

A Review on Roles of Smallholder Milk Production in Ethiopia

Asrat Ayza¹ and Yohannis Olikamo²

¹Department of Animal and Range Science, College of Agriculture, Wolaita Sodo University, Ethiopia

²Livestock and Fishery Resource Office vice Head, Boloso Bombe District, Wolaita, Ethiopia

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***For Correspondence**

Asrat Ayza, Department of Animal and Range Science, College of Agriculture, Wolaita Sodo University, Ethiopia

Tel: +251913292891

E-mail: ayzaasrat@gmail.com

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ABSTRACT

Ethiopian economy is highly dependent on agriculture where the livestock subsector plays a vital role as source of food, income, services and foreign exchange and contributes up to 12 and 33% of the total and agricultural GDP, respectively, and accounts for 12-15% of the total export earnings, second in order of importance. Milk and milk products play a very important role in feeding the rural and urban population of Ethiopia and have high nutrition value and is daily produced, sold for cash or readily processed. It is a cash crop in the milk-shed areas that enables families to buy other foodstuffs, contributing significantly to the household food security and income generation. Based on climate, land holdings and integration with crop production, three dairy production systems are recognized in Ethiopia; namely the rural dairy system (pastoralists, agro-pastoralists, and mixed crop-livestock producers); peri-urban and urban systems. Smallholder farmers represent about 85% of the population and are responsible for 98% of the milk production and play an important role in household food security and income for smallholder farmers. The greatest potential for dairying is expected in Ethiopia, due to low disease pressure and good agro-climatic conditions for the cultivation of feed. High population densities and animal stocking rates, as well as easy access to markets, make it attractive to invest in market-oriented dairy production technologies and cross-bred cows, improved feeding and management in peri-urban areas. Even though with increasing their production potentials, there are challenges that hinder dairy productivity within the ever-demanding socio-economic, demographic and ecological changes. Therefore, the objective of this paper is to review the roles and potentials of smallholder dairy cattle farming in Ethiopia.

INTRODUCTION

Ethiopia has a huge livestock production potential because of good agro-ecology and large livestock number that is about 163.86 million (CSA, 2013) [1]. Different production systems like those that pastoralists' mixed crop/livestock, urban and peri-urban, etc are predominantly practiced over the Country. Livestock play a vital role in economic development of Ethiopia, particularly as societies evolve from subsistence agriculture into cash-based economies Ahmed et al., 2004[2].

The donation of livestock sector is estimated to be about 12 to 16% of the total gross domestic product (TGDP) and 30 to 35% of the agricultural gross domestic product (AGDP) (Ahmed et al., 2004)[2]. In addition, the contribution can be in home consumption, income generation, farm utilities, symbol of status and manure.

From earlier reports it can be observed that the contribution of milk and milk products is about 20-36% to the total farm income of smallholder farmers in Selale and Holleta areas in the central highlands (Yilma, 1999); up to 46% (Beyene and Abrahamsen, 1994)[3] in the Southern Ethiopia and 12-50% in and around Boditti town, Wolaita zone (Asrat et al., 2013)[4].

As reported by Yilma and Ledin (2000)[5] in the crop/livestock production system of mid highland of Ethiopia, the contribution of the dairy operation ranged from 7 to 44% of the total income of farmers depending on the distance from urban centers. Another report on market-oriented dairy producers around Holleta area indicated that dairying on average contributed 34% to the total income of the farmers (Ahmed et al., 2003)[6].

As the findings indicated that the contribution of dairying to the income of rural families is quite insignificant due to home consumption and lack of market for fresh whole milk. In the contrary, it plays great role in the livelihood of the urban dwellers

which can be considered to have good prospect for further promotion of dairying (Asrat et al., 2013)[4]. The amount of income obtained by dairy producers is affected by different factors such as herd size, income from other sources, crop land (farm) size and productivity of animals.

Currently demand for dairy products in the country exceeds supply due to rapid population growth (FAO, 2004)[7], increased urbanization and expected growth in incomes (Ahmed et al., 2004)[2] and consumer preference. These factors are the driving forces to improve dairy sector, so that satisfy population demand and generate more income to engaged farmers.

Milk and dairy foods can make an important contribution to improving nutrition for women and children and are an important constituent in food products aimed at treating malnourished children. In livestock-keeping communities where milk is readily available milk and dairy products are fed preferentially to young children, whose nutritional requirements for growth and mental development are greatest between conception and two years of age.

However, milk and milk products play an important role to the livelihood of the engaged households, there is no adequate information to understand the contribution of milk and its products to farm families.

Roles of Smallholder Dairy Milk Production

Milk and its products as part of diets

Milk and dairy foods are nutrient-dense foods supplying energy and significant amounts of protein and micronutrients. The inclusion of dairy products adds diversity to plant-based diets. The primary role of milk is to nourish the infants of a species. The consumption of animal milk is a by-product of animal domestication, which occurred about 10,000 years ago. For early humans, the advantages of milk consumption and its effects on growth and bone. In contrast, for contemporary human populations, while childhood growth and bone strength are important for health, it is the effects of milk and dairy consumption on individual well-being and on chronic diseases and their associated economic costs that are of greater relevance (Elwood et al., 2008) [8].

Milk is a complex food containing numerous nutrients. Most of the constituents in milk do not work in isolation, but rather interact with other constituents. It is also important to remember that dietary fats, in addition to being a concentrated energy source, serve as an important delivery medium for fat-soluble vitamins and contain various fatty acids (e.g. conjugated linoleic acid [CLA]) and bioactive factors beneficial to health (e.g. triacylglycerols and phospholipids) (German and Dillard, 2006[9]; Fleming and Harris, 2010). Similarly, to consider even saturated fatty acids (SFAs) as one uniform group of fats may be an oversimplification (FAO and WHO, 2010; Feinman, 2010)[10,11], since individual fatty acids (FAs) have specific functions depending on their chain length.

Food Security

Milk is a nutritious food and can make a major contribution to household food security. Many health and stunting problems associated with child under nutrition can be tackled through simple low-cost milk fortification tailored to local needs, e.g. iron (helps prevent anemia) and extra vitamin A (for vision, the immune system), etc. A daily 200 ml glass of milk provides a 5-year-old child with: 21 percent of protein requirements; 8 percent calories and key micro-nutrients. The FAO definition of food security states that “food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern” (FAO and WFP, 2009) [12].

A widely used conceptual framework published by UNICEF in 1990 identifies three main underlying determinants of nutritional status: (i) availability and access to adequate food; (ii) the quality of feeding and care-giving practices; and (iii) the health of the surrounding environment and access to health care (UNICEF, 1990). Thus good nutritional outcomes can only be attained if an individual has access to a nutritionally adequate diet relative to his/her physiological requirements in combination with access to clean water and sanitation and adequate health and social care.

A varied diet composed of sufficient quantities of diverse foods is the cornerstone of food security and key to avoiding both under and over nutrition (obesity). Policy-makers must ensure that not only sufficient staple foods are produced but a variety of micronutrient-rich foods are accessible to the world's poor and malnourished. While staple foods frequently provide the bulk of energy and protein, dietary variety is pivotal for human health, proper child growth and socio-economic development. In addition to staples, fruits, vegetables and legumes, some animal sourced foods such as dairy products, eggs and fish are essential in a healthy diet.

Some fat and healthy vegetable oils are also needed to provide essential fatty acids and to enhance the body's ability to absorb vitamin A from plant foods. Dietary recommendations for milk and dairy products continue to generate significant interest. Many comments from around the world have been posted recently (2011) on the FAO Dairy Outlook online discussion network (FAO, 2011b). FAO and WHO are frequently asked about recommended amounts of milk and dairy products for consumption. There are currently no global dietary recommendations for specific foods or groups of commodities, with the exception of the

dietary goals established for the intake of fruit and vegetables, and for fats and oils (WHO, 2003) [13-15]. Most national dietary guidelines recommend daily consumption of milk. Some but not all make recommendations on the quantities to be consumed daily. Recommendations differ according to the nutritional needs of different age groups. Generally, larger quantities of milk and dairy are recommended for children and adolescents, pregnant and lactating women and the elderly, who have special requirements.

Milk and dairy foods can make an important contribution to improving nutrition for women and children and are an important constituent in food products aimed at treating malnourished children. In livestock-keeping communities where milk is readily available milk and dairy products are fed preferentially to young children, whose nutritional requirements for growth and mental development are greatest between conception and two years of age.

NGOs including Heifer International, FARM-Africa and Oxfam report increased milk consumption and child growth in households raising livestock. However, the possible impact of increased income and associated purchase of animal products and improved health care is seldom considered in such reports. Smallholder dairying, especially in crop–dairy systems, contributes to food security and poverty alleviation of most smallholders directly through milk consumption (Muriuki, Mwangi and Thorpe, 2001). In the Ethiopian Highlands, the introduction of improved technologies (cross-bred cows, improved feeding and management) made a significant contribution to food security and nutrition as well as to alleviating poverty (Tangka, Ouma and Staal, 1999).

Income and Employment Generation

Income generation

Income and employment are key drivers of livelihood improvement in smallholder Dairy Industry Development Programs (DIDPs). A number of organizations conclude that market-oriented small-scale dairying can increase household income, reduce food losses, generate employment in milk collection, processing and marketing and stimulate rural development (Bennett et al., 2006; FAO, 2005a). The largest example is India's Operation Flood, replicated in selected states with the technical support of FAO from 1970 to 1996. It was successful both because it was driven by demand created by urban milk droughts, and because bottom-up cooperative milk products were actively marketed, even advertised in topical cartoons, attracting consumers.

Record quantities of dairy products supplied from European commodity aid were carefully monetized and invested in milk processing and transport infrastructure, which increased capacity without incentivizing Indian farmers (Scholten, 2010). The programme was administered and implemented by Indian organizations, and generated huge increases in income: a World Bank report (Candler and Kumar, 1998) lauded Operation Flood for the lesson that no intervention alleviates poverty so much as those that raise smallholder incomes. The programme, in which 70 percent of the 14 million farming families currently participating are landless or smallholders, owes much of its success to effective management and strong leadership by leaders of farmers' cooperatives, government support and the effective umbrella organization of the National Dairy Development Board. In the last decade India overtook the United States as the world's top milk-producing country.

Employment generation

In milk production About 12 to 14 percent of the world's population, nearly a billion people derive at least some part of their livelihood from livestock (Steinfeld et al., 2010). In 2005 the World Bank Agricultural Investment Sourcebook (World Bank, 2005a) reported that smallholder dairying was cost effective and a key source of nutrition and income to 300 million farm families globally, including 40 million in India. Mean herd size is around two cows, giving an average milk yield of 11 liters per farm per day and creating one full-time on-farm job; in developed countries over five times that volume of milk is needed to create one farm job (FAO, 2010a). An ILRI study in Ethiopia and Kenya in East Africa and India and Pakistan in South Asia supported these findings (Staal, Nin Pratt and Jabbar, 2008a, 2008b).

In India farm-level studies highlighted the continuing importance of dairy farming in generating regular employment (Shiyani and Singh, 1995; Singh, 1997). These studies estimated that a dairy cow generated 60-100 work days per annum, depending on region, category of farm household and type of dairy cattle. On a per household basis, employment generated varied from 150 to 300 work days per year. The livestock sector provides much more employment and regular income than rice and wheat or allied activity. Productivity of labor in dairying is about 2.5 times higher than in agriculture generally, with corresponding annual returns per unit of labor of INR 45,000 (US\$1,020) and INR 17,000 (US\$390), respectively.

On smallholdings in India and Pakistan, employment generated per unit of milk production decreases dramatically as herd size increases (Staal, Nin Pratt and Jabbar, 2008a). In Kenya, smallholder surveys estimate two million dairy farming households keep over five million grade or crossbred dairy cattle. Some 77 people are employed full time for every 1,000 liters of milk produced daily, equating to a total of 841,000 jobs (256 000 self-employed and 585,000 hired). Small- and medium sized dairy enterprises represent 87 percent of this employment (SDP, 2005). In Kenya, dairy farming generates an average income per enterprise of KSh 38,000 (US\$475) for small-scale farmers and KSh 298,129 (US\$6,025) for large-scale farmers, with an average weighted income of KSh 114,000 (US\$1,425) compared with an average per capita gross domestic product (GDP) of KSh 27,825 (US\$347) for Kenya (World Bank, 2003).

Ethiopia's livestock sector accounts for 30-35 percent of agricultural GDP or 12-16 percent of GDP; dairying represents half of livestock output, and livestock contribute to livelihoods of 60-70% of the population (Aklilu, 2002; Ayele et al., 2003). A study of employment and income from all dairy-related activities for two groups of farms in the Ethiopian highlands found urban/perurban systems produce 205 million liters of milk annually, creating 15,000 full-time jobs, while the small-scale mixed farming system produces 900 million liters of milk annually, creating over 550,000 jobs (Muriuki and Thorpe, 2001).

Other studies show that farmers who adopt the FARM-Africa goat model in Ethiopia and Kenya can raise their annual incomes from under US\$100 to US\$1,000 (Peacock, 2008). There is, however, a lack of broader data on the role and potential of small ruminants and other milk species in dairy-industry programs. Falvey and Chantalakhana (1999) note that smallholder dairying in the tropics has not been an investment focus by the World Bank, African, Asian and other regional development banks or most bilateral aid agencies. This does, however, appear to be changing, with agencies such as the World Bank showing a renewed interest and return of a focus towards investing in agriculture. The World Development Report 2008, for example, concludes that agriculture alone will not be enough to massively reduce poverty, but it is an essential component of effective development strategies for most developing countries (World Bank, 2007a). The International Fund for Agricultural Development (IFAD), for instance, is increasingly supporting dairy industry development projects.

Although high dairy consumption may be considered a health risk in some developed countries, dairy consumption is far lower in most developing countries, where the micronutrients in milk and dairy products enrich people's diets. Considering the benefits to smallholder incomes, and to the treasuries of countries that import large amounts of dairy products, the rationale for dairy-industry development is clear. Underscoring this is the fact that cattle can thrive on plant matter inedible to humans.

In Milk Processing and Marketing

In addition to a substantial number of on-farm jobs, the dairy sector generates significant employment in downstream industries and services. In India, for example, for every 1,000 liters handled on a daily basis, the informal markets generate: 10.6 milk jobs for vendors (dudhias); 20 jobs in sweet shops; 13 jobs in creameries that produce indigenous milk products, e.g. paneer, butter, ghee, cream and dahi (yoghurt); 5 jobs in retail sales of packaged milk; and 26 jobs in local ice-cream production (1.7 in the form of services to maintain equipment) (Staal, Nin Pratt and Jabbar, 2008a).

Extrapolating these figures to the national level suggests that up to 1.8 million dairy jobs are found in the informal processing and marketing of milk in India. A decade ago the National Sample Survey Organization database (1999/2000) estimated 1.3 million jobs in processing and marketing of milk and milk products. Informal dairying in Lahore, Pakistan, generates nine jobs per 1,000 liters of milk while distributors and formal processors generate four and three jobs per 1,000 liters of milk, respectively. Women constituted less than one percent of employees of formal processors. Extrapolating the survey results to the provincial level, it is estimated the informal dairy sector generates 158,600 jobs in Punjab while milk-processing companies generate 3,100 jobs. Corresponding estimates for Sindh province are 32,600 and 4,200 (FAO, 2007a).

In Kenya, processing and marketing of about eight million liters of milk daily generate jobs for traders, transporters, mobile milk traders, milk bars and shops/ kiosks, small and large processors, vehicle repairs, security firms and catering outlets. The number of direct and indirect jobs created in the marketing segment of the supply chain varies from 3 to 20 people per 1,000 liters traded daily.

Informal marketing generates on average 18 jobs per 100 liters of milk handled daily, including three indirect jobs. Corresponding figures for the formal sector are 13 and one. Employees in formal processing and marketing and informal traders earn approximately the same monthly income of US\$150. In contrast, the government's minimum wage guideline is US\$43 (Staal, Nin Pratt and Jabbar, 2008a). A joint study by ILRI and FAO found that in Kenya "the informal sector has been growing at over 10 percent in the last decade and its share of total employment, excluding employment in small-scale farming activities, was estimated at 70 percent in 2000" (Mburu, Wakhungu and Gitu, 2007).

In Ethiopia only a small amount of milk (nine million liters) is processed into pasteurized milk, butter and cheese by large-scale commercial processors. Most milk is processed on farm into butter and soft cheese (ayib) for home consumption and sale. Dairy processing and marketing nationally were estimated to create 174,000 jobs. About 94 percent of these jobs were in on-farm processing, which is dominated by women. In contrast, men dominate industrial processing (Staal, Nin Pratt and Jabbar, 2008b).

FAO (2012) states that poverty levels of 2,000 Afghan families were reduced by 19 percent by an FAO/GTZ project that significantly increased productivity per cow, and farmers' income from milk increased from US\$1.73 per week in 2002 to US\$10.20 per week in 2006. Women and children benefited and participated in these activities. Eighty-four percent of income from the sales of dairy products returned as payment to rural farmers. Increased milk production contributed to import substitution and improved food security (FAO and IDF, 2007). In Mali an FAO/World Bank dairy development mission concluded that, with the ongoing small milk processing programme, each 10liters of milk collected could generate one full-time job annually, directly or indirectly (J.C. Lambert, personal communication, 2012). In many countries smallholders earn more from dairying than from arable crops and dairying creates more jobs than other food chains.

Gender and Household Well-Being

Well-executed DIDPs contribute to improved health and well-being of people, well-being is defined as “a state of being with others, where human needs are met, where one can act meaningfully to pursue one’s goals, and where one enjoys a satisfactory quality of life” (WeD, 2007).

Small-scale dairying provides regular income for families and households around the world, and women are engaged in milk production, collection, processing and marketing of dairy products. Gender is defined by FAO (1997) as “the relations between men and women, both perceptual and material. Gender is not determined biologically, as a result of sexual characteristics of either women or men, but is constructed socially”. But “gender” does not denote the promotion of women only; it encompasses all of family well-being and household food security (Bravo-Baumann, 2000).

Women’s traditional roles were often overlooked in development programs directed at men who were the nominal owners of animals. Interventions sometimes resulted in higher labor input by women, while their control of production, resources and output was unclear. In recent decades gender issues attract more attention by researchers and development partners in the design stage, and it is increasingly recognized that women’s participation is a key to ensuring food and nutrition security in developing countries (IFPRI, 2005). A World Bank report, *The Role of Women in Afghanistan’s Future* (World Bank, 2005b), identifies gender responsive actions that can enhance growth, incomes and well-being even where discrimination is pervasive. It states that women play increasingly important roles in livestock production and processing of dairy products but most of women’s labor is non-monetized.

The contribution of women in reducing hunger is also emphasized in a report by the International Centre for Research on Women (ICRW): “If the global community is to increase agricultural productivity and income-generating activities in hunger-prone communities (Bunch and Mehra, 2008). The World Bank (2007b) examined five pathways linking agriculture and nutrition and concluded that the empowerment of women is the pathway that carries special significance for household nutrition and particularly children’s health and nutrition outcomes. Women were consistently more likely than men to invest in their children’s health, nutrition and well-being. Women have a significant and important role in many livestock activities and this needs to be better recognized and planned for (Mera Declaration, 2010). FAO and other agencies are mainstreaming gender issues in their livestock programs. In Viet Nam, for example, the main income beneficiaries of an award winning project focused on goat milk were small-scale women farmers, who not only did much of the farm work but also processed and marketed high-quality cheese (FAO, 2000).

Operation Flood in India worked with non-governmental organizations (NGOs), notably the Self-employed Women’s Association and Bhagavatula Charitable Trust, who founded 6,000 women-only dairy cooperative societies (DCSs), some with the support of the Ford Foundation. These are said to operate more smoothly than their male-dominated equivalents; women, when empowered, proved more adept at the utilization of improved husbandry methods than their husbands. Since 1998, 6,000 out of 7,000 DCSs formed in India are women’s societies and women continue to gain more control over the sale of milk and the use of income from it (Candler and Kumar, 1998). Moser (2006) argues that “poverty itself can be regarded as a lack of assets but also a lack of rights (social, economic, cultural, political and civil). Toward that end, working within organized groups increases the ability of women to be agents of their own development”.

A similar FAO project in North Korea (TCP/DRK/0168) targeted women to improve child nutrition. Two pilot units processing goat milk were set up on collective farms to demonstrate the bulking and processing of drinking yoghurt for local school feeding schemes (FAO, 2004b). For the first time in North Korea, farmer workers could milk their own goats at household level and sell the milk to collective processing units. Drinking yoghurt was selected because children in North Korea were assumed to be lactose-intolerant (fermented milk products including yoghurt contains less lactose than milk).

Around Gogounou, in the north of Benin, 300 women involved in an FAO dairy development project delivered 600 liters of milk a day to a small dairy plant set up by the project, with 20 milk collectors and a team of three women for the milk processing (Bennett, 2010). In June 2003, at the beginning of an FAO goat milk production project near Lima, Peru, six women were collecting 1,530 liters of goats milk each month; by October 2005 this had increased to 264 women collecting 21,500 liters per month. During this period each poor family in the valley saw their income increase from 200 Soles per month to 1,800 soles (J.C. Lambert, personal communication, 2012). In 1989, the Sichuan Livestock Development Project, a project sponsored by IFAD, found that involving women in dairying increased family income and reduced the need for men to leave the village for employment (Rahman, 1995).

A study by ILRI and the national research institutes in Kenya and Ethiopia (Tangka, Ouma and Staal, 1999) confirmed the traditionally important role of women in milk production in Kenya but found that women played a much smaller role in dairying in Ethiopia. In Kenya, women alone controlled dairy income in 50 percent of interviewed households, with husbands and wives jointly controlling income in another 25 percent of the cases.

On average Kenyan women constitute 70.4 percent of dairy-farm operators, ranging from 88.9 percent in female-headed households to 61.1 percent in male-headed households. In contrast, in Ethiopia women contributed only 5.5 percent of the labor involved in dairying in households with crossbred cattle, and only 5 percent in households with indigenous cattle.

The Grameen Bank/FAO integrated social dairy chain model in Bangladesh (livestock/fish farming system) increased the number of women beneficiaries from under 5 percent to over 60 percent, with over half of women rising to become Village Group Chiefs. Nobel Laureate Muhammad Yunus cites benefits of women's participation in livestock/fish farming systems which supply the Grameen Danone yoghurt plant (Grameen Bank/FAO/UNDP, 2007).

Dairy programs such as the EADD project prepare women and youth for leadership and management at primary farmer organization, secondary dairy company management and technical levels (EADD, 2010). Results from a limited survey in two dairy business hub sites in Kenya show that increased milk production at household level translates into increased milk consumption by children and therefore improved nutrition. The challenge for farmers who intensify dairying relates to increased labor requirements for women. Recent calls for awareness raising and promotion of labor-saving technologies to mitigate possible negative impacts show recognition that family well-being and gender relations need attention as production scale rises from subsistence, to transforming, to commercial dairying.

Dairying and the Environment

Smallholder dairying fosters environmental sustainability in integrated farming and optimizes use of local natural resources. Methane emissions can be significantly reduced by modest increases in productivity and technological changes. On the other hand, if dairy products are imported, energy consumption is far higher (FAO, 2008). Smallholders in developing countries use little energy in milk production compared with farmers in industrialized countries. Other energy and resource efficient advantages include: (i) the use of animal and human power for producing feed and fodder; (ii) feeding of crop by-products that do not need additional energy to produce; (iii) relatively low consumption of energy-intensive concentrate feed; (iv) the predominance of grazing over stall feeding; (v) keeping animals in low-cost sheds or in the open; (vi) use of human power for milking; and (vii) use of manure for biogas production for cooking and lighting/heating and for fertilizing crops (Dugdill and Morgan, 2008; FAO, 2008).

Conclusion

Smallholder dairying is a cost effective and key source of nutrition and income sources for farm families globally and playing an important social role and is considered an important means of alleviating poverty and for using organic fertilizers. It provides very important nutrients for all age categories from infants to elders, contributes about 65% to income in pastoral and agro-pastoral areas, 46-50% in mixed production and 47% in urban/peri-urban systems. It created employment opportunity in milk production, milk processing and marketing levels for many jobless youths and assure gender and family well-being since more than half of the venture is operated by females at smallholder level. Smallholder dairying fosters environmental sustainability in integrated farming and optimizes use of local natural resources. With these all, transport, draft power, manure, savings and insurance, social status etc. roles of smallholder dairying is also meaningful in areas practicing it.

REFERENCES

1. CSA, 2013. Federal Democratic Republic of Ethiopia Central Statistical Agency. Agricultural Sample Survey (2012/13 [2005 E.C). Volume II, Report on Livestock and Livestock Characteristics. Statistical Bulletin 570. Addis Ababa, Ethiopia.
2. Ahmed M, et al. Dairy Development in Ethiopia. Environment and Production Technology Division. International Food Policy Research Institute. 2004.
3. Beyene F, et al. Present situation and future aspects of milk production, milk handling and processing of dairy products in Southern Ethiopia. Farm-made milk products in Southern Ethiopia: Chemical and microbial quality. 1994:1-16.
4. Asrat A, et al. Characterization of milk production systems in and around Boditti, South Ethiopia. J Irrd. 2013; 25:10.
5. Yilma Z and Ledin I. Milk production, processing, marketing and the role of milk and milk products on small farm's income in the central highlands of Ethiopia. 2000; 139-154.
6. Ahmed MAM, et al. Dairy development in Ethiopia, Paper presented at the 'Successes in African agriculture. 2003; 21-23.
7. FAO. 2004. Livestock Sector Brief in Ethiopia. Food and Agriculture Organization of the United Nations. Livestock Information, Sector analysis and Policy Branch. AGAL.
8. Elwood PC, et al. The survival advantage of milk and dairy consumption: an overview of evidence from cohort studies of vascular diseases, diabetes and cancer. J Am Coll Nutr. 2008;27:723S-734S.
9. German JB and Dillard CJ. Composition, structure, and absorption of milk lipids: a source of energy, fat-soluble nutrients, and bioactive molecules. Crit Rev Food Sci Nutr 2006;46:57-92.
10. FAO & WHO. 2010. Interim summary of conclusions and dietary recommendations of Total fat & fatty acids. From the joint FAO/WHO expert consultation on fats and Fatty acids.
11. Feinman RD. Saturated fat and health: recent advances in research. Lipids. 2010;45:891-892.
12. Food and Agriculture Organization. *Milk for Health and Wealth*. Rural Infrastructure and Agro-Industries Division United Nations

Rome, 2009.

- 13.WHO 2003. Guiding principles for complementary feeding of the breastfed child. Yilma Z. 1999. Smallholder Milk Production Systems and Processing Techniques in the central highlands of Ethiopia. MSc Thesis, Swedish University Agricultural Sciences. Uppsala, Sweden.
- 14.FAO 2013. Milk and Dairy products in human nutrition. Food and Agriculture Organization of the United Nations. Rome, Italy.
- 15.Halaba Pilot Survey. The Discription of the halaba special woreda Geneva, World Health Organization, 2005.