaptable to various agro-ecologies is a potential for increased dairy development in the country. The introduction of higher-performing indigenous dairy animal breeds into similar agro-ecology and production systems, as well as improved feed supplies and management, might be an alternate option for maximizing genetic resources and increasing milk output. Even though Ethiopia's dairy sector has challenges, there remains room for growth. Imports and exports, as well as macroeconomic policy and the degree of economic openness, can all have an impact on the rate of development of the dairy industry.

In conclusion, improved cattle breeds should be supplied to farmers to boost output. Developing or improving the image of the dairy industry through professionalizing the sector to produce better-quality jobs for young, well-educated individuals and professional farms, as well as a stronger marketing plan for adding value, greater earnings, and a more appealing dairy sector; and disseminating new technologies to individual farmers.

To boost the genetic potential of indigenous breeds, artificial insemination services must be expanded, as must veterinary services. Develop and implement an animal feed resource plan, as well as encourage feed processors to invest in viable areas for livestock development. The disease is one of the key restrictions; consequently, dairy owners should be taught hygienic milking and milk processing techniques, as well as the equipment utilized to decrease the likelihood of disease incidence owing to inadequate cleanliness.

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