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Dairy Production in Western and North-Western Zones of Tigray, Ethiopia

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Abstract

This study identifies the dairy productivity and production in North western and Western zone of Tigray region using both secondary and primary data sources collected from survey, KII and FGD so that cross-sectional data type that was collected during 2018. This study employed multi-stage sampling technique to withdraw Tahtay adiyabo district from North western zone and Kafta humera district from Western zone where a total of 309 smallholder dairy cattle keepers (farmers) who were selected randomly from both districts. Applying the descriptive statistics on average farmers owned 2.7 and 4 number of dairy cows with the average yield per cow per day of 2.53 and 3.33Lt milked for the average number of 27 and 26 days per month respectively for Tahtay adiyabo and Kafta humera districts. The average number of milking months was 6.3 and 6.4 so that the total milk produced was 1166.25Lt and 2291.29Lt per household produced at the total expense of 5556.8 and 10538.4ETB respectively for Tahtay adiyabo and Kafta humera districts. In Tahtay adiyabo district, 50% of the respondents totally allocated the milk they obtained for family consumption while in Kafta humera district 70.5% of the respondents had allocated the milk they obtained for both family consumption and partly for selling. It has also found that the family consumed 70.86% and 57.35% of the total amount of milk taken-off, while the remaining 29.14% and 42.65% has sold at local market, respectively for Tahtay adiyabo and Kafta humera districts. So this study recommends that it is important to organize producers as nearby and establish and make functional cooperatives so that producers could sell at their nearby. It is also important that dairy cows should provide collected feed while in its shed for the months other than green feed grazed in rangeland and supplement by improved forages. It will also be important if collected feed could provide to the dairy cows with the intensive protection from diseases and pests.

Key words: Dairy, Kafta humera, Milk Production, Milk productivity and Tahtay adiyabo,

1. Introduction

1.1. Background and Justification of the study

The role of livestock in Ethiopia generally and in the study area particularly, is complex and significantly different from that of the developed nations. Livestock production in developing countries plays major role both in driving economic growth and benefiting from it nutritionally; as, it provides increased income, employment, food and foreign exchange earnings as well as healthier nutrition. The contribution is in the form of live animal, its products such as meat and milk as well as its hide and skin. Livestock helps in improving human nutrition, which acts as a crucial source of macro and micronutrient including high-quality protein, minerals and vitamins to the population in the form of milk, meat and eggs. Thus, it is a critical element in achieving food security. Besides, for many rural smallholder farmers, livestock is a 'living bank' that serves as a financial reserve for periods of economic distress (Perera and Jayasuriya, 2008).

Despite the significant progress in reducing global hunger over the last few decades, food insecurity and under nutrition remain serious problems in many countries (IFPRI, 2016 and FAO, 2017). Around 11% of the world's population is chronically undernourished, meaning that these people do not have sufficient access to calories (FAO, 2017). One-third of the global population suffers from micronutrient malnutrition, mainly due to insufficient intakes of vitamins and minerals to support a healthy life (IFPRI, 2016 and FAO, 2017). Most food-insecure and undernourished people live in Asia and Africa. In sub Saharan Africa, the number of undernourished people is even increasing (Foley et.al, 2011). Much of the food in Asia and Africa is produced by smallholder farmers (FAO, 2014), and, ironically, smallholder

farmers are also those most affected by food insecurity (Herrero et.al, 2010; Barrett, 2010 and WB, 2007). Hence, the small farm sector is a crucial entry point for policy interventions to improve food security and nutrition.

In Ethiopia regardless of the increment in milk amount from year to year, the demand for milk raises and its price is boosting from time to time because of different factors. Of these factors the population growth and nutritional focus towards dietary are the major once (Azage and Berhanu, 2017). Currently Ethiopia's population has boosted to about 110 million people (Google, 2019), that is a huge market opportunity for milk and milk products. With this also the country has the highest cattle populations in Africa, estimated to 60.39 million heads of which 98.24% are endogenous breeds (CSA, 2018) to produce about 4 billion liters of milk per year; obtained from cows, camels, goats, and to a lesser extent sheep, of which about 90% comes from cows (Azage and Berhanu, 2017). However, regardless of the population, there is high paradox in the number of cattle owned (two third of the world) while the milk production obtained (which is less than ¼ of the milk produced in the world) (Tsegay, 2010). Thus, there is too low milk yield in developing countries particularly in Ethiopia as the cow milk yield is 1.37Lt per day per cow for the average lactation period of six months (CSA, 2018).

In Tigray region, the trend in the number of cattle shows an increase across years, but its yield per cow per day was declining. As per the report obtained from CSA (2013), the number of cattle in Tigray in 2012/13 was 4.065Million (of which 49,180 are milking cows milked for the average lactation periods of six months yielding 1.36Lt per day per cow). This number reaches to 4.82 million cattle (of which 52,538 are dairy cows milked for the average lactation period of six months providing the average milk yield of 1.27Lt per day per cow) (CSA, 2018). The report obtained from CSA (2013 and 2017), also indicated that in Northwestern and Western zones of Tigray the 1.439 million and 741,824 number of cattle (in 2012/13) is increased to 1.88 million and 885,100 cattle (in 2016/17) respectively. While, the number of milking cows decreased from 8,404 to 7,470 (in Northwestern zone) and increased from 1,802 to 3,257 (in Western zone).

Dairy has so many dietary, food security and food self-sufficiency importance. As the report of World Bank (2008) importance of the dairy cow is expected to increase as food imports to Sub-Saharan Africa (SSA) which will be projected to more than double by 2030 under a business as usual scenario. Similar to the global scenarios, dairy provides rural farmers with a way to increase assets, a method to diversify income and nutrition. Dairy is also an important tool to address poverty, enhance agricultural development, and create employment opportunities beyond an immediate household or smallholder dairy operation.

In the lowland areas of Northwestern and Western zones of Tigray, there is high potential for dairy production. Few of the potentials are the availability of special breed called begait cattle, wider rangeland, different grass natural forages and comfortable agro-ecology. Being these, under intensive management the dairy productivity in the area could be boost to 8lt per cow per day (HuARC, 2016). However, regardless of the potential, milk productivity in the area was too lower which was also declining from year to year. As evidence for its productivity trend it is important to understand the report obtained from CSA (2013 and 2017), which is indicating that the average milk yield per cow per day in North western and Western zones of Tigray is decreased from 1.41Lt to 1.25Lt and from 1.82Lt to 1.47Lt, respectively. Nevertheless, this is lower than the report obtained from the selected districts, which is about 5.25Lt per day (TaOoARD, 2019). Generally, irrespective of the huge untapped potential for dairy production in the area milk productivity was lower for unidentified factors. Meanwhile, there were no studies conducted in the area showing the average milk productivity and its determinant factors. This was so to assess the average milk productivity in the area and its determinant factors.

Besides, in the study areas regardless of the amount annually produced the demand for dairy products is raising rapidly due to the ever-growing population size and the focus on dietary nutrition. Thus, the per capita consumption of milk is raising across time but it is still lower than that of the FAO's recommendation (which is about 200 liters per year). Unfortunately, milk production and consumption are lower because of different reasons, which could affect milk yield, and so its supply to market as by now milk has mainly used for household consumption. Due to the miss-much of supply and demand, this study focuses on the value chain analysis in Western and Northwestern zones of Tigray, focusing on the production determinants, market actors, their collaboration and market participation decision, amount supplied and its determinants factors. Why this dairy value chain analysis is essential to study is that, to understand the milk production, markets, the market participation of different actors with their relationships, market participation decision of producers and its determinants, and the critical constraints that limit the growth of milk production and supply by smallholder farmers. Then the improvement, which recommends at each part of the value chain to address the shortcomings of dairy value chain.

Regardless of the dairy production potential and its importance the following trends affected dairy production, particularly in rural areas smallholder livestock producers such as; lower productivity and production, increasing

pressure on common grazing and water resources; unavailability of structured dairy market access and infrastructures. In the study area, farmers gave lower intention to dairy as source of income. Being these all there was no studies conducted in the study area focusing on identifying the dairy productivity determinant factors, market participation and its intensity with its determinants and who were the major dairy value chain actors and their roles. Therefore, this study has proposed to address these gaps to improve the dairy value chain.

Dairy products marketing system in the study areas was also conducted traditionally which makes complex with un-clear linkage among the value chain actors. Identifying this helps to decide where should the adjustment done and the ways of adjustment. This study has so designed to identify the dairy products market performance not yet conducted in the area before. Generally, in order to mitigate challenges that limit productivity and thereby exploit the untapped potential, it is necessary to analyze the milk productivity and production with its allocation in the study area.

1.2. Objectives

Generally, this study has designed to estimate milk productivity, total production and its allocation in North western and Western zones of Tigray Region, Ethiopia.
Specifically, this study seeks to address the following specific objectives:

- Identify mean milk Productivity and production in Western and North western zones of Tigray; and
- Analyze the allocation of milk taken-off from dairy cows in the study area

2. Methodology

2.1. Description of the study area

The study has conducted at lowland areas of Northwestern and Western zones of Tigray, by selecting one district from each zone that has dairy production potential endowed (Fig 1). The study area borders by Sudan from Western, Eritrea from North, Laelay adiyabo and Welkayt districts from East and Tsegedie district from South. According to the report obtained TARI Working paper No.1 (2019), the geographical location of the study districts is 14.05-14.89N and 37.34-38.17E, 13.67-14.45N and 36.27-37.53E respectively for Tahtay adiyabo and Kafta humera districts. From the same source, it is also found that 94.13% and 85.7% of the districts respectively, for Tahtay adiyabo and Kafta humera districts. These districts are located in lowland agro-ecology. According to the report obtained from the respective districts, Tahtay adiyabo district has a total population of 105,871 with the total households of 26499 (TAOoARD, 2019), while Kafta humera district has a population of 103692 with 25,293 households covering 396852 ha cultivable land (KHARDo, 2013).

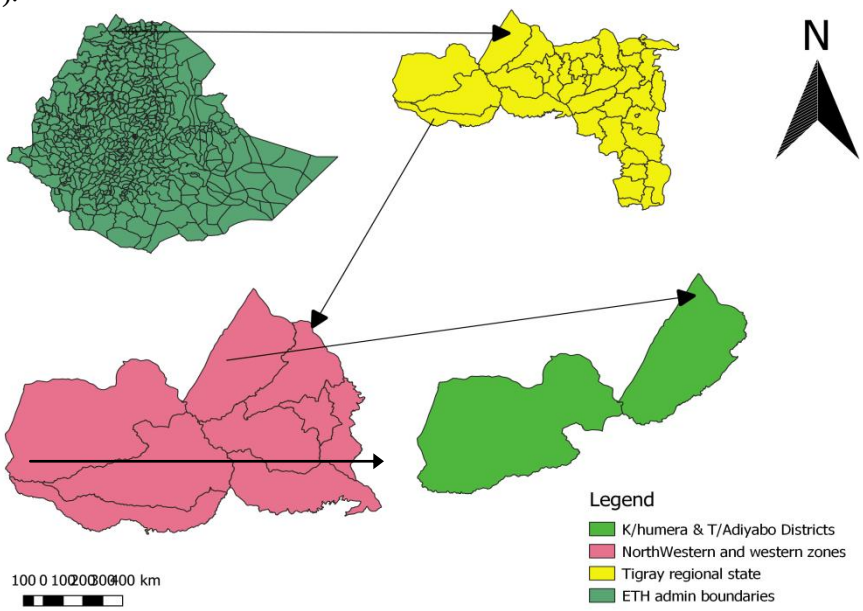

Figure 1. Map of the study areas

Source own sketch from QGIS 3.2

2.2. Farming System and Agricultural production potential of the area

Farming community in the lowland parts of the North western and Western zones of Tigray region practice fixed farming system of both crop production and livestock rearing. As shown in figure 2, the study areas has endowed with

higher potential for crop (majorly Sesame, Sorghum and other lowland pulses and irrigation crops) and livestock (special breed called begait cattle, goat and sheep). Here there is also relatively rich in forest plants and green forages (during the rainy season).

Figure 2. Agricultural Production potential in the study Districts

2.3. Sample size and Sampling Method

In selecting respondents, this study used multistage and snowball sampling techniques. Multistage sampling technique employed to select dairy producers. While, snowball sampling technique is employed to select traders (collectors), Hotels and cafeterias and Processors (ripening). First, lowland areas of North western and Western zones of Tigray purposely selected for their potential in dairy production. Then districts such as Tahtay Adiyabo from North western zone of Tigray and Kafta Humera from western zone of Tigray are selected (Figure 1). Following, four Kebeles from each district (such as A/Aser, M/Kuhli, Ziban gedena and Mentebteb from Tahtay Adiyabo, and Adebay, Rawiyan, Mai-kadra and Bereket from K/Humera) has selected randomly. Finally, 309 dairy producers (160 from T/adiyabo + 149 from K/humera) selected using simple random sampling based on PPS of the dairy producers. Besides, snowball-sampling technique used for selecting collectors, Hotels and cafeterias.

2.4. Data Types and Sources

This study used both primary and secondary data sources to collect cross-sectional data type. Primary data sources used obtained from dairy cattle rearing farmers, milk collectors and consumers by interviewing from the selected respondents. While, the secondary data sources obtained from published and unpublished sources and reports. Few of the unpublished reports obtained from the districts have presented in figure 3.

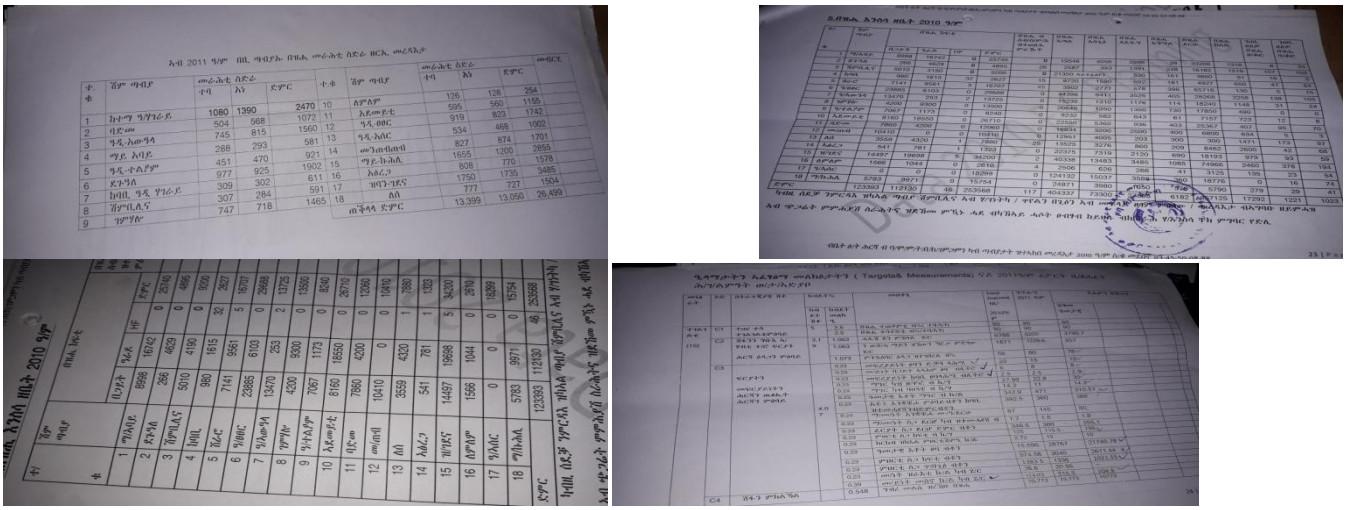

Figure 3. The different data obtained from the study Districts

2.5. Methods of Data collection

The cross-sectional data used in this study is collected from primary sources by survey (interviewing) using semi-structured questionnaire and KII, while the secondary data sources was collected from published and unpublished documents.

2.6. Methods of Data Analysis

For analyzing the data and reporting the results, this study applied both descriptive and inferential statistics. The descriptive statistics used for presenting the results in the form of: means, percentages, maximum and minimum and ratios.

3. Result and Discussions

It is here that the results presented and discussed by dividing in to descriptive and inferential statistical parts.

3.1. Descriptive statistical results

Considering the dummy and categorical variables, this study found that there is significant difference in market participation, extension service and religion between Tahtay Adiyabo and Kafta humera districts. While, it is insignificant regarding the training obtained, marital status and gender of the household heads. As presented in Table 1, in Tahtay adiyabo and K/humera districts about 82% and 63% of the respondents were literate respectively. It also found that 87.5% and 68.46% of the respondents get extension contact respectively. Of the total respondents, also 87.5% and 83.2% are married respondents respectively for the districts.

Table 1. Socio-economic characteristics of the dairy farming households considering the continues variable

S. No.	Dummy Variables		T/Adiyabo	K/humera	Difference
1	Milk market participation (%)	Participate non-participant	51.25 48.75	27.52 72.48	chi2(1) = 18.14 P = 0.00
2	Gender (%)	Male Female	91.25 8.75	92.55 7.45	chi2(1) = 0.09 P= 0.77
3	Extension Service (%)	No Yes	12.50 87.50	31.54 68.46	chi2(1) = 16.48 P = 0.00
4	Training Service (%)	No Yes	72.50 27.50	65.10 34.90	chi2(1) = 1.97 P = 0.16
5	Religion (%)	Orthodox Muslim	100.00 0.00	96.64 3.36	chi2(1) = 5.46 P= 0.02
6	Marital status (%)	Married Single Divorced Widow	87.50 3.75 6.25 2.50	83.22 4.70 8.72 3.36	chi2(3) = 1.16 P = 0.76
7	Milking materials used (%)	Paint container Baldi Woody material	95.00 1.25 3.75	95.98 2.01 2.01	chi2(2) = 1.08 P = 0.58
8	Milk collected/put-in (%)	Jeilin Others	95.63 4.37	88.59 11.41	chi2(1) = 5.33 P = 0.02
9	Hygiene protection of the collecting material (%)	Washing by Boiled water Washing by Boiled water and fumigating in it	75.62 24.38	45.64 54.36	chi2(1) = 29.21 P = 0.00

Considering the continues variables also it is found that the average age of the respondents engaged in dairy farming in Tahtay Adiyabo and Kafta humera districts is 44 and 50 years old respectively (Table 2). It also found that the average family size found is six persons per family with similar one to one ratio of male to female members and the average education level of the respondents is about 3rd grade for both districts. These respondents have 20 and 18 years of experience in cattle rearing and 18 and 17 years of experience in dairy production respectively for T/adiyabo and K/humera districts (Table 2).

The average distance of cattle farm from local market is 20.37km and 23.72km respectively. It also found that the average frequency of training related to cattle rearing provided per year is almost one time in both districts (Table 2).

There is significant difference between the two districts regarding milk market participation, extension service, religion, frequency of extension contact, age of the household heads, education level of the household heads, Experience in agriculture, distance of cattle farm to local market, distance of cattle farm to residence and distance cattle travels to drink water (Table 1 and 2). However, insignificant difference regarding training obtained, marital status and gender, experience in cattle and dairy production, total family size, distance of residence from district town.

Table 2. Socio-economic characteristics of the dairy farming households considering the continues variable

Variables		Tahtay Adiyabo		Kafta humera		Difference	
		Mean	Std. Err.	Mean	Std. Err.	Mean	T-test P (Ha: diff! = 0)
Family size	Male	3.07	0.12	3.15	0.13	-0.08	t = -0.45, P(v)= 0.66
	Female	3.16	0.12	2.92	0.12	0.23	t = 1.38, P(v)= 0.17
	Total	6.22	0.18	6.06	0.19	0.15	t = -0.62, P(v)= 0.54
Age of the house hold head (Years)		44.24	0.78	50.18	0.98	-5.89	t = -4.75, P(v)= 0.00
Education level (years of schooling)		3.47	0.22	2.91	0.24	0.52	t = 1.6, P(v) = 0.11
Experience in Cattle production (Years)		19.50	0.79	20.26	0.88	-0.77	t = -0.65, P(v) = 0.52
Experience in dairy production (Years)		16.20	0.83	17.5	0.87	-1.30	t = -1.08, P(v) = 0.28
Distance from cattle farm to L. Market		8.24	0.60	5.92	0.63	2.32	t = 2.65, P(v) = 0.01
Distance from Cattle farm to residence		1.42	0.28	8.26	0.83	-6.83	t = -8.05, P(v) = 0.00
Distance from residence to District		18.15	0.84	17.38	1.07	0.77	t = 0.57, P(v) = 0.57
Number of Livestock related Training obtained		0.70	0.08	1.05	0.11	-0.35	t = -2.59, P(v) = 0.01
frequency of extension contact		2.28	0.08	1.94	0.12	0.34	t = 2.34, P(v) = 0.02
Experience in agriculture (Years)		20.47	0.77	23.71	0.86	-3.24	t = -2.81, P(v) = 0.01
distance cattle travel to drink water		1.59	0.21	3.36	0.37	-1.77	t = -4.22, P(v) = 0.00

3.1.1. Dairy Production Inputs and dairy yield obtained

3.1.1.1. Cattle rearing and management,

Feeding system and feed Sources

This study found that most of the farmers use both family and hired labors for managing their dairy cows. During the group discussion regarding the feeding system, participants explained that in the rainy season as the cattle travels far distant from residences and live there by fencing temporary barn, which you can understand from figure 4. Thus, it is common that cattle herd by hired laborer. This continues for three to four months, as there is rain and green feed and fodder that cattle can graze by it. This also found that about 67%and 76.5% of the respondents in Tahtay adiyabo and Kafta humera districts respectively manage their dairy cows together with the other non-dairy cattle, while the remaining 33%and 23.5% in the same order manage their dairy cows separately from the other non-dairy cattle (Table 3).

Table 3. Cattle rearing and management practices, feeding system and feed supplementation periods of the farmers in Tahtay adiyabo and Kafta humera districts

Activities			Tahtay adiyabo (in % from 160 respondents)	Kafta humera (in % from 149 respondents)
Cattle rearing and management are performed by	Family members		55	10
	Hired laborers		16	49
	Both family & Hired laborers		29	41
Dairy cows management system	Together with the other cattle		66.88	76.51
	Separately from the other cattle		33.13	23.49
Feeding system of the dairy cows	Feed Together		63.76	70.47
	Feed Separately		36.25	29.53
Practices of Feed supplementation	Not supplemented		40.00	44.00
	Feed supplementation in	February -June	33.13	35.57
		March or April -June	15.00	16.78
		May -June	8.75	2.68
		June -June	3.13	0.67

As presented in table 3, in rearing of their cattle most of the farmers in T/adiyabo used their family labor, while most of the farmers in K/humera district used hired laborers. That is 55% and 49% of the respondents in T/adiyabo and K/humera districts used family labor and hired labor respectively for rearing and management of their cattle. While the fewer number of farmers used family labor and hired labor respectively for K/humera and T/adiyabo districts. It is also explained by the FGD participants in T/adiyabo that the hired laborers were used during the summer season as the cattle live at areas where green feed could be available at. So, during this season as the cattle farm is far distant from residence by the tradition of one laborer rear and manage by collecting large number of cattle together. While, in Kafta humera district cattle are forced to travel far from residents because of the reason that residents are found together where there is no free area for grazing. So, it is necessary to use hired laborers to manage their cattle in most of the months.

Figure 4. Temporary cattle burns during the rainy season while living far apart from residences for searching green feed

Farmers in the area practice both free grazing and supplementation by different feeds (hey, crop residues, concentrated feed, and even grain) during the dry seasons. Regarding the feeding system, this found that 36% and 29.5% of the farmers allow their dairy cows to feed separately from the other cattle. While, the remaining 64% and 70.5% allow their dairy cows to free graze during the rainy season that green grasses could easily obtained and latter supplement by controlled feed respectively for T/adiyabo and K/humera districts (Table 3). This is indicating that there was no special management provided for the dairy cows particularly during the rainy season that there could have green feed that has similar practices with in the two districts.

It is also found that from the total respondents, 40% and 44% of the farmers in T/adiyabo and K/humera districts did not provide supplementary feed for their dairy cows, While the remaining 60% and 56% supplement by providing concentrated feed where 55% and 64% of the supplementation providers start the supplementation on February respectively (Table 3). But it is important to supplement cattle during the dry seasons particularly a special care is necessary for the dairy cows in these seasons that large number of farmers are lagging to practice. Regarding free grazing system all cattle (including dairy cow) travel and live at least for four months during summer season. But during the other months it live around the residence passing the hottest hours in shed and travel for searching of feed at night and cool hours in nearby around.

As it is presented in Table 3, in both districts most of the farmers start supplementation of feed for their dairy cows during February and stay until June. It is for the reason that starting the month of February there where scarcity of crop residues and green grass residues. During this month also the temperature starts to increase (becomes warm) which makes difficult for cattle and dairy cows particularly to travel for searching/grazing of feed rather enforce it to rest during the day light under sheds and move around during cool hours and night. This is why most of the farmers start supplementation from February.

3.1.1.2. Composition of the Concentrated feed

As shown in Table 4, during their supplementation by providing concentrated feed, it is found that 59% and 87% of the farmers provide (supplement by) sorghum grain only. But there are also farmers who supplement by providing such as sesame seed cake (Asera), fruska and its combinations. As the data obtained from the FGD during their group discussion, the reason why most of the farmers provide sorghum grain is that the area belt for sorghum production so it is produced as major crop with in the area. Thus, there is high amount of sorghum grain produce in the districts. However, its storage faces challenges of storage pests.

Table 4. Composition of the concentrated feed supplemented to dairy cows

Composition of Concentrated feed	Tahtay adiyabo (in % from 160 respondents)	Kafta humera (in % from 149 respondents)
Sorghum Grain	59.38	87.25
Fruska	13.13	4.70
Asera	18.13	4.70
Sorghum G. and Fruska	3.75	1.34
Sorghum G. and Asera	1.88	1.34
Fruska and Asera	3.75	0.67

Besides its price is lower which could not cover the price of other concentrated feed. Here also the farmers believe that it can substitute the content of the other concentrated feeds. Due to the reasons explained above, most of the farmers prefer to supplement by providing sorghum grain. With this it is important to understand that the sorghum grain provided is supplemented not as it is rather in processed for.

3.1.1.3. Water Source and its distance

Similar to the feeding system, in the study area cattle drink water in two systems. One is that during rainy season cattle drinks water in anywhere as it can get at natural ponds. Nevertheless, during the dry season, cattle travel to either water sources such as rivers communally constructed water ponds (as shown in figure 4). In dealing with the water sources 80 and 84% of the farmers in T/adiyabo and K/Humera districts respectively, enforce their cattle to drink water in their nearby water sources (Table 5). As it is also presented in Table 5, the average distance that the cattle travels to drink water from the water source is 1.59 and 3.36 Km respectively for Tahtay Adiyabo and Kafta Humera districts. Here 82.2% of the farmers also respond that their dairy cows travel together with the other cattle to drink water regardless of the distance.

Table 5. Water sources from which the Cattle drinks

Cattle's Water Source	Tahtay adiyabo (in % from 160 respondents)	Kafta humera (in % from 149 respondents)
At farm	19.38	13.42
At near water source	80.00	83.99
At Communal ponds	0.63	2.68
Average distance cattle travel to drink water (Km)	1.59	3.36

3.1.1.4. Cattle Breed type Owned

Regarding the dairy cattle breeds that the farmers own, it is found that all owns endogenous breeds of that 62.7% and 95.3% of the farmers in T/adiyabo and K/humera districts own Begait cattle breed, followed by 30.6% and 2.7% whom owns Arado and the remaining 6.7% and 2% owns both Begait and Arado respectively (Table 6). This result is so inline with the CSA (2018) reports, which says more than 98% of the cattle in Ethiopia are endogenous breeds.

Table 6. Breed type of the Cattle owned by the farmers in the study districts

Cattle Breed type	Tahtay adiyabo (in % from 160 respondents)	Kafta humera (in % from 149 respondents)
Begait	62.50	95.30
Arado	30.63	2.68
Both Begait and Arado	6.87	2.02

3.1.1.5. Dairy Production Feed Shortage and its Consequence

According to the response of the farmers as shown in Figure 5 and 6, regardless of the feed quality they prepare from the total respondents in Tahtay adiyabo and Kafta humera districts about 62% and 74% did not face feed shortage for their dairy cattle beyond the plan they have planned before. However, the remaining 38% and 26% faces feed shortage that the amount they planned had finished and faced to feed even by buying from other sources and/or simply accepting with no action.

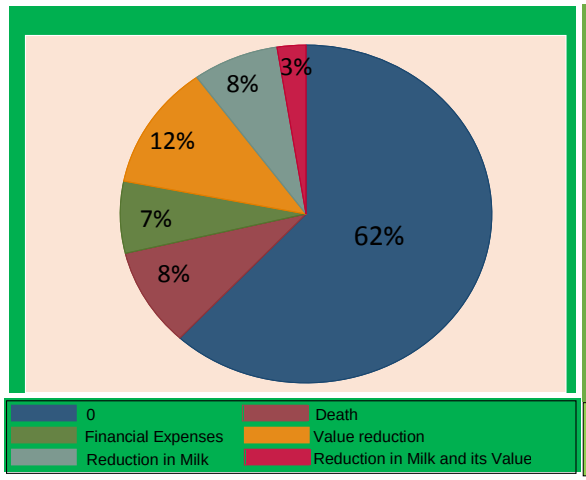

Figure 5. Consequence of the feed shortage faced in K/humera district

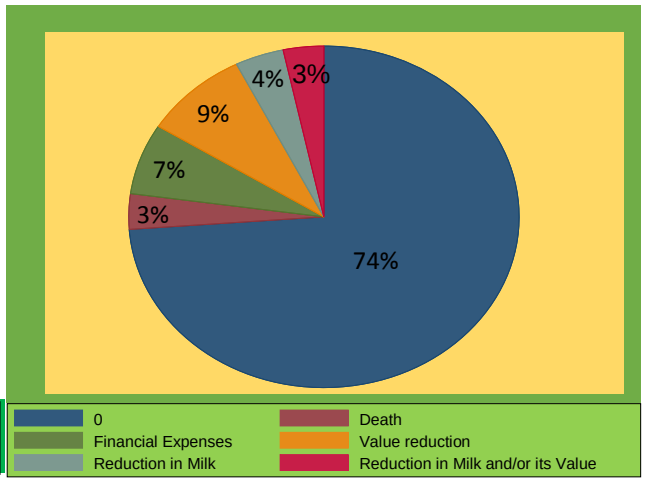

Figure 6. Consequence of the feed shortage faced in T/Adiyabo district

Here it is important to understand that most of those who faced shortage of feed beyond what they had planned (that is 74% of the respondents) was faced during the months of May and/or June. Due to this feed shortage, different consequences had faced and of which the highest percentage has shared by value reduction.

Generally, the consequences of feed shortage faced has presented in Figure 5 and 6. In both figures, the 'o' in the legend indicates the percentage of farmers who did not face feed shortage beyond the plan they planned. With this, it is important to be-remained you that they did not face feed shortage means that it is regardless of the content of the feed they have. Unless otherwise the feed content they consider as feed is crop residues with no other supplement, crop grain that is not yet re-mixed with other concentrates and hay. Thus, the feed nutritional content is lower which does not recommend for dairy cows.

3.1.2. Amount of Milk obtained, Number of Dairy Cow Owned and Length of Lactation period

3.1.2.1. Yearly Milk Yield and Production

As it is presented in Table 7 on individual bases, the average amount of milk produced per year per individual farmer in T/adiyabo and K/humera districts is 1166Lt and 2291Lt; of which 826Lt and 1314Lt is consumed at home and wasted thrown, while the remaining about 340 Lt and 977Lt is sold at local market respectively. This total milk amount is obtained by the individual households from the average number of 2.7and 4.1cows that were milked for more than six months providing the average milk amount per day of 2.53Lt and 3.33Lt respectively for Tahtay adiyabo and Kafta humera districts. The average milking months is similar with the reports of CSA (2018) and other studies; but milk yield is greater than that of the CSA (2018) which could be due to the breed type. However, still milk yield is lower compared to the potential reported by HuARC (2016) and the plan proposed by the districts which was about 8Lt per cow per day.

Figure 7. Few of the reasons for lower amount of milk-taken-off from milk cows

As per the data obtained from the FGD, KII and the researchers' observation, milk was not fully taken-off rather part of it was remained and allowed to be sucked by calf; and in some cases calf is sucking while milk is taken-off (you can also observe this from figure 7).

Table 7. Number of dairy cows owned, its milk yield, number of milking months and total milk production in the study districts per household

Variables	Tahtay adiyabo	Kafta humera	Difference	
			Mean	T-test and P-value
Average No. Dairy Cows owned	2.71 (0.13)	4.1 (0.33)	-1.40	t = -4.11, P =0.00
Milk yield per Day per Cow (in Lt)	2.53 (0.09)	3.33 (0.09)	-0.80	t = -6.29, P=0.00
No. Milking Days per Month	27 (0.33)	26.1 (0.47)	0.93	t = 1.61, P=0.11
No. Milking Months /cow per year	6.3 (0.19)	6.43 (0.17)	-0.17	t = -0.66, P=0.51
Total Milk Produce	1166.25 (99)	2291.29 (308)	1125.04	t = -4.01, P=0.00
Average amount of milk Sold at local market (in Lt)	339.87 (44.74)	977.16 (280.43)	-637.29	t = -3.05, P=0.00
Average amount of milk consumed at home (in Lt)	826.38 (82.77)	1314.12 (108.85)	-487.74	t = -3.59, P=0.00
Average milk selling price	12.03 (0.41)	12.36(0.48)	-0.32	t = -0.51, P= 0.60
Average milk production cost	5556.82 (580.59)	10538.39 (939.47)	-4981.57	t = -4.57, P = 0.00

The numbers in the brackets are the standard errors.

Here also it was once a day milk is taken-off during, either morning or evening but not both times. These makes lower amount of milk to be collected from milk cows regardless of the potential the breed has. This is indicating that the milk production potential per cow per a day is too much higher than the amount taken-off by the individuals. As shown in Table 7, this study found that there is significant difference between Tahtay adiyabo and Kafta humera districts in number of dairy cows owned, milk yield obtained per cow per a day, total amount of milk collected, amount of milk consumed at home, amount of milk sold at local market and average milk production cost. Which all are significant at one percent significance level. On the other hand, there is insignificant difference between the two districts regarding number of milking days per month, number of milking month per cow and average milk selling price.

3.1.2.2. Purposes of Milk production

The primary objective of cattle production in the study area is not for dairy production rather to get a greater number of cattle. Therefore, dairy production is by-side activity attached with getting more calf. Thus, the purpose of milk produce has mainly used for rearing of calves followed by family consumption and/or selling. As the data obtained from FGD, half of the milk the cow has had left for calf while the remaining had taken-off either for family consumption and/ or for selling purposes.

Regarding the purpose of milk production by the individual households in Tahtay adiyabo district about 50% and 39% of the total respondents taken-off milk from their milk cows for their own family consumption and for both selling and home consumption respectively (Table 8). While 70.5% and 27.5% of the farmers in Kafta humera district allocate the milk they takeoff from their milk cows for both selling and home consumption and own family consumption respectively which is in-line with the study result obtained by Befekadu *et al*. (2018). Thus, most of the farmers produce milk targeting for calf rearing; but besides they also used for their family consumption and/or for selling at local market.

Table 8. Purpose of milk takeoff from milk cows in the study districts

Purpose of the milk produced	Tahtay adiyabo (in percent from 160 respondents)	Kafta humera (in percent from 149 respondent)
For Selling	10.62	2.01
For home Consumption	50.4	27.52
For Selling and home Consumption	38.98	70.47

The reasons for targeting most of the producers for their home consumption especially in Tahtay adiyabo district is that there are no milk collectors from the rural residences as all most all of the farmers live far apart from each other. There is also lack of infrastructural facilities such as collecting materials, storage and road facilities. These enforces farmers to allocate most of the milk amount they takeoff for their family consumption.

3.1.2.3. Milk and its Products Buyers

According to this study result as shown in Figure 8, 66% of the milk taken-off from milk cows in Tahtay adiyabo district was sold to consumers, followed by the percentage sold to raw-milk traders (19%). Why consumers bought most of the product is for the reason that there was lake of market infrastructure, which hinders not to travel far distant to search for the other buyers. The shelf life and nature of the product has also greater impact, which makes farmers not to store and wait for competitive buyers rather to immediately consume or sale it. This makes the farmers to sold around their nearby even at lower price.

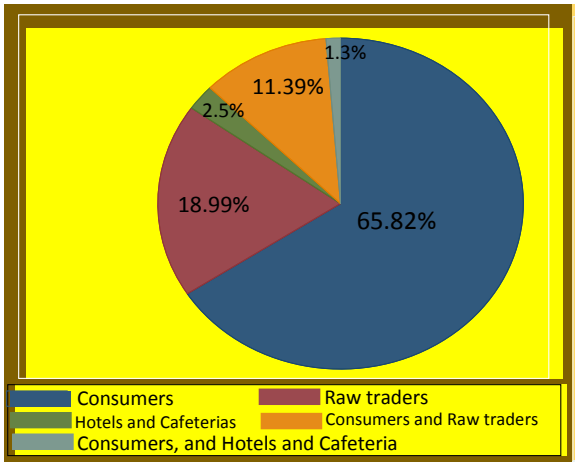

Figure 8. Milk buyers in T/adiyabo district

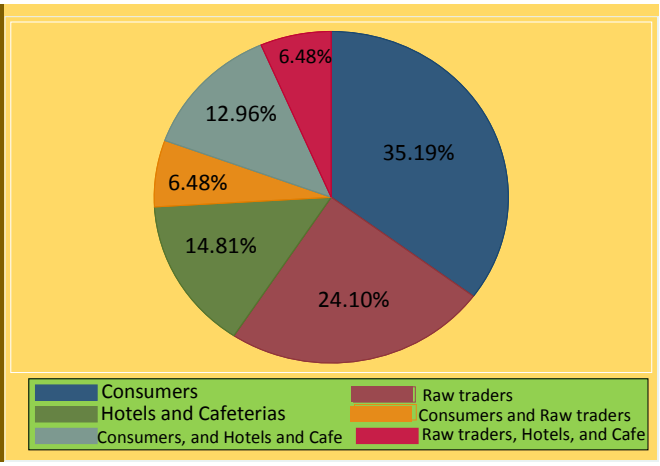

Figure 9. Milk buyers in Kafta humera district

Similarly, as it has presented in Figure 9 dealing with the buyers of milk in Kafta humera district, about 35% of the farmers sold the milk they obtain to consumers followed by those who sold to raw-milk traders. Relatively compared to the percentage of farmers who allocated to sale the milk in Tahtay adiyabo district, in Kafta humera district the residences found in nearby one to each other and there is relatively good road accessibility so that milk could easily transported from one to another place.

3.1.2.4. Utilization forms of milk

As it has shown in figure 10, regardless of its allocation (either for home consumption and/or for selling) milk is used indifferent forms (such as in the form of boiled fresh milk form, yogurt, and other products). Supporting to the above idea according to the data obtained from FGD, larger amount of milk has utilized in boiled fresh milk followed by yogurt.

Figure 10. Milk and its products value addition and selling in different forms

3.1.3. Dairy production cost

As the data obtained from the selected farmers, the average production cost of dairy is 5556.82 ETB and 10538.39ETB per the average number of cows owned by each household in Tahtay adiyabo and Kafta humera districts respectively (Table 7). Thus, the average cost per single dairy cow is 2050.49ETB and 2570.34ETB respectively for the farmers in Tahtay adiyabo and Kafta humera districts.

3.2. Major challenges and constraints of dairy production

Regarding the major challenges and constraints facing dairy production in the study areas, this study interviewed the sampled respondents, conducted discussion with FGD and interviewed key informants. Accordingly, this study found that the major challenges and constraints of milk production as per priority (rank) have presented with in table 9.

Table 9. Milk market characteristics in the study districts

Major dairy production challenges and constraints	Tahtay adiyabo (in % from 160 respondents)	Kafta humera (in % from 149 respondent)	Mean Rank
Diseases and pests	40.65	43.82	1
Shortage of grazing land	21.72	15.35	2
Drought	13.05	14.42	3
Unavailability of water in near by	09.48	12.86	4
Unavailability of organized milk markets	07.25	04.91	5
Unavailability of milk value addition and processing technologies	04.75	05.05	6
Shortage of improved feed at all seasons	3.10	3.59	7

Keeping the above result, which has shown in table 9, it was necessary to evaluate its replicability and repeatability as per group discussion and KII. Therefore, the focus group discussion and key informants interview has conducted that finally reach to consensus in identifying and prioritizing these challenges and constraints after so many debates. Based on these challenges and constraints found from this FGD, are consistent with those obtained during the individual interview results found and shown in table 9. This study also conducted KII, in identifying and ranking these challenges and constraints. Finally, the KII individuals also agreed as these cases were the major once with the priority specified in the above in table 9. From the literatures perspective also these major challenges and constraints found are consistent with the results found by Gedadaw *et al*. (2017) and IPMS (2011).

4. Conclusion and Recommendations

4.1. Conclusion

It is found that there is significance difference between kafta humera and Tahtay adyabo districts regarding frequency of extension contact, extension service, age of the household head, Experience in agriculture, distance of cattle farm to local market, distance of cattle farm to residence, number of livestock related trainings obtained, distance cattle travels to drink water and milk market participation. However, insignificant difference regarding experience in cattle and dairy production, education level of the household head, total family size, distance of residence from district town.

It is also found that the two districts has significant difference regarding milk yield (2.53Lt and 3.33Lt per cow per a day), number of dairy cows owned by individual household per a year (2.7 and 4 cows). So that, total milk obtained (1166.25Lt and 2291.29Lt), average milk production cost (which was 5556.82ETB and 10538.39ETB), total amount of milk sold at local market (that was 339.87Lt and 977.16Lt) and consumed at home (that was 826.38Lt and 1314.12Lt) respectively for Tahtay adiyabo and Kafta humera. However, there is similarity in the total number of milking months (6.3 and 6.43months), average number of milking days per month (27 and 26 days) and average farm gate selling price per litter (12.03 and 12.36ETB per Lt). As compared to the potential and the benchmarks obtained in other parts of the glob, the milk yield obtained by the farmers in the study area was too lower.

Considering the dairy cattle management system, this study found that its management system depends on the status of the cow, season and availability of rangeland in nearby the residence (search feed at night and rest in the day light time at shed). It also found that, on average about 58% of the farmers in these districts supplement by providing concentrated feed to their dairy cows, which is mostly sorghum grain. Most of these supplementing farmers start it during February. This study also found that cattle had enforced to travel to drink water from the nearby water source; that more than 80% of the cattle keepers enforce their cattle to drink water in the nearest water source even travelling the average distance of 2.44Km (1.59 and 3.36 Km respectively for Tahtay adiyabo and Kafta humera districts).

It has also found that from the total milk taken-off from milk cows about 70.86% and 57.35% respectively for Tahtay adiyabo and Kafta humera districts has allocated for family consumption; while the remaining 29.14% and 42.65% was supplied to local market respectively.

4.2. Recommendations

To improve milk yield, total production and so profitability obtained from dairy sector in Tahtay adiyabo and Kafta humera districts:

- It is important to organize producers as by nearby and establish and make functional cooperatives so that producers could sell at their nearby which could then improve the accessibility of market place and then farmers' intension could be improved and so milk productivity could be increased.
- It will also be better if dairy cows provided collected feed while in its shed for the months other than green feed could be grazed in rangeland, as the number of months that the dairy cows feed collected feed had significant and positive relation with yield.
- As solutions for shortage of grazing land and drought incidence, improved forages that could be used for all seasons are better to adopt.
- It will also be good if collected feed is provided to the dairy cows with the intensive protection from diseases and pests.

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