



Challenges and opportunities of dairy farming in Adigrat town, Eastern Tigray, Ethiopia

Haftom Teshale Gebre

Department of Geography and Environmental Studies, Adigrat University, Adigrat, ETHIOPIA

Received: 19 July 2022; Revised: 11 Sep 2022; Accepted: 22 Oct 2022

ABSTRACT

A dairy product refers to the food produced from the milk of animals. The production of milk in the study area was about 1.2 million liters per year [1]. The main objective of this study was to examine the challenges and opportunities for milk production in Adigrat town. Data for this study was collected *via* smallholders' and cooperative dairy farmer's surveys by applying the stratified random sampling method ($n = 130$). Data was gathered using questionnaires, key informants' interviews, and field observation which were analyzed by using descriptive statistics tools including a one-sample t-test, chi-square, and regression. The findings of the present study revealed that the average domestic milk consumption per capita per annum (L) at the study area $M = 15.16$ was significantly less than the world standard of milk product $M = 200$, $t(128) = (-437.620)$, $P = .000$. The result of chi-square shows that insignificant association between supply and demand of milk product $X^2(1, N=129) = 0.425$, $P < 0.05$. Study findings revealed that the Pearson's correlation analysis indicated a strong and positive association between Milk production per liter and Income and Assets of the farmer's variables ($r = +.847$, $p < 0.000$). Hence, appropriate and skilful implementation of milk production management will minimize the gap between the supply and demand of milk products. Therefore, it needs further investigation.

Key words: Dairy farming, Milk production, Adigrat, Ethiopia

1) INTRODUCTION

Eastern Africa is the leading dairy producer in Africa, and approximately 68% of dairy products of the continent come from Ethiopia, Kenya, and Tanzania [2]. It is estimated that the dairy sector contributed 9%–14% of East Africa's agricultural gross development product [3]. In this context, dairy production and processing clearly appear industry of at most importance in contributing to the global challenges of food security and for decades to come. The role of livestock plays a great contribution to a developing country, especially to the rural livelihood improvement [4]. Apart from the breast field infants, human consumption of the dairy products is sourced primarily from milk cows, yet goats, sheep, horses, camels, and other mammals are other sources of dairy products consumed by humans [5]. Some environmental constraints are low access to water; high temperature, low forage production, common plant association, livestock and human carrying capacity, the incident of important livestock disease as well as parasites mainly defined the lowlands [6]. The line with this, substantial potential, the dairy sector is not developed to the expected level. The annual growth rate in milk production of 1.2% falls behind the annual human population growth estimated at 3 percent [7]. Ethiopia produced 3.3 billion liters of milk in 2011-12, worth \$1.6 billion, and imported an additional \$10.6 million of dairy products [8]. At 19 liters per annum, per capita, annual

milk consumption is well below the world average of 105 liters and the African average of about 40 liters [8].

Ethiopia has the largest livestock population in Africa comprising about 55.03 million in 2013. Out of this total cattle population, the female cattle constitute about 55.38% and the remaining 44.62% were male cattle. From these 6,675,466 and 10,731,656 were dairying and milking cows respectively [9]. In Adigrat town, milk is marketed where people are mostly concentrated. According to the Adigrat food security office [1], there were about 2000 local cows and 182 crossbreed cows. However, most of the milk was produced from the crossbreed cows as well as emphasize given to them. This is because of their high milking amount. In fasting seasons excess milk was produced and sold at a lower price because the majority of people are Christians who forbid using milk and its products [1].

Statement of the Study: Dairying in Ethiopia is highly subsistence and major contribution comes from small scale producers who own almost 90% of dairy animals. Countries that are presently taking pleasure in the maximum standard of living are those that have well-developed animal agriculture as demand for animal products enhance with economic growth. Dairy production is an important part of the livestock production system in Ethiopia [10]. Market-oriented smallholder dairy farming is an emerging business

* Corresponding Author: **Mr. Haftom Teshale Gebre**
Email address: haftomteshale1@gmail.com

and is becoming an important supplier of milk and milk products to urban centers [10].

According to earlier reports [11], market access poses a key bottleneck to the expansion of smallholder milk production and processing. Since the present dairy products marketing system in Ethiopia is young, not all market mechanisms are expected to be operational. An average milk production per cow per day for smallholder dairy farmers has remained low compared to what obtains in the large-scale sector [12]. There is a constraint shortage of products in most parts of the country. This reflects where only 5% of milk produced in rural areas is marketed as liquid milk [5].

The proportion of the total national population living in urban areas of Ethiopia has slightly increased over the last 12 years. The urban population of Ethiopia was increased by 2% in 23 years; from 14% in 1984 to 16% in 2007. The current Ethiopian urban population share is 20.4% and it is projected to grow much more rapidly doubling from 2007 at a rate of 16% of the population to 32% by 2045. The average price of milk per liter in five successive years (2016, 2017, 2018, 2019, and 2020) was 10 birrs, 15 birrs, 20 birrs, 30 birrs, and 40 birrs respectively [1].

This frequent change in the cost of the price of milk was mainly due to the increment of the demand of the population and the low milk production capacity of the dairy farmers in the study area. Demand for dairy products is expected to have a positive impact on the increment of milk production. Milk production and consumption in Adigrat was very low. The amount of milk produced in the study area was about 1.2 million liters per year [1].

The per capita consumption was 15 liters per year which is very low compared to the recommended consumption of 200 liters per year [13]. This low level of milk production limited to fulfill the demand of the population on milk, and milk products in the study area. Adigrat was one of the towns looking for milk and milk products as food. The dairy sector of Adigrat was found at a low level of development, and this unimproved milk production did not satisfy the rising demand of the population of the study area. Hence, to minimize the gap between the high demand and the low supply of dairy products, it was important to increase the domestic production level of milk in Adigrat town. The amount of milk production, the number of both local and crossbred cows, milk processing, and the role of dairy farming have not been documented properly. Thus, dairy production in Adigrat needs primarily assessment and documentation. This study assessed the challenges, the opportunities, and the role of dairy farming in the study area.

The general objective of the study was to examine the challenges and opportunities of milk production in Adigrat town.

2) MATERIALS AND METHODS

Source of data: Both quantitative and qualitative data were collected from both primary, and secondary sources by using the different techniques of data collection.

Primary sources: To obtain sufficient primary data, a well-designed questionnaire was used in this study. The

questionnaires were completed by the household respondents.

Secondary sources: were gathered from published and unpublished documents, journals, reports, and internet sources related to the topic.

The data was collected from household heads who are occupied in the study area and the document which is found in the Adigrat food security office in various mechanisms such as Direct communication, questionnaire, and field observation.

Direct communication: under this data collection was applied using face to face communication with the researcher and direct communication to obtain the correct data. The researcher has used direct communication with the development agent or expert respondents in order to get relevant information about the challenges and opportunities of milk production in Adigrat town by questions and answers.

Questionnaire: Questionnaires were used to cover wider spread areas and to get the respondent's adequate and well thought out answers. The type of questions in the questionnaires were both closed-ended and open-ended. And 130 questionnaires were distributed to collect data regarding the small holder dairy farmers.

Field observation: Observing the smallholder dairy farmers, dairy cooperatives, and lifestyle of the community.

Sample size and sampling procedure: The study employed both probability and non-probability sampling techniques. The study selected Adigrat town as a research site was used purposively sampling techniques because of the author's familiarity with the town and knowledge of culture and also was no study had been conducted in the woreda regarding the dairy farmers for challenges and opportunities of smallholder dairy farmers. After decided the sampling area and the sampling design, it was important to fix the sample size. The sample population was stratified into two groups, the small holder dairy farmers and dairy cooperatives. Then, the sample was drawn proportionately using a simple random sampling technique. The overall sample size was 130 dairy respondents, 28 were taken from kebele one, two, and four of small holder dairy farmers, respectively and 38 were taken from kebele three of smallholder dairy farmers and 8 were taken from the dairy cooperatives. The sampling population had been drawn from a total of 176 dairy farmers in the smallholder dairy farmers group and 8 dairy farmers from 11 dairy cooperatives. Therefore, the sample size was believed to be represented for each group of dairy farmers who are homogeneous in their livelihood of the dairy farmers.

Data Analysis: Both qualitative and quantitative approaches were used to analyze the collected primary and secondary data using Statistical Package for Social Science (SPSS) version 20 Software. A descriptive statistical analysis technique was carried out through frequencies, means, and standard deviation for the qualitative data, such as constraints and opportunities of milk production and marketing. Quantitative research on the other hand explores traits and situations from which numerical data can be obtained. It makes use of measurement and statistics. The study used inferential or statistical techniques, such as a one-sample t-test was employed to compare milk

Table 1: Sample size taken proportional allocation from each kebeles.

S/n	Kebeles	Smallholder dairy farmers & Cooperative	Type of Sampling technique used	Sample size /S/ or proportional allocation ($n_i = \frac{n}{N} * N_i$)	Type of Sampling technique used
1	k-01	38	Stratified Sampling	28	Simple Random Sampling
2	k-02	38		28	
3	k-03	51		38	
4	k-04	38		28	
5	Cooperative	11		8	Purposively
Total		176		130	

Source: Own computation

consumption in liter per capita per day. Chi-square (χ^2) was applied to evaluate the association or difference between supply and demand of dairy products.

Multiple linear regression model: Multiple regression model was also used to show the role of dairy farming of dependent and independent variables. The dependent variable is the milk production (MP) per liter.

The independent variables are Employment (Em), Feed (F), Assets (As,) milk yields (MY), and Income (I).

Model specification: The multiple linear regression model equation be presented as:

$$MP = B_0 + B_1Em_1 + B_2F_2 + B_3As_3 + B_4MY_4 + B_5I_5 + E \dots \dots$$

(Equation 1)

3) RESULTS AND DISCUSSION

Response Rate: the purpose of this research topic sample size of 130 from the whole kebeles were proposed. The prepared questionnaires for the respondents were dispatched to selected kebeles, technically all of the questionnaires were returned, however, while feeding the data to SPSS, three incomplete questionnaires were rejected. Hence, the response rate of 129 questionnaires was found to be 99.23 percent.

According to FAO [13], as shown in Table 2 the mean domestic milk consumption per capita/ year (L) at the study area ($M = 15.16$) was significantly less than the world standard (200 L) of milk product $M = 200$, $t(128) = (-437.620)$, Precision -Value = 0.000. The milk consumption of the world standard mean was higher than the mean of domestic milk consumption per year in the study area. However, they did support the H_A hypothesis that the world consumption rate and milk consumption in the study area were significant different since t- value was obtain as -437.620 at the 95% confidence level., Similar finding was being reported by [5] for the dairy farmers of Adigrat town), who found the dairy production was constrained by an insufficient supply of feed, and its high cost, access to credit, and seasonal fluctuation of demand, particularly during the fasting season. Lack of training and follow-ups were also problems is faced by the majority of the dairies farmers who felt to meet the rising demand of the population of the study area.

Table 2: Milk consumption per year in liter

	One-Sample Test			
	Test Value = 200 L			
	Mean	T	Df	P-Value
Domestic milk consumption per capita/ year in liter	15.16	-437.62	128	.000

Table 3: Supply and demand of milk product

X ² - value (Pearson Chi-Square)	X ² critical value	Df	P - value
0.425	3.84	1	0.515

Table 4: The Results of multiple regression (only significant predictors are included)

Milk production per liter						
Variables	Adjusted R Square	R Square	F Change	df 1	df2	Sig. F Change
Income	0.715	0.717	321.930	1	127	.000
Assets	0.770	0.772	429.240	1	127	.000

As shown in Table 3 the chi-square test measures the discrepancy between the observed cell counts. There was a significant difference between supply and demand of milk product $\chi^2(1, n=129) = 0.425$, $P > 0.05$ since, χ^2 value 0.425 is less than the critical value 3.84 imbalances between supply and demand of milk product. Thus the study shows that one other outcome was associated insignificant with each other at Degree of freedom = 1 $p > 0.05$. In line with this, the production (supply) and consumption (demand) for milk and milk products in Pakistan are characterized by conflicting seasonal fluctuations. Milk production is at its Maximum during the period between January and April and at its minimum during May–August when fodder is limited. Milk consumption is at its peak in summer. At this time, because of the warmer ambient temperatures, people increase their milk intake and consume a greater range of dairy products including ice cream and yoghurt [14]. In the stepwise multiple regression that milks products significantly contributed to the income of the respondents

or livelihood of the dairy farmers in R^2 (0.717), degree of freedom (1, 127) and $p=0.000$ and also 71.70% of the variance in milk products per liters was contributed to enhancing the income of farmers (Table 4). Milk products significantly contributed to the assets of respondents (television, refrigerator, and house) in R^2 (0.772), degree of freedom (1, 127), and $p=0.000$. The variance (77.20%) in milk products per liters was contributed to improving the Asset's ownership of farmers. The variables left out of the analysis at the last step all have significant values smaller than 0.05 and Pearson's correlation analysis indicated a strong and positive association between Milk production per liter and Income and Assets of the farmer's variables ($r=0.847$, $p<0.000$).

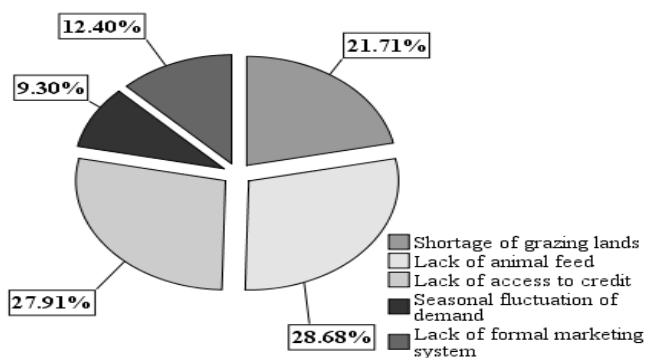


Figure 1: Constraints of the Dairy Product

As shown in figure 1, constraints of the dairy product were 28.70% of the respondents said that lack of animal feed, 27.90% of the respondents answered that lack of access to credit, 21.70% of the respondents reply that the shortage of grazing lands, 12.40% of the respondents said that lack of formal marketing system and 9.30% of the respondents said that seasonal fluctuation of demand was that major constraints of the dairy product. In addition to that the study cross-checks *via* out of the key informants discussed on the FGD, the dairy farmers discussed the challenges that faced them during milk production and marketing system. They identified the challenges as a market problem, shortage of grazing lands, lack of animal feed, and lack of access to credit, seasonal fluctuation of demand during fasting seasons (fasting is the abstention from eating any types of meat and drinking of milk and milk products), and lack of formal marketing system. The farmers also indicated that those challenges continuously influence the amount of milk to be produced which intern affected the income of the dairy farmers. The degree and significance of the constraints differed among the dairies farmers in the study area. As a result, this finding is similar to the findings of [15], who found different areas that show the dairy production was constrained by insufficient quality of feed, and its high cost, access for credit, seasonality of demand particularly in the fasting time and lack of processing industry. Lack of access to credit was one of the major factors that affected dairy farming in Adigrat town. This is similar to the finding of [5] who found access to credit was low in the study area. In addition to this, most of the dairy farmers have lacked extension services. The dairy farmers were assisted extension service once a day which is very limited to follow-

up the dairy animals. Similarly, [16] reported access to land as the main constraint in the areas of Shashemene, Hawassa, and Dilla milk shed. The dairy farmers of the study area were constrained by the low access to water, especially during the dry season. There were two sources of water in Adigrat town; water pipelines and wells. This finding is coherent with the finding of [5]. As shown in figure 2, the Opportunities of Dairy Products 41.10% of the respondents have had an extension service, 24.80% of the respondents were having accessing adequate land and 34.10 % of the respondents have had an training services. In addition to this, Milk production gives a lot of opportunities for smallholder farmers to use the land, labor, and feed resources and make a regular income. In this case, support service regarding accessing adequate land, organizing input supplies, provision of credit, extension, and training services, sound market opportunities, and linkage are the key elements of success for the milk industry [15]. Due to the high demand in the area, the dairy farmers were willing to continue and expand the dairy products to the future. This sector also has an opportunity for dairy producers to perform dairying in cooperatives and to generate income as it is the high demanded product. The dairy farm also has other opportunities for milk producers concerning accessing adequate land and credit service for the dairy cooperatives, extension service, and training services. As dairy farming is labor-intensive, it promotes the motto of the government policy in creating employment opportunities at the household level by the producer family and the other consumers. It also can address and serve as one of the major instruments of government policy in achieving food security.

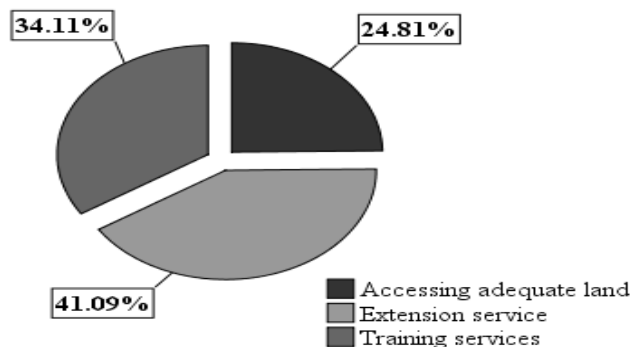


Figure 2: Opportunities of Dairy Products

4) CONCLUSION

The study highlighted that the milk consumption of the world standard mean was higher than the mean of domestic milk consumption per year in kebele one, two, three, and four of small holder dairy farmers and there was an insignificant association between supply and demand of milk product. Milks products significantly contributed to the income of the respondents or livelihood of the dairy farmers and a strong and positive association between Milk production per liter and Income and Assets of the farmer's and also it is evidenced that dairy farming has become an important economic activity in generating income and a means of asset owner ship. The study revealed that dairy farming has numbers of challenges related to animal feed

which included high expenditure on and low access to animal feed, low accessibility to grazing land, and shortage of water for their dairy farm activities, lack of training and follow ups and limited extension service. In addition to this the study has shown that the dairy farming were affected by many constraints; market problem which is related to low price of milk and milk products (especially in the Ethiopian orthodox followers' fasting time), shortage of market information, shortage of feed and its high cost, lack of grazing land, fluctuation of milk demand, less access to credit and shortage of water for their dairy animals..

Recommendation

The study finding confirmed that problems related to animal feed like lack of grazing land, much less get entry to credit, shortage of water, the high value of feed, and seasonality of demand have a significant effect on milk production. So to enhance milk production the government and the concerned bodies should work at the provision of animal feed and expansion of pipeline water in addition to the availability of feed and access to credit. The dairy farmers should further process excess milk to butter during fasting seasons for later consumption. As the finding of this study showed, dairy farming is an important answer in securing food and assets in the have a look at the area. Thus, dairy farmers should be given the interest in training at the control of dairy cows and the version farmers need to be advocated through rewards periodically. Concerned bodies need to inspire investments targeting the establishment of companies that technique milk and its merchandise so as to reduce the distance between the delivery and demand of milk products.

SUPPLEMENTARY MATERIAL

Questionnaire of the study is available at <https://gjestenv.com/index.php/gjest/article/view/168/144>

REFERENCES

- 1) AFSO. 2020. Population size. Adigrat Town finance and Economic Development Office Adigrat town.
- 2) Bingi, S., & Tondel, F. 2015. Recent developments in the dairy sector in Eastern Africa. Briefing note of the European Centre for Development Policy Management, 78, 19.
- 3) Lukuyu, J. M., Blanchard, R. E., & Rowley, P. N. 2019. A risk-adjusted techno-economic analysis for renewable-based milk cooling in remote dairy farming communities in East Africa. *Renewable energy*, 130, 700-713.
- 4) Ayeneshet, B., Wondifraw, Z., & Abera, M. 2017. Survey on Farmers Husbandry Practice for Dairy Cows in Alefa and Quara Districts of North Gondar Zone, Amhara National Regional State, Ethiopia. *Int J Anim Sci*, 1(2), 1010.
- 5) Solomon, M. G. 2014. Exploration of Challenges and Prospects of Dairy Production: A survey study of Mekelle city (Doctoral dissertation, Mekelle University).
- 6) ILRI, A. A. E. 2008. Dairy production, processing and marketing systems of Shashemene-Dilla area, South Ethiopia. ILRI (aka ILCA and ILRAD).
- 7) Mihret, T., Mitku, F., & Guadu, T. 2017. Dairy farming and its economic importance in Ethiopia: a review. *World journal of dairy & food sciences*, 12(1), 42-51.
- 8) FAOSTAT. 2011. Food and Agriculture Organization of the United Nations. Farmer, Elizabeth. End Market Analysis of Ethiopian Livestock and Meat. Rep. no. MicroReport #164. USAID, Mar., 2010.
- 9) Metekia Tamiru and Nezif Amza. 2017. Review on the status of dairy cattle production in Ethiopia. *Journal of Genetic and Environmental Resources Conservation*, 5(2), 84-95.
- 10) Getachew Feleke 2003. Milk and dairy products, post-harvest losses and food safety in sub-sahran Africa and the near east. A review of the smallholder dairy sector, Ethiopia. FAO prevention of food losses.
- 11) Tegegne, A., Gebremedhin, B., Hoekstra, D., Belay, B., & Mekasha, Y. 2013. Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development.
- 12) Mengsitie, T. D. 2007. Characterization of cattle milk and meat production, processing and marketing system in Metema district, Ethiopia (Doctoral dissertation, Hawassa University).
- 13) Fao, F. A. O. S. T. A. T. 2008. Food and agriculture organization of the United Nations. Retrieved on, 15. From <https://www.fao.org/statistics/en/>
- 14) Gobena, M. M. 2016. Household dairy production system, marketing and constraints in Ethiopia. *Journal of Marketing and Consumer Research*, 29, 46-52.
- 15) Sintayehu, Y. Fekadu B. Azage T. and Birhanu G. 2008. Dairy Production and Marketing system of Shashemene-Dilla areas, South Ethiopia: IPMS of Ethiopian farmers project working paper 9.ILRI, Nairobi Kenya, 62 pp.
- 16) Weldemicael, S. 2008. Dairy marketing chains analysis: The case of Shashemane, Hawassa and Dale District's milk shed, Southern Ethiopia (Doctoral dissertation, Haramaya University).