

Production Performance, Milk and Milk Products Handling Practice and Constraints of Dairy Cattle Production in Ethiopia

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Abstract: This review aimed to evaluate the production performance (lactation milk yield and lactation length), milk and milk products handling practices and constraints of dairy cattle production in Ethiopia. Milk and milk products play an important role in human diet all over the country. The lactation milk yield of pure exotic breeds ranged from 1583 to 3796 kg and lactation length ranged from 276 to 362 days. Lactation milk yield for indigenous breed's ranged from 494 to 809 kg and lactation length ranged from 128 to 353 days. Lactation milk yield for cross bred ranged from 970 to 2343 kg and lactation length ranged from 257 to 448 days. Milk yield and lactation length were significantly affected by breed, level of nutrition, suckling, management system and environmental temperature. The handling and protection of milk and milk products have become a great concern around the world; this is especially true in the developing countries where production of milk and milk products take place under unhygienic condition must consider the health of the consumers. Dairy cattle production in Ethiopia is constrained by prevalence of disease and parasites, lack of good quality and quantity of feed, clean water and poor farm husbandry practices. In conclusion, good clean milk quality is necessary to produce good quality milk products to provide safe healthy food for consumer.

Key words: Dairy Cattle • Milk Production • Handling Practices • Constraint • Ethiopia

INTRODUCTION

Ethiopian cattle population is believed to be about 55.03 million [1]. Out of the total cattle population, the female cattle constituted about 55.48% and the remaining 44.52% were male cattle [2]. The majority (83%) of all milk produced in Ethiopia came from cattle with the remainder came from goats and camels [3]. About 2.8 billion liters of milk was produced during 2012 and 2013, out of which 42.3% was used for household consumption. The traditional (smallholder) milk production system, which was dominated by indigenous breeds, accounted for about 97-98% of the total annual milk production in the country [4]. Over 85% of the milk that was produced by rural household was consumed with the producer's households with the proportion marketed being less than 7% [5]. The total dairy cows were estimated to be 10 million [5]. Despite the largest dairy cattle population of Ethiopia, the per capita milk consumption in Ethiopia was

18.68 liters which is very low as compared to the global average of 100 liters even far below the average for Africa, 27 kg/year [6].

Dairy sector has been a major contributor to economic development especially among the developing countries. As an engine of growth, it provided increased income, employment, food and foreign exchange earnings as well as better nutrition in Ethiopia [7]. Dairy production, among other sectors of the livestock production system, is a crucial issue in Ethiopia [8].

The average daily milk yields of crossbred and local cows (indigenous Horro) were 7.3 and 1.5 liters/day, respectively [9]. The daily milk yield of local cows was less affected by season compared to crossbred cows, indicating that local cows can produce milk even under the scarcity of feed [9]. The daily milk yields of crossbred and local animals were influenced by the stage of lactation [9].

Milk is highly perishable and can easily be adulterated whilst the quality of the milk are still dependent on farm management. Strict and comprehensive dairy regulations were therefore customary and necessary [10]. The safety of dairy products with respect to food-borne diseases attained a great concern around the world. This is especially true in some of the developing countries where production of milk and various dairy products took place under rather unsanitary conditions and poor production practices [11].

The use of plastic and traditional containers can be a potential source for the contamination of milk by bacteria, because this allows the multiplication of bacteria on milk to contact surfaces during the interval between milking [12]. Some producers use collective towel to clean the udder of two or three milking cows. Such practice had a negative effect on milk quality and led to the transmission of udder health problems and related complications [13]. Ethiopia holds large population of dairy cattle but their production performances are low due to several constraints such as lack of market-oriented production, lack of adequate information, in adequate permanent trade routes and other factors such as feed, water, prevalence of disease, in adequate infrastructure and illegal trade [14].

The low productivity of the country's livestock production system in general and the traditional sector in particular are mainly attributed to shortage of crossbred dairy cows, lack of capital by dairy producers, inadequate animal feed resources both in terms of quality and quantity, unimproved animal husbandry systems, inefficient and inadequate milk processing materials and methods, low milk production and supply to milk processing centers and poor marketing and market information systems [15].

The success of dairy production monitored regularly by assessing the productive performance under traditional management system. However, information is limited about the productive performance of dairy cattle and detailed scientific study was not made on milk and milk products handling practice and constraints of dairy cattle production. Therefore, to improve the production performance, milk and milk products handling practice and constraints of dairy cattle production, it is important to review production performance and understand traditional milk and milk products handling practice.

Objective: To review on production performance, milk and milk products handling practice and constraints of dairy cattle production in Ethiopia.

Milk Production in East Africa: According to FAO [16], the world's milk production has increased by 150 million tons per year from 2002 to 2007. Africa contributed to only 5 percent of the world's milk production. In spite of its largest cattle population in the continent, Ethiopia is not among the four largest milk producing countries which include Egypt, Kenya, South Africa and Sudan [16].

In Eastern Africa, the dairy sector is crucial for rural development, poverty reduction, food and Nutrition security. Yet, its potential remains underexploited. Despite a strong interest from policymakers and investors and the on-going re-structuring of dairy value chains, a number of productions, marketing and trade constraints hinder their development [17]. East African countries face similar issues, notably low dairy farm productivity and inadequate milk quality. These challenges stem from various constraints, including technological, capacity, organizational and policy ones. Removing some of these bottlenecks may require regional-level interventions, especially to remove barriers to trade products as well as inputs [17].

East Africa has the leading first milk producing region in Africa, representing 68% of the continent's milk output [17]. Ethiopia, Kenya and Tanzania were among the biggest dairy producers in Africa (Susan and Fabien, 2015). Dairy sector is one of the fast-growing agricultural sub-sectors in Eastern African countries which had generated significant economic returns and employment opportunities along dairy value chains [17]. In Rwanda, according to the 2013 National Dairy Strategy (NDS), milk production has been rising rapidly, from 51.5 million (m) liters (l) in 2000, 445 million liters in 2012 and continued rapid growth is expected. This rapid rise in milk production has been attributed to a favorable policy and institutional environment and important investments by the Government and development partners [17]. Eastern Africa has the highest concentration of indigenous and exotic cattle, with indigenous breeds being principal [18]. Ethiopia hosts the largest cattle population in Africa, estimated at 50.9 million [18].

Milk Production in Ethiopia: Ethiopia has one of the largest livestock inventories in Africa with a national herd estimated cattle population in Ethiopia is about 57.83 million, 28.04 million sheep, 28.61 million goats, 1.23 million camel and 60.51 million poultry. From the total cattle in the country 98.59% (57.01million) are local breeds and remaining are hybrid and exotic breeds that accounted for about 1.19% (706,793) and 0.14% (109,733), respectively [19]. Milk production in Ethiopia depends

Table 1: Milk production in Eastern Africa in 2011

Country	Milk (in million)	Milk (% of growth rate)	Butter (1000 t)	Cheese (1000 t)
Ethiopia	4.4	14.2	17.6	5.8
Kenya	4.3	5.5	14.7	0.3
Rwanda	0.2	5.3	0.7	n/a
Tanzania	1.8	7.8	31.5	13
Uganda	1.2	8	n/a	n/a

Source: FAO STAT, 2014

Table 2: Total number of milk animals by Ethiopian region ('000) (2009/10)

Region	Total cattle '000'	Milking cows '000'	% of milking cows
Tigray	3243	593	18.3
Afar	500	128	25.6
Amhara	12747	2151	16.9
Oromia	22475	4395	19.6
Somali	591	139	23.5
Benishangul	422	86	20.4
SNNPR	10543	2076	19.7
Gambela	221	38	17.2
Harari	45.4	11	24.2
Dire dawa	46.7	10.7	22.9
Ethiopia	50884	9628	20.83

Source: CSA (2010)

mainly on indigenous livestock genetic resource dominated by smallholder farmers especially on cattle, goat, camel and sheep [20]. Cattle had the largest contribution (81.2%) of total national animal milk output followed by goat (7.9%), camel (6.3%) and sheep (4.6) [20].

Milk production in the country had generally increased over the last 10 years from about 1.5 billion litres in 2001 to about 2.2 billion litres in 2005 and around 2.9 billion litres in 2010. This increasing trend is mostly associated with an increase in the number of cows. However, the per capita milk consumption had declined from 26kg per annum in 1980, to 22kg in 1993, 19kg in 2000 and 16kg in 2009. This was likely attributed to the mismatch between the growth rate of milk production and human population [21].

In Ethiopia, dairy products (fresh milk, butter, buttermilk and cottage types of cheese) are distributed through the informal and formal marketing systems. The informal market involved direct delivery of dairy products by producers to consumers in the immediate neighborhood and sales to itinerant traders or individuals in nearby towns [22]. In the formal marketing system, there were cooperatives and private milk collecting and processing plants that receive milk from producers and channel to consumers, caterers, supermarkets and retailers; this system does exist in urban and per-urban dairy system of Shashemene–Dilla milk shed, although the number of cooperatives were few and its performance was low [23].

Dairy processing in the country is basically limited to smallholder level and hygienic qualities of products are generally poor [11]. As reported by CSA [24], of the total annual milk production in rural areas, 85% is used for household consumption, 7% is sold, only 0.3% is used for wages in kind and the remaining 8% is used for other purposes such as production of edible and cosmetic butter and Ayib.

The productivity of indigenous breeds is low because of low genetic capability for milk production and poor management system [20]. The spreading of diverse milk producing livestock species varies from one region to another [24]. The total cattle population as well as milking cows is highest in the Oromia Region, estimated to be about 22.5 million (44.17%) and 4.4 million (45.6%) respectively of the total national population, while the lowest figures were found in Harari Region with a total cattle population of 45,400 (0.09%) and milking cows of 11000 (0.11%). Three main regions include Oromia, Amhara and Southern Ethiopia account for 89.94% of the total cattle population and 89.55% of the total number of milking cows in the country [24].

Dairy production in Ethiopia is anticipated to increase rapidly in response to the fast-growing demand for livestock products resulting from increasing human population, especially in urban areas and rising consumer income, provided that appropriate interventions were made along the dairy value chain [25].

Table 3: Number of milking cows, daily and total annual milk yield by region

Region	Number of milking cows x10 ³	Average daily milk yield/ ton	Total milk yield/ton
Tigray	592.8	1.29	155 429
Afar	128	2.64	79 739
Amhara	2150.8	2.13	634 109
Oromia	4395.3	1.5	1 308 958
Somali	138.6	1.6	41 318
Benishangul	85.5	1.25	24 220
SNNPR	2076.5	1.65	667 562
Gambela	38.4	2.11	21 616
Harari	11.1	2.09	4 622
Dire dawa	11.1	1.48	2 643
Ethiopia	9627.7	1.69	2 940 216

Source: CSA (2010)

Pastoral areas in Ethiopia are generally known as rangelands and cover about 0.7 million square km (two thirds of total area) (WUR). In the lowlands, especially where livestock keeping was the main occupation, milk was consumed by all groups of the society. In the highlands, the rural people were sedentary farmers raising both livestock and crops, with their diet consisting mainly of cereals [21]. Moreover, the consumption pattern of milk and milk products produced at home varied depending upon the amount of milk produced per household, dairy production system and market access, season of the year and fasting period (particularly for the followers of Orthodox Christian) [25].

In 2010, a total of 2,940 million liters of milk were produced from about 9.6 million cows at national level [26]. In 2010, the average daily milk production was 1.69 litres with average lactation length of about 180 days and mean annual milk yield per cow of 305 liters [26]. Consumption of dairy products constituted about 19 kg per capita per year. This was one of the lowest levels in Sub-Saharan Africa, due to economic and cultural factors. WHO recommends 175 kg [26].

Estimated calf consumption and wastage of milk was 32% of the milk produced [27]. Households consumed approximately 85% of the milk collected, 8% of the milk was processed into products with longer shelf life and 7% was sold [3]. Fresh milk, *Ergo*, whey, Ethiopian cottage cheese (*Ayib*) and traditional butter were the most common milk products produced and consumed by different part of the country [28].

Cow milk accounted for 95.1% of the total milk produced in 2009/2010 from milking cows. The regional differences in the distribution of the population of milk animals are also reflected in milk production. Accordingly, Oromia, Amhara and SNNPR regions accounted for 88.8% of the total annual milk produced from cows at national level [24].

Milk Production Performance: Indigenous breeds of cows are generally considered low milk producers. However, they were the major source of milk in Ethiopia that account for 97% of the total milk production in the country [29]. Milk yield had remained extremely low with the average of 1.09 litre/day/cow [30]; 2.6 litre/day/cow [31], 1.8 litre/day/cow [32], 1.79 litre/day/cow [33], 1.74 litre/day/cow [34]. The average milk yield of Arsi cows was 1 litre/day/head [35]. Lactation milk yield for indigenous breed's ranged from 494 to 809 kg and lactation length ranged from 128 to 353 days [36]. Lactation milk yield for cross bred cows ranged from 970 to 2343 kg and lactation length ranged from 257 to 448 days [29, 37].

Ethiopia has one of the highest cattle populations in Africa, estimated as 53.99 million heads [2]. Unfortunately, milk production and consumption were very low. This is driven by a number of factors. In rural areas small holder farmers used indigenous breed of low milk production and managed their animal in traditional systems. They mostly depended on natural pasture with no supplementary feeds [2]. Milk produced was mainly used for household consumption, not marketed and any surplus was usually converted in to butter and sold in local markets [2].

For crossbred cow's milk production per day was 11-15 liters [38]. In addition, the overall mean dairy milk yield per liter per cow in Western Oromia were 2.2±0.6 and 6.5±1.6 for local and cross bred dairy breed respectively [39]. Moreover, the milk yield for crossbred and local cows in Wolmera areas were 8.60±2.703 and 1.96±0.8193 liters/day, respectively [40]. In addition, the lactation milk yield of pure exotic breeds ranged from 1583 to 3796 kg and lactation length from 276 to 362 days [36, 41]. Breed, level of nutrition, suckling and management factors affected lactation length. Therefore, to increase milk yield through cross breeding, selection, better feeding and improved management were suggested to increase the lactation length [42].

Traditional Handling Practice of Milk and Milk Products: Milk is the most easily contaminated and perishable product of animal origin. The high nutritional values of milk facilitate its spoilage due to the growth of pathogenic microorganisms [43]. The handling and protection of milk and milk products have a great concern around the world, this is especially true in the developing countries where production of milk and milk products took place under unhygienic condition regardless considering the health of the consumers. In Ethiopia, most of the milk produced was marketed to consumer without being pasteurized with no official quality control standards [44].

According to Zelalem and Faye [11], about 52% of smallholder producers and 58% of large-scale producers used common towels to clean the udder or they did not do it at all. Above all they do not use clean water to clean the udder and milk utensils. In Ethiopia there is no hygienic condition followed by producers during milk production. The hygienic conditions varied according to the production system, adapted practices, level of awareness and availability of resources [13]. In most of the cases under smallholder condition, the most hygienic measures taken during milk production specially during milking were limited to letting the calf to suckle for a few minutes and/or washing the udder before milking [13]. Equipment used for milking and storage of milk products determined the quality of milk and milk products [45].

The use of plastic and traditional containers can be a potential source for the contamination of milk by bacteria, because this allowed the multiplication of bacteria on milk to contact surfaces during the interval between milkings [12]. Hand washing (especially in the developing countries) between milking, during, pre and post milking stages using safe disinfectants can reduce bacterial load and enhance production of safe fresh milk [46, 47] which was reported in Eastern Hararghe where the milk producers wash their hands before milking. However, none of them use warm water and detergent for hand washing but use cold water without detergent. The milker can be an important source of milk contamination. In addition to keep good personal hygiene, milkers should be in good health during milking operation [43].

Constraints of Dairy Productions in Ethiopia: The major constraints that hinder the performance of dairy cattle were prevalence of disease and parasites, lack of good quality feed and clean water, genetics, poor farm management and shortage of grazing land [43].

Lack of Animal Health Protection: According to Gatwech [48] the major loss of animals due to diseases aggravated by shortage of veterinary professionals, accessibility of veterinary service and lack of adequate transport facility. The use of communal pastures and watering as well as marketing places play an important role in the transmission of economically significant infectious and parasite diseases. Such livestock movements could be the cause of direct or indirect transmission of various economically important livestock diseases [49]. The prevalence of various animal diseases, tick borne diseases, internal parasites and infectious diseases affects dairy development programs in varying scales, depending on ecological zones and management levels [21].

Feed Shortage: Feed scarcity could be seen from different dimension in terms of quality and quantity and seasonal feed supply to meet the nutritional requirements of dairy animals. Both roughage and concentrate feeds were either too expensive or inaccessible in adequate quantity and quality to improve dairy production [25]. Lack of adequate feed resources as the main constraint to animal production was more pronounced in the mixed crop-livestock dominated highlands as well as in the mid altitude areas of the country where most of the cultivated areas are located. These areas have high human population density that has led to intensive crop production causing continuous conversion of grazing lands to crop production [50]. Eyayu *et al*, [51] reported that the feed shortage as the major problem had contributed to the low production and productivity of cattle in Gamo Zone Southern, Ethiopia. Similarly, Derese [52] reported that feed shortage was the most important constraint to milk production in west Shoa zone of Oromia region.

Genetic Performance: The main problem of milk production in the country was that of the poor genetic potential of the indigenous cattle, which gave rise to low milk output. Milk production was as low as 0.5 to 2 litres per day over a lactation period of 160 to 200 days [21]. Genetics make up of indigenous breed covers about 99% of the cattle populations in Ethiopia that were adapted to feed and water scarcity, diseases challenges and severe climates. The production of indigenous cattle believed to be poor even if no practical recording scheme has been used to judge their merit [53]. The main problem of milk production in the country was that of the poor genetic potential of the indigenous cattle which produce low milk [54].

According to Kelay [55], activities to improve genetic performance for dairy production in Ethiopia were constrained by a number of factors. The same authors further explained that, climatic stress in the form of erratic and inadequate rainfall, low fodder yield, high price for concentrate and susceptibility to a wide variety of serious diseases damagingly affect the productivity of genetically improved dairy cattle, specially the upgraded ones.

Shortage of Grazing Land: Shortage of land and feed production induced a major constraint in urban and peri-urban dairy farming system in Shashemene-Dilla milk shed [25]. Most of the dairy producers constrained by shortage of land for grazing and improved forage crops cultivation and most dairy cattle producers had limited knowledge on the conservation of seasonal available feed [28]. In highland zones, high population growth and density caused the shortage of grazing land on which livestock production by small holders depend [25]. In the lowland areas, the scarcity of feed and water during the dry season forced animals and livestock keepers to walk long distances searching for food [25]. Daniel [56] indicated that shifting of natural pasture to crop cultivation and deterioration and fragmentation grazing land was the serious problem for livestock production in Bahir Dar Ethiopia.

CONCLUSION AND RECOMMENDATIONS

Milk production in Ethiopia depended mainly on indigenous livestock genetic resource dominated by smallholder farmers especially on cattle, goat, camel and sheep. The productivity of these indigenous breeds was low because of poor genetic capability for milk production and poor management system. Indigenous breed of cows are generally considered low milk producers. However, they were the major source of milk in Ethiopia that account for 97% of the total milk production in the country. Breed, level of nutrition, suckling and management factors affected lactation length. Therefore, to increase milk yield through cross breeding, selection, better feeding and improved management will increase lactation length. The type and the quality of milking utensil used as well as and method of milking affected the quality of milk and milk products. Dairy cattle production in Ethiopia was constrained by several factors such as prevalence of disease and parasites, lack of good quality and quantity of feed and clean water and poor farm and husbandry practices. Therefore, to improve management practice problems like water, water related problem, prevalence of diseases and parasites, constructing

different water harvesting technology and adequate inputs and veterinary services should be expanded and distributed in to all kebeles in the town in order to reduce disease problems.

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