URBAN AND PERI-URBAN DAIRY CATTLE PRODUCTION IN ETHIOPIA: A REVIEW

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✎*Supporting Information*

ABSTRACT: Dairy production is among the developing agricultural sector in the urban and peri-urban areas of Ethiopia. This paper reviews the status of the current urban and peri-urban dairy cattle production systems and indicates possible recommendations. Hence management practices which includes feeds and feeding, breeding, housing and cattle holding are assessed based on different findings. Besides milk production potential, change drivers of the sector and major challenges are reviewed. The major feeds available for cattle are hay, crop residue and agro-industrial byproducts with stall feeding being the dominant system. In all reviewed findings both natural mating and AI is used though the preference is mostly affected by accessibility. Cities with highest population and better market and input access hold higher number of cattle per house hold than with lower population and market access. The average daily milk yield is higher in and around Addis Ababa followed by other big regional cities. High rate of urbanization, population growth, change in life style together with better access to inputs are behind the expansion of the sector. But shortage and cost of feed, shortage of land and waste disposal are the major challenges. Therefore, there is a need to organize the current status of the sector and look for solutions to cope up with the growing need of milk and milk products around the cities.

Keywords: Cattle Feeding, Dairy Breeding, Milk Production, Peri-Urban Dairy, Urban Dairy

INTRODUCTION

With a cattle population of 59.5 million heads (CSA, 2016/17) Ethiopia stands at the top in Africa. They play important role in different agricultural activities and socio-economic aspect of people. Power, meat, milk and cash income are among the major roles. Dairy production is practiced almost all over Ethiopia involving a vast number of small subsistence farms are one of the major economic development contributor (Ayalew and Abateneh, 2018; Belay, 2014). They contribute enormously for agricultural and total GDP (Tegegne et al., 2013).

According to Land O'Lakes (2010) the dairy production systems can be divided into four main systems: rural dairy smallholder, peri-urban and urban, commercial, and pastoral and agro-pastoral. The largest cattle population, 75% of the total is found in rural dairy smallholders where they are used mainly for traction followed by milk and meat production.

Ethiopia is the second most populous country in Africa next to Nigeria with a population estimated at 99.39 million out of which over 19.4% live in urban and peri-urban areas (SADC, 2017). The need for milk and its products majorly come from the urban and peri urban dairy production systems. The systems involve production, processing and marketing of milk and milk products that are channeled to urban centers (Eyassu and Asaminew, 2014; Tegegne et al., 2013). This system is contributing immensely towards filling in the large demand-supply gap for milk and milk products in urban centers, where consumption of milk and milk products are remarkably high. Dairy farmers and cooperatives involved in milk production in the peri-urban and urban areas are selling milk to consumer in the nearby town and city (Metekia and Nezif, 2017; Gebremichael et al., 2014). Producers have a better understanding of dairy management, processing facilities, better genetics (50 – 62.5% crosses) with experience of receiving AI services (Land O'Lakes, 2010).

Due to 3% population growth, 4.8% growth per year urbanization (Ulfina et al., 2013) together with change in life style, this production system is expanding and will have a bright future ahead. The system is practiced in and around major cities due to market and relatively better input access than the rural dairy small holders. The feeds and feeding system, breeding, housing, cow performance, and challenges of the sector have been studied in most of the cities and towns by different researchers. But the differences and similarities in management and constraints are not well organized and reviewed to show the comparative variance in between the locations.

So, the objective of this paper is to review the management, milk production performance,

MANAGEMENT OF DAIRY CATTLE

Feeds and feeding

The dominant feeding systems for keeping dairy cattle in Jimma, Badalle, Ambo, Gimbi and Naqamte towns were grazing and grazing with some stall-feeding (Ulfina et al., 2013). In Adet and Merawi towns stall-feeding followed by seasonal grazing is mostly practiced whereas in Ejere and Hinchini towns, mixture of concentrate with some forage (in stall feeding) is dominant (Gizaw et al., 2016) though there is some feeding system variation between local and crossbreed cows. This can be due to the fact that crossbreed cows require more quality and quantity feed than local ones to produce higher amount of milk.

In Adwa and Axum, hay, crop residue, grazing, crop after math and non-conventional feed like *Atella* (by-product from the production of local beer) were identified as major sources of feeds (Gebrekidan and Gangwar, 2015). Whereas in Bishoftu the principal feed available were concentrates (noug cake and wheat bran), crop residues, stored hay, some forage legumes, vegetable and fruit wastes (Mulisa et al., 2011). The proportion of concentrate in the stall-fed diet was high in Gondar as compared to rural dairy cattle production (Addis et. al., 2011) and the feeds were of natural pasture, purchased concentrates, beer brewery and roughages (Moges, 2015). Hay and wheat bran were the main feed type used in Adis Ababa (Awoke and Mekibib, 2017).

The main feed resources available in the farm for cows in Hawassa city were crop residues, including stover (especially maize), grass hay, industrial byproducts and to some extent *Attela* (Haile et al., 2012). Concentrate feed composed of wheat bran and noug cake and salt additionally during the dry season is provided mainly to cows and calves at Shambo, Fincha and Kombolcha (Demissu, 2014). According to Hulagersh et al. (2017) the commonly available and frequently applied feed stuffs in Mekele dairy farms include straw, grass hay, concentrate "Frusca", and other green grasses (Alfalfa and Elephant grass). A study in Jimma town revealed that majority of farmers use green feeds as the main basal diet, and wheat bran, commercial concentrate mix and noug cake were the most important concentrate supplements (Duguma and Janssens, 2016). Though crop residue and hay are most common feeds in the system, the difference in the kind of concentrate feed is due to the type and availability of agro-industries in the area.

Housing

According to Gizaw et al. (2016) almost all farmers in urban areas keep their cows in a separate improved housing, whereas only about half farmers do so in peri-urban areas of West Gojam and West Shoa zones with 40.0 % and 81.0% of the farmers in peri-urban and urban areas provide feeding and watering troughs in the barns, respectively. In Nekemte, closed barn housing system is mainly used for urban dairy housing and traditional housing system (open crush barns) is mainly used in peri-urban area (Misgana et al., 2015). Different from most areas, 71.6% of the households in Boditti town used cooking places (kitchen) for their animals (Asrat et al., 2013).

On the other hand housing in the peri-urban dairy production system of Shambo and Kombolcha was mainly roofed housing where 65.6% of cows living under shade while the remaining 34.4% passed the night in open backyard and/or traditional barn (Demissu, 2014). In Bishoftu town most farms have permanent house for their cattle and 83 % of the house of dairy farms is roofed while the remainder is not roofed (Mulisa et al., 2011).

Mating system

The most common performance trait mentioned in different studies for selection of superior bull is high daily milk yield followed by high fat content and shorter age at first calving. With regard to mating system in Addis Ababa for instance 77.4 % use artificial insemination (due to its accessibility), 3 % use only natural mating and 19.4 % use both Artificial Insemination (AI) and Natural mating alternatively (Awoke and Mekibib, 2017). In Shashemene and Dilla only 50% use AI as sole source of genetic improvement and the rest use a combination of both AI and natural mating (Sintayehu et al., 2008). On the contrary in Gondar 57% use natural mating, 20% AI and 22.5% use both AI and natural mating (Chanie et al., 2018). In Boditi 48.4 % used AI while 51.7% used natural mating with local bull where access and cost of AI is the determining factor (Asrat, 2013). In Bishoftu 40% use only natural mating, 22.5% use only AI and 37.5 use both natural mating and AI (Mulisa et al., 2011) depending on the accessibility at the time when cows are in estrus. On the other hand, according to Yayeh et al. (2017) natural mating was the only method used for dairy cattle breeding in and around Debre Markos town. The variation in the use of AI and bull is due to the access and preference by farmers to insure conception.

Dairy cattle holding

The average cattle herd size per household in peri-urban areas of greater Addis milk shed was 11.8 TLU (Tropical Livestock Unit) (Fekede et al., 2013). In Debre Markos 7.35 cattle her size is reported by Yayeh et al (2017). This result is higher than the finding of Yitaye et al. (2009) at Bahir Dar and Gondar peri-urban milk shed areas which is 6.5. The average number of cattle from the total herd in urban and peri-urban areas of Adwa and Axum is 6.78 and 4.83, respectively (Gebrekidan and Gandwar, 2015). In Boditti town the average number of cattle per house hold was 3.9 (Asrat et al., 2013) while in Hawassa city was 3.15 cow per house hold (Haile et al., 2012) in Shashemene 3.34 and in Dilla 1.51

(Sintayehu et al., 2008). From this we can understand that the bigger the city the larger the number of cattle per house hold. This could be due to the fact that bigger cities have better access to AI, concentrate feed and market.

MILK PRODUCTION POTENTIAL

Daily milk yield

A daily milk yield (DMY) of 11.6 and 10.8 liters were recorded in Bishoftu and Akaki towns, respectively, for crossbred cows (Dessalegn et al., 2016) and in Adama milk shed was 11.3 liters (Nigusu and Yoseph, 2014). In Hawassa a DMY of 10.32 liters for cross bred cows is recorded (Haile et. al., 2012). This result is higher than the finding of Yitaye et al. (2009) who reported 7.8 liter at Bahir Dar and Gondar peri-urban milk sheds and Yayeh et al (2017) who reported 7.3 liter in Debre Markos town. On the other hand Asaminew and Eyasu (2009) reported 5.2 liter of DMY in Bahir Dar Zuria. Demissu (2014) reported the average daily milk yield in three towns of Horo Guduru Wollega zone was 7.21 liters. Those findings revealed that the bigger the cities the dairy production is found the higher the daily milk yield is recorded. This could be due to the fact that bigger cities have better access to inputs like concentrate feeds, AI, veterinary service and market.

Lactation length

Lactation length is the time of period from when a cow starts to secrete milk after parturition to the time of drying off. A lactation period of 10 moths is recommended to take advantage of 2 months dry period. Zewdie (2010) reported that the average lactation period of crossbreed dairy cows in Debre-Birhan and Sebeta were 9.7 and 10 months, respectively. Similarly in Shambu and Kombolcha towns of Oromia region 10.53 and 12.0 months of lactation length is reported, respectively (Demissu, 2014). While in Melkasa and Welenchiti was 10.8 and 11.4 months, respectively (Nigusu and Yoshep, 2014). Those findings are larger than 9.17 months in Gondar town (Kumar et al, 2014) and 8.7 months in Debre Markos (Yayeh et al., 2017). While Assaminew and Eyasu (2009) reported 10 months of lactation length in Bahir Dar Zuria. In Bishoftu and Akaki a lactation length of 9.22 and 9.36 months was reported by Dessalegn et al. (2016) at Bishoftu and Akaki towns, respectively. While in Jimma town a lactation length of 10 months was recorded (Ulfina et al., 2013). So lactation length is not a problem in the production system except in Debre Markos town.

Change drivers of the sector

Eastern Africa is the leading first milk-producing region in Africa, representing 68% of the continent's milk output. In Ethiopia, according to FAOSTAT (2014) milk production in 2011 was 4.4 million tons with 14.2 % growth rate between 2000 and 2011. Most Ethiopians are important consumers of milk and dairy products. Generally, milk consumption is rising although there are disparities among different cities and towns. Population growth, urbanization, rising incomes and change in lifestyles are the main drivers of this trend. Currently Ethiopia's milk consumption is only 19 liters per person – but urbanization is driving up consumption and per capita consumption in Addis Ababa is 52 liters per person (ATA, 2016). According to different authors, the majority of dairy farms in and around most of the cities were established in the past 20 years in response to the growing market demand for fresh and processed milk (Adiss et al., 2011; Zelalem et al., 2011) and contributing immensely toward filling the larger gap for milk and milk product supplement (Awoke and Mekibib, 2017). Access to different inputs, though a lot of work is needed, is another driver of the change in the sector. The accessibility to AI, concentrated animal feeds like agro-industrial by products and better veterinary services are additional opportunities for owners to rear dairy cattle in and around cities and towns.

Challenges of the sector

Shortage of animal feeds is the most important limiting factor of dairy production followed by limited space for proper housing, milking, waste disposal, and expansion, and animal disease incidence in Hawassa town (Haile et al., 2012). Availability and costs of feeds, land shortage, and problems related to waste disposal are the main challenges in Boditti town (Asrat et al., 2013). The same result was observed in Shashemene and Dilla towns (Sintayehu et al., 2008). Lack of market in the fasting season and poor genetic potential of local cows are main constraints in Debre Markos town (Yayeh et al., 2017). The main challenges mentioned in Mekele town were feed shortage, disease problems, and market problems (Huluageresh et al., 2017). This finding agrees with the report of Zekarias and Shiferaw (2012) in Jimma town where shortage of feed, disease and large number of local animals are the major bottle neck. The major constraints for dairy development in Bahir Dar and Gondar peri-urban milk shed areas include little availability and high costs of feeds in connection with shortage of farm land, poor access to waste disposal, poor market infrastructure and marketing systems (Yitaye et al., 2009). So in urban areas shortage and cost of feed and land are the major challenges while in peri-urban areas large number of local cattle and disease are additional problems.

Conclusions and Recommendations

Hay, straw and concentrates are main source of feed and free grazing with some stall feeding is a common feeding system. All in urban area and most dairy cattle owners in peri urban area keep their animals in a separate improved housing. Natural is still the major mating system due to less AI access, cost of AI and farmers preference to ensure

conception. The average dairy cattle holding is negatively correlated with population size and size of towns. Though there is a variation in daily milk yield in between crossbreed and local cows, the average is still low. In all reviewed papers the lactation length is almost up to standard which is around 10 months. Population growth, urbanization, rising incomes and change in lifestyles are the main drivers of the sector. Shortage and cost of feed, shortage of land and waste disposal are major challenges reviewed in this production system.

From this review the following recommendations are made:

➢ Formulated feed mixers (to supplement quality feed) should invest to support the sector and chemical treatment improve the quality of hay should be implemented.

➢ The government and nongovernment organizations should strive to give access of AI for cattle owners.

➢ To improve the conception rate of AI, the technicians should improve their efficiency through training and experience.

➢ Waste disposal is an emerging challenge in the sector. So, using manure to biogas and compost should get attention.

DECLARATIONS

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