Factors Constraining Postharvest Cow Milk Quality in The Case of Oromia Regional State Milk Suppliers

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Abstract

This study was dealt with factor constraining postharvest cow milk quality in case of Oromia regional state. Using systematic random sampling technique, 373 smallholder milk suppliers' households were selected and 50 milk collectors were involved in the sample. The required data were collected from both secondary and primary sources of data and analyzed using descriptive and econometric method of data analysis. The factor constraining postharvest milk qualities along supply chain of milk suppliers and first line milk collectors are identified in the region were market distance, bulking time, and price offered, sanitation condition and logistic facility.

The regression results showed that all of the independent variables are significant and have an influence on postharvest milk quality. Independent variables; market distance, logistic facility, sanitation situation and retained time before bulking have negative influence on postharvest milk quality.

These four explanatory variables have coefficients of 0.009, 0.015, .010 and 0.008 respectively in the regression model. One variables milk price have positive effect influence on postharvest milk quality with coefficient 0.022. All these explanatory variables have significant influences on the dependent variable, postharvest milk quality. According to agreement level collected data from milk supplier respondents for the constraining factors with 20 measurement item, the overall Cronbanch's alpha value is .736 which is above the standard threshold level 0.70. More than 55% of the respondents showed their agreement and strongly agreement on aggregate on each measurement item scale of the constraining factors. Hence, the more than half of the respondents believe (agreed) that bulking time, market distance, price, sanitation situation and logistic facility have constraining effect on postharvest milk quality. establishing quality based payment system, establish diary factories and bulking centers near to milk suppliers, establishing rules and regulations which enforce maintaining of milk quality and facilitating immediate milk collection mechanism are among the recommendation suggested by the researcher.

Keywords: Postharvest Milk Quality, Price, Market Distance, Bulking Time, Logistic Facility and Sanitation Situation

1. Introduction

1.1. Background of the study

The livestock sub sectors play vital roles as sources of food, income and foreign exchange to Ethiopia economy and contribute about 12 and 33% of the total and agricultural GDP respectively. Ethiopia holds the largest livestock population in Africa estimated about 63.1million head of cattle, 23.6 million of sheep, 16 Millions goats (CSA, 2008). Livestock and their products are estimated to compose a third of total value of agricultural gross output in developing countries and this share is rising from time to time (CSA, 2008).

The total annual national milk production in Ethiopia from about 10 million milking cows is estimated about 3.2 billion liters, which is 1.54liters/cow on average (CSA, 2008).

The dairy value chain entailed about 500,000 smallholder rural farmers who produce about 1,130 million liters of milk of which 370 million liters of raw milk, 280 million liters of butter and cheese and 165 million liters is consumed by the calves (Mohammed, 2009). The remaining 315 million liters was marketed through both informal and formal retailers through cooperatives and farmers' organizations.

Both large- and small-scale dairy farmers operate under highly uncertain production and economic environments. One of the biggest concerns of dairy farmers is the quality and safety of milk production. Failure to meet quality assurance standards and regulatory requirement affects both the farmers and consumers. Penalties imposed for production of poor quality milk reduce income for farmers. Consumers are exposed to potential public health threats and diseases from consumption of potentially contaminated milk sources. At the same time, farmers also face other challenges such as increased production costs, low productivity, low milk prices, lack of liquidity or capitalization, and poor input support (Ndambi, Hemme and. Latacz-Lohmann 2007). The dairy industry has not been spared from the adverse effects of drought and extreme temperatures. Despite these challenges the farmers are still expected by all stakeholders to produce good quality milk that is free from microbial, physical, and chemical contamination (Pantoja, Reinemann, and Ruegg 2009).

Milk and its products are rich in nutrients and contain high moisture and neutral PH. Milk, thus, easily favours the growth and multiplication of bacteria and other disease-causing agents. Contaminated milk may cause tuberculosis, brucellosis, listeriosis, gastrointestinal disorders and salmonellosis. Milk contamination can originate from different sources such as the milking environment, wind, milking equipment, feeds, soil, faces, farm personnel, and housing (Tesfaye, and Azage 2010). Although contamination of milk can occur at various stages including during handling, during transportation or storage at farm, and during processing or at the market, most of the contamination is usually associated with the farm. Therefore, it is important to put in place sound quality control measures at the farm level.

Postharvest loss is a major problem of the dairy sector in tropical countries. The high temperature coupled with the absence of cooling facilities and inadequate transportation means hasten the spoilage of milk produced in these countries (O'Mahoney and Peters, 1987).

1.2. Literature

1.2.1. Milk Marketing Practices

In Ethiopia, fresh milk sales by smallholder farmers are important only when they are close to formal milk marketing facilities, such as government enterprise or milk groups. Results from a sample of farmers in Northern Shewa in 1986 estimated that 96% of the marketable milk was sold to the Dairy Development Enterprise (Debrah and Berhanu, 1991). Farmers far from such formal marketing outlets prefer to produce other dairy products instead, such as cooking butter and cottage cheese. The vast majority of milk produced outside urban centers in Ethiopia is processed into dairy products by the households, and sold to traders or other households in local markets (Debrah and Berhanu, 1991). The major portion of the milk comes from small dairy farmers with few milk animals located in the rural areas. What is produced on the animal farm has to reach the market, and the nearer the market the lesser would be the transportation charges and the lesser would be loss due to spoilage. Enhancing the ability of smallholder dairy farmers to participate in the market and improve their financial profitability is one of the most pressing development challenges. (Jones, 1998).

Dairying is a means of providing an additional source of employment and income to small and marginal farmers. The smallholder farmers produce about 93% of dairy products (Tsehay, 1998). It is only small quantity of this production that is marketed in the form of liquid milk; the larger volume is processed into different dairy products for home consumption and sales. Large scale marketing and processing of milk is limited to the area around Addis Ababa, which is the Addis Ababa milk shed. It appears that butter dominates dairy marketing, and the transaction in the form of raw milk is limited around major urban centres. There are a few milk-processing plants in Ethiopia. The processed products of these plants are pasteurised fluid milk, table butter, and hard cheese, yoghurt and ayib (cottage cheese) (Zegeye, 2003).

Field surveys have shown that many potential liquid milk-marketing households are hours distant away from any milk group. Setting up new groups would clearly reduce the travel time to group, and the actual number of households that would benefit depends on local population densities.

It is also important to keep newly emerging milk groups small and geographically limited to ensure proximity and avoid large groups that would tend to increase average travel times (Holloway et al., 2000). Another study showed that the creation of new market outlet for fluid milk brought major improvements in the production, marketing and consumption behaviour of smallholder households. The new marketing outlet may also promote involvement in more intensive dairying (Nicholson et al., 2000).

1.2.2. Milk Quality

Milk produced at smallholder farms in Ethiopia is marketed without any form of pasteurization or quality control measures. According to former reports in Ethiopia, on the total milk production, it is reported that 71 to 97% of milk is consumed through an informal market that is basically characterized by selling of low quality milk and milk products (Stanly, 2012).

Milk spoilage is a major problem of the dairy sector in tropical countries. The high temperature coupledwith absence of cooling facilities and lack of adequate transportation means accelerate the spoilage of the milk produced in this area (O'Mahoney and Peters, 1987). In Ethiopia the rural milk production system accounts for about 97% of the total milk production in the country where it is difficult to transport the raw milk to the market areas or to the processing plants due to poor infrastructure (Staal and Shapiro, 1996). Only about 5 % of the milk reaches to the market areas and the rest of the milk is processed at the farm into different dairy products. A significant amount of milk is spoiled due to the absence of cold storage facility such as refrigeration.

1.2.3. Factor affecting postharvest milk quality

In Ethiopia milk marketing system is not well developed (Ahmed *et al.*, 2003) especially, market access in pastoral production system is a critical factor (Tsehay, 2002). This has resulted in difficulties of marketing fresh milk where infrastructures are extremely limited and market channel has not been developed. In the absence of organization of rural fresh milk market, marketing in any volume is restricted to peri- urban areas. Milk being perishable and demand being high for urban consumption, efficiency in collection and transportation of this bulk from widely scattered rural sources, requires a well-defined method of preservation and distribution.

This would impact on the amount that would be available for consumption through losses in quality (Ahmed *et al.*, 2003).

A. Market Distance

In Ethiopia milk marketing system is not well developed (Ahmed et al., 2003) especially, market access in pastoral production system is a critical factor (Tsehay,2002).This has resulted in difficulties of marketing fresh milk where infrastructures are extremely limited and market channel has not been developed. In the absence of organization of rural fresh milk market, marketing in any volume is restricted to peri- urban areas (Ahmed et al., 2003).

Distance to market is measured in estimated kilometers. The closer the market is the lesser would be the transportation charges, reduced transaction costs, reduced trekking time, reduced loss due to spoilage, and reduced other marketing costs, better access to market information and facilities. This improves return to labour and capital and increase farm gate price and the incentives to participate in economic transaction and dairy marketing will increase (Bultossa, 2016).

B. Bulking Time

The time taken to deliver the milk is relatively lower when compared to other areas of the country as these districts are located in the per-urban areas where infrastructure and marketing structures are relatively well developed. However, unlike the current study, in some parts of the country such as Holeta, Selale and Debrebirhan the evening milk is collected the next day morning (Yilma et al., 2013).

C. Logistic facility

Milk is a bulky and heavy commodity which requires high cost storage and transportation and it spoils quickly without cooling (Knips, 2005). In the tropical countries of Africa with high ambient temperatures, lack of refrigeration facilities at the farm and house hold level imply that raw milk will acidify very fast unless and otherwise protected. Therefore the collection systems must be designed to move the milk to the cooling and/or processing center in shortest possible time. In addition every effort should be made to use available systems such as water cooling, air circulation or shaded areas to reduce milk temperature (Alehegne, 2004).

Having limited the number of bacteria entering milk during milking, it is essential that contamination from equipment situated between the cow and the refrigerated storage unit is kept to a minimum. Bacteria are present in the air, dust and water, especially any water containing traces of milk residues which may have been left in the milking plant overnight, as such residues provide a very good source of food for bacteria, thereby enabling the bacterial counts to increase rapidly (Nangamso, 2006). Non-pasteurized milk, goes off within a few hours. It must therefore be kept cool and quickly pasteurized and again cooled to a temperature of 4°C if possible (Pauline and Karin, 2006).

D. Sanitation

Handling methods employed during transportation and storage affect milk quality to a great extent. Milk handling material type also affects milk quality. Spoilage and contamination of raw milk occur as a result of poor hygiene, extended time of transportation and lack of suitable storage facilities.

Milk should be handled in containers which are made of seamless stainless steel without cracks where bacteria can lodge and multiply leading to spoilage and these containers should be unaffected by milk or by chemicals used in cleansing (Younan et al, 2007).Poor hygiene to a greater extend has been one of the most important reasons of spoilage of products (Bonfoh 2006).

E. Price

The introduction of bonuses for clean milk and penalties for poor quality milk will motivate farmers to produce clean milk. The price incentive system is practiced in countries like Zimbabwe and Zambia (Alemayehu et al, 2012).

Pricing can effectively serve as an instrument of supply and demand management. It has a significant role to develop and influence the structure of any segment of the economy including dairying. The selling price for milk and milk products must be competitive with others selling prices, consistent with the objective of social justice, relative consumer preferences and techno-economics of dairying (Dajesh, 2019).

1.3. Statement of the Problem

The (Livestock products) contribute substantially and directly to food security and to human health. For poor and under-nourished people, particularly children, the addition of modest amounts of livestock products to their diets can have substantial benefits for physical and mental health (Neumann et al. 2003). Postharvest losses have been highlighted as one of the determinants of the food problem in most developing countries (Babalola et al., 2010).

Food losses attain increased attention in recent times. It is predicted that about 1.3 billion tons of food is lost each year (Gustavsson, Cederberg, Sonesson, Otterdijik & Meybeck, 2011). While a reasonable part of food losses results from food waste in developed countries, a major portion of food loss in developing countries is owing to high postharvest losses in food supply chains (Lucia & Assennato 2006).

Due to various postharvest factor raw milk is no longer reaching milk collectors and processing plants in good quality. Different literature reveal that incredible amount of milk consignment are being rejected at dairy farms and collection centers due to milk spoilage, which resulting in high volume reduction milk volumes, quality. However, the constraining factor of postharvest milk quality and extent of the factors are not well studied (especially in our country) as a result there is no up-to-date full information which can help to minimize losses and maintain milk qualities.

Identifying factor constraining post-harvest milk quality enable the stakeholder to take action against the constraining factors and ensure food security by reduces post-harvest losses.

2. Objectives of the Study

The main objective of this study is to identify factor constraining postharvest cow Milk quality in the study area.

In line with the general objective, this research will specifically attempt to:

- To evaluate market distance effect on postharvest milk quality
- To evaluate bulking time effect on postharvest milk quality
- To examine logistic facility effect on postharvest milk quality

- To evaluate sanitation effect postharvest milk quality
- To identify the extent of associate between price postharvest milk quality in the study area.

3. Materials and Method

3.1. Study Site, Sampling, and Data Collection

The study was conducted in Oromia regional state by targeting North Shoa Zone milk suppliers. These

Zone were purposefully selected because of their potential for dairying and the zone is the largest milk shed (Wytze, Dawit, Binyam, Mahlet and Jan, 2013) and holds the largest crossbred dairy cows population in Ethiopia amounting to 49,738 heads a figure even larger than that of the Southern Nations, Nationalities and Peoples State (CSA, 2011).

The target population of this study are milk suppliers in North shoa zone, Oromia Regional state, whom supplies milk for milk collectors (individual milk collector, diary firm and farmers union). Total of 5488 target population of milk suppliers identified using registered notes of 52 individual milk collectors, 4 diary firm milk collectors and 1 farmer's union milk collectors.

For the purpose of this study systematic random sampling technique was used for collection of data from milk supplied. The sample size was calculated using formula of Yamane (1967) and using margin of error .05 the researcher draw 373.

$$n = \frac{N}{1+N(e)^2}$$

Where:

n= corrected sample size,

N = population size and

e = Margin of error,

Besides the researcher draw 50 milk collectors using Yemane (1967) formula and selected the interviewee using purposive sampling. Out of total respondents of these 47 of them are individual milk collectors, 4 are diary firm representative and 1 is farmers' union representative.

3.2. Data Analysis

The collected data was analyzed by using SPSS 20. Using this statistical package software the researcher descriptive and inferential statistics was analyzed. Regarding the analysis of demographic information, frequency count, tables, and charts are used to present the observations.

The primary analysis of identifying factors constraining postharvest milk quality was done by regression, hypothesis testing and correlation.

A linear regression model used to determine the relative importance of each explanatory in affecting the postharvest cow milk quality of is determined using the linear equation. The linear regression model is:

$Y=\beta x+ \varepsilon t$ - is the error term……

Where

Yi = Quality milk supplied to the market

β = a vector of estimated coefficient of the explanatory variables

X= a vector of explanatory variables

Ui = disturbance term

The Models are expressed as follows:

$Y=\beta 0+\beta 1(TRBBulk)+\beta 2(MarkDIS)+\beta 3(PriOf)+\beta 4(LogFac)+\beta 5(SaniSit)+\varepsilon it$

Where,

TRBBulk = Time of milk retained with milk supplier before bulking (Bulking time)

LogFac = Logistic facility for milk supplier

MarkDis = Market Distance from milk supplier

SaniSit = Sanitation situation of milk supplied

PriOf = Price offered for a liter of milk

Hypotheses:

H0: all the coefficients = 0 or H0: $\beta 1 = \beta 2 = ... = \beta 5 = 0$

HA: at least one coefficient is not 0 or HA: at least one $\beta x \neq 0$

3.3. Scope of the Study

Due to time and financial constraint, the scope of this study was limited to house hold level milk supplier's factors that constrain postharvest cow milk quality on the way from milk suppliers to milk recipient farmers union, diary firm and milk collectors. Moreover, this research was conducted only in one zone of the regional state (North Shoa Zone) cow milk suppliers to the diary firms and milk collectors. North Shoa zone is the largest milk shed (Wytze, Dawit, Binyam, Mahlet and Jan, 2013) and holds the largest crossbred dairy cows population in Ethiopia amounting to 49,738 heads a figure even larger than that of the Southern Nations, Nationalities and Peoples State (CSA, 2011).Therefore, all information of this research is limited only to the factor constrain postharvest milk quality in this Zone of Oromia Regional State.

4. Results

4.1. Descriptive Testing Multivariate Assumptions of Classical Linear Regression Model

Gujarati (2003) Classical assumptions linear regression model are as follows:

Assumption 1: Linear Relationship Test

Milk quality is assumed to be linearly related with constraining factors (Price, market distance, bulking time, logistic facility and sanitation situation). The linear relationships are observed in figure below.

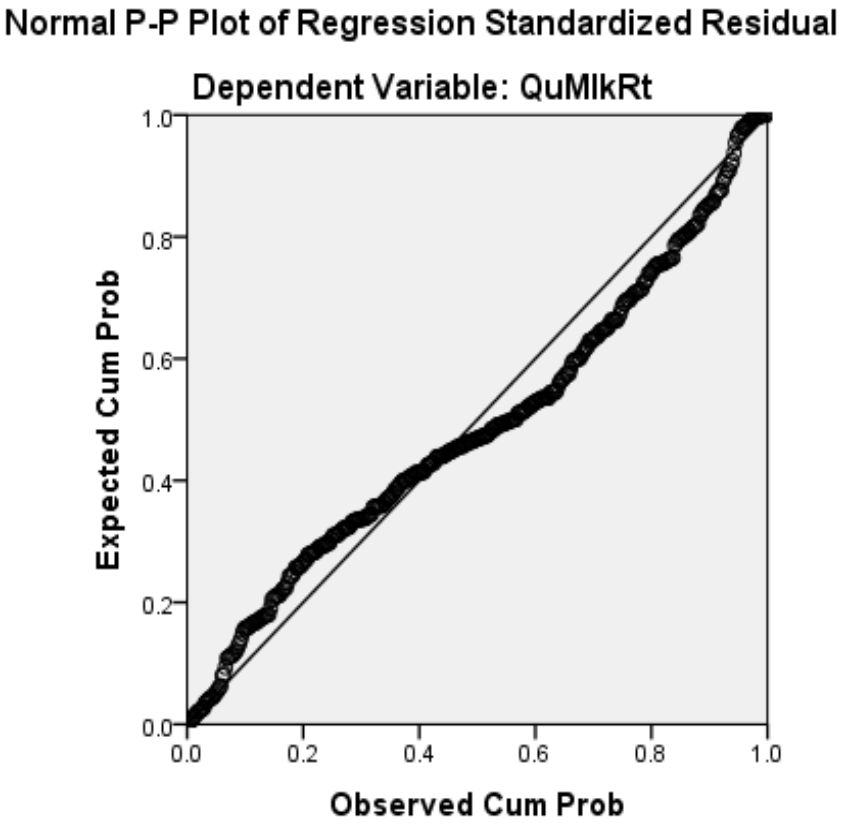

Figure 1 Regression standard residuals

Source: Analysis of Survey data 2020, using SPSS

Assumption 2: Homoskedasticity

According to Gujarati (2004), homoskedasticity means equal variance. That is, the Y populations corresponding to various X values have the same variance. Put simply, the variation around the regression line (which is the line of average relationship between Y and X) is the same across the X values; it neither increases or decreases as X varies. As shown in the graph below, the variations of the independent variables around the regression line is the same. We can say that at this stage all Y values corresponding to the various X's are equally important.

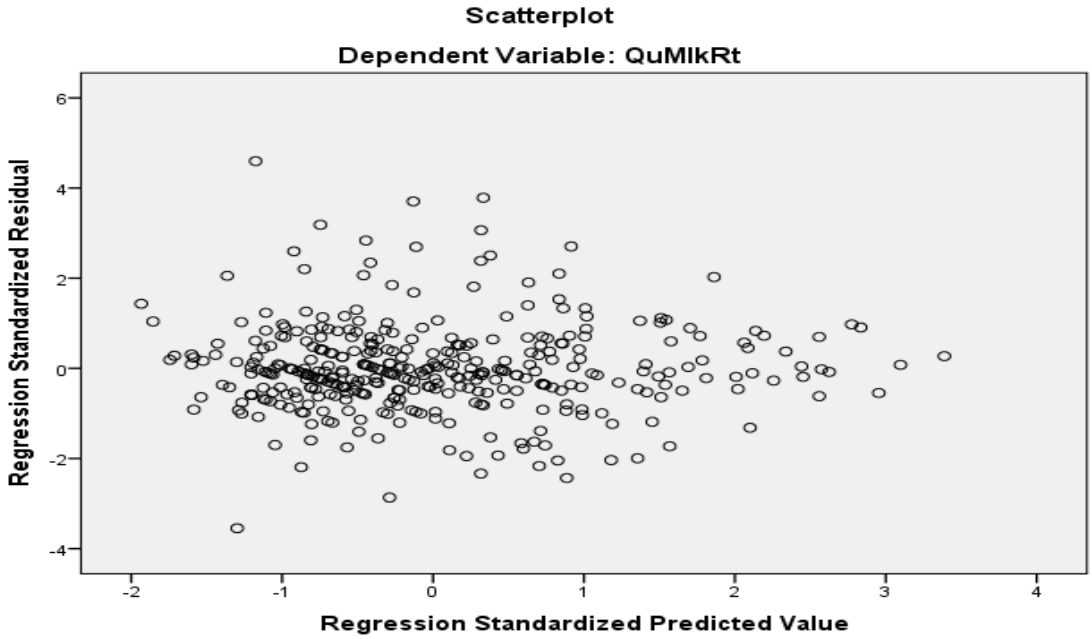

Figure 2 Regression Standardized value

Source: Analysis of Survey data 2020, using SPSS

Assumption 3: Normality

An informal approach to testing normality is to compare a histogram of the sample data to a normal probability curve. The empirical distribution of the data (the histogram) should be bell-shaped and resemble the normal distribution.

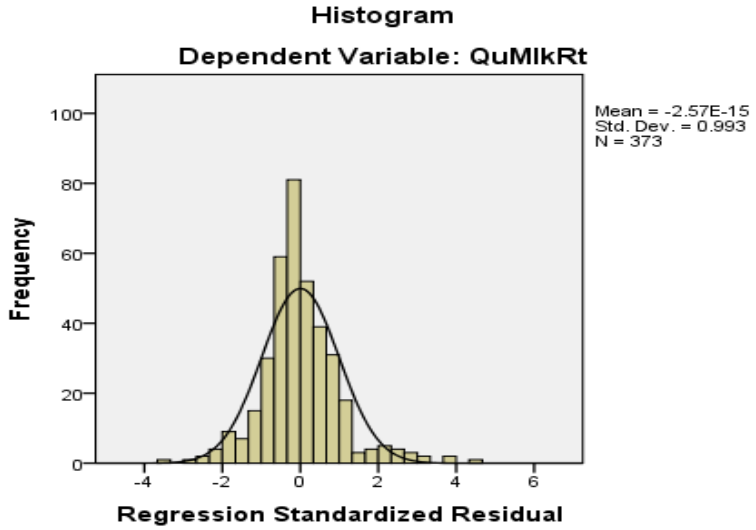

Figure 3 Regression Standardized residuals

Source: Analysis of Survey data 2020, using SPSS

Assumption 4: Multicollinearity

Table 1 Collinearity Statistics of the data

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Time retained before bulking	.970	1.031
	Market distance	.959	1.042
	Milk Price	.975	1.026
	Logistic facility	.959	1.042
	Situation of sanitation	.986	1.014

Source: Analysis of Survey data 2019, using SPSS 20

Using rule thump correlation matrix which is discussed in the above sections VIF of the variables are around 1, which imply that all the independent variables are not highly correlated.

Accordingly, in this study, there was no problem of multicollinearity, which enhanced the reliability for regression analysis.

Assumption 5: Exogeneity

All that this assumption says is that the factors not explicitly included in the model, and therefore subsumed in the error term, do not systematically affect the mean value of the dependent variable, postharvest milk quality in our case. According to Brooks (2008), if a constant term is included in the regression equation, this assumption will never be violated. Because the regression model used in this study included a constant term, the errors were assumed to exhibit zero meanand catering institutions. Farmers' milk sells distribution by customer category was dominated by cooperatives/

4.2. Regression analysis

Multiple regression analysis is defined as "a statistical technique which analyzes the linear relationships between a dependent variable and multiple independent variables by estimating the coefficients for the equation of a straight line" (Hair et al., 2004).

Table 2 Model Summary of the regression results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.757[a]	.573	.567	.05431

a. Predictors: (Constant), Situation of sanitation, Time retained before bulking, Market distance , Milk Price, Logistic facility

b. Dependent Variable: QuMlkRt

A value of 0.757 in table 3 above and according to Nunnally (1978) offered a rule of thumb of 0.7 the value indicate good level of prediction. We can see from the results of the table, the R2 value is 0.423 that our independent variables explain 57.3% of the variability of our dependent variable,

milk quality rate. The Adjusted R-square statistics of the Model Summary table means that 56.7% of the variation in milk quality rate can be attributed from these variables included in the study.

One-way ANOVA was run next to see if significant differences between the means of the variables. The results are given in the following tables. According to the ANOVA tables that are shown below, the overall significance level of market distance, price, bulking hour, logistic facility, and sanitation situation is less than 5% implying these variables are significant. This shows that postharvest quality rate for beer products is significantly influenced by the overall effect of the explanatory variables included in the model.

The F-ratio in the **ANOVA** table (table below) tests whether the overall regression model is a good fit for the data. The first table shows that the independent variables statistically significantly predict the dependent variable, F = 98.438, p = 0.000 (i.e., the regression model is a good fit of the data).

Table 3 ANOVA results of the study

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.452	5	.290	98.438	.000[b]
	Residual	1.082	367	.003		
	Total	2.534	372			

a. Dependent Variable: QuMlkRt

b. Predictors: (Constant), Situation of sanitation, Time retained before bulking, Market distance , Milk Price, Logistic facility

Source: Analysis of Survey data 2019, using SPSS 20

4.3. Influences of each of the explanatory variables

Table below revealed the result of multiple regression analysis between the dependent variable (milk quality) and the individual independent variables (market distance, price, bulking hour, logistic facility, and sanitation situation).

As shown in the table, the study revealed that all of the explanatory variables (market distance, price, bulking hour, logistic facility, and sanitation situation) have significant level constraining effect on milk quality with p-value of 0.000 ($p<0.01$) that means, these independent variables have strong influence on postharvest cow milk quality. This is because the coefficients of the explanatory variables in the model are significantly different from zero.

Regression Equation

The general form of the equation to predict postharvest milk quality from the independent variables is:

PI =. 627+ (-.008*TRBB) + (-.009*MarkDis) + (.022*PriOf) + (0.015*LogFac) + (.10*SaniSit)

Ho: TRBB, MarkDis, PriOf, LogFac and SaniSit) do not help to explain milk quality rate. This means that the values of the coefficients of the explanatory variables are equal to zero.

The Coefficients, the t-values and corresponding p-value are located in the “B”, "T" and "Sig." columns, respectively, as shown below:

Table 4 Coefficients of the model showing the direct influences on dependent variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.627	.031		20.41	.000
	Time retained before bulking	-.008	.001	-.473	-13.667	.000
	Market distance	-.009	.002	-.166	-4.756	.000
	Milk Price	.022	.002	.395	11.437	.000
	Logistic facility	-.015	.002	-.213	-6.129	.000
	Situation of sanitation	-.010	.002	-.145	-4.230	.000

a. Dependent Variable: QuMlkRt

Source: Analysis of Survey data 2019, using SPSS 20

As shown in the table above, the study revealed that all of the explanatory variables (market distance, price, bulking hour, logistic facility, and sanitation situation) have direct significant level influences on postharvest milk quality with p-value less than .05 that means,

These independent variables constraining factors on postharvest milk quality. Coefficients of the explanatory variables in the model are significantly different from zero.

Time retained (bulking time): a one-unit change in time retained, there are -0.008 unit change in milk quality. In other words there is -.8% variation in milk quality was caused due to time retained by milk suppliers, which is significant. The results obtained confirmed that time retained have negative and significant influence on postharvest milk quality. Hence, the study rejects the null hypothesis and accept the Alternative hypothesis.

Market distance on average in one unit change market distance, there are -0.009 unit change in milk quality. In other words there is -.9% variation in milk quality was caused due to market distance. The results obtained confirmed that market distance have negative and significant influence on postharvest milk quality. Hence, the study rejects the null hypothesis and accept the Alternative hypothesis.

Milk Price: on average a unit change milk price, there are 0.022 unit change in milk quality. In other words there is 2.2% variation in milk quality was caused due to milk Price offered by milk collectors, which is significant. The results obtained confirmed that milk price have positive and significant influence on postharvest milk quality. Hence, the study rejects the null hypothesis and accept the Alternative hypothesis.

Logistic facility: a one unit change in logistic facility, there are -0.015 unit change in milk quality. In other words there is -1.5% variation in milk quality was caused due to logistic facility by milk suppliers, which is significant. The results obtained confirmed that logistic facility have negative and significant influence on postharvest milk quality. Hence, the study rejects the null hypothesis and accept the alternative hypothesis.

Situation of sanitation: a one unit change in Situation of sanitation, there are -0.010 unit change in milk quality. In other words there is -1.0% variation in milk quality was caused due to Situation of sanitation by milk suppliers, which is significant. The results obtained confirmed that Situation of sanitation have negative and significant influence on postharvest milk quality. Hence, the study rejects the null hypothesis and accept the Alternative hypothesis.

4.4 Discussion of summaries of the measurement items Base on agreement level

4.4.1 Reliability tests of the data gathered

Reliability test of the 373 responses for the 20 items and has been done to check whether the scale used on the questionnaire consistently reflect what it intends to measure or not. To check the internal scale consistency of questionnaire the researcher did the reliability test by Cronbanch's alpha using SPSS. As per the result found from the collected data, the overall Cronbanch's alpha is 0.736 which is above the standard threshold level of 0.7, This shows that the data extracted from the questionnaire is reliable.

Table 5 the reliability statistics of the data gathered

Reliability Statistics

Cronbach's Alpha	N of Items
.736	20

4.4.2 Measurement items market Distance

The three measurement items of market distance and their SPSS results are discussed below. See table 6.

Table 6 market distance spss result

Measurement items	Scale	Frequency	Percent	Mean	Standard Deviation
Lack nearby market	strongly Disagree	20	5.4	3.9	1.130
	disagree	25	6.7		
	neutral	63	16.9		
	agree	129	34.6		
	strongly Agree	136	36.5		
	Total	373	100.0		

Distancing of milk supplier home from asphalt	strongly Disagree	22	5.9	3.73	1.103
	disagree	26	7.0		
	neutral	79	21.2		
	agree	148	39.7		
	strongly Agree	98	26.3		
	Total	373	100.0		
Distancing of collection center from nearby asphalt	strongly Disagree	47	12.6	3.57	1.309
	disagree	27	7.2		
	neutral	72	19.3		
	agree	122	32.7		
	strongly Agree	105	28.2		
	Total	373	100.0		

Source: Analysis of Survey data 2020, using SPSS 20

According to table 6, we can see from the response values for questionnaire item 1 that majority of the participants (36.5%) strongly agreed that lack of nearby markets has a constraining factor on postharvest milk quality. The next majority of the respondents (34.6%) agreed that distancing of collection center has constraining factor on postharvest milk quality. The mean value of the results obtained for item one is 3.9 with standard deviation of 1.13. Thus, we can say that market distance constrains postharvest cow milk quality due to lack of nearby markets.

4.4.3 Measurement items that describe bulking time

The four measurement items bulking time and their results are discussed below.

Table 7 Measurement items of bulking time and their results

Measurement items	Scale	Frequency	Percent	Mean	Standard Deviation
Early morning bulking time	strongly Disagree	50	13.4	3.44	1.326
	disagree	42	11.3		
	neutral	65	17.4		
	agree	127	34.0		
	strongly Agree	89	23.9		
	Total	373	100.0		
Keeping longer before transporting	strongly Disagree	42	11.3	3.60	1.231
	disagree	23	6.2		
	neutral	66	17.7		
	agree	154	41.3		
	strongly Agree	88	23.6		
	Total	373	100.0		
Inconvenience of bulking hour	strongly Disagree	58	15.5	3.73	1.438
	disagree	22	5.9		
	neutral	33	8.8		
	agree	108	29.0		
	strongly Agree	152	40.8		
	Total	373	100.0		
Lack of immediate acceptor	strongly Disagree	49	13.1	3.52	1.263
	disagree	23	6.2		
	neutral	66	17.7		
	agree	155	41.6		
	strongly Agree	80	21.4		
	Total	373	100.0		

Source: Analysis of Survey data 2020, using SPSS 20

According to table 7, we can see from the response values for early morning bulking time that majority of the participants (34.0%) agreed that early morning bulking time has a constraining factor on postharvest milk quality.

The next majority of the respondents (23.9) strongly agreed that early morning bulking time has constraining factor on postharvest milk quality. The mean value of the results obtained for item one is 3.44 with standard deviation of 1.326. Thus, we can say that early morning bulking time can affect postharvest cow milk quality.

In the next measurement, majority of the respondents (41.3%) agree that keeping longer before transporting has an effect on postharvest milk quality. The next majority of the respondents (23.6%) strongly agreed keeping longer before transporting has constraining factor on postharvest milk quality. The mean value of item two is 3.60 with standard deviation of 1.23. From the results we can say that keeping longer before transporting constrains postharvest cow milk quality.

4.4.4 Measurement items that describe logistic facility

The four-measurement items logistic facility and their results are discussed below.

Table 8 measurement items of logistic facility and their results

Measurement items	Scale	Frequency	Percent	Mean	Standard Deviation
Milk storing (container) material	strongly Disagree	38	10.2	3.54	1.199
	disagree	34	9.1		
	neutral	62	16.6		
	agree	166	44.5		
	strongly Agree	73	19.6		
	Total	373	100.0		
Unfortunate milk Storing room facility	strongly Disagree	43	11.5	3.50	1.252
	disagree	37	9.9		
	neutral	61	16.4		
	agree	153	41.0		
	strongly Agree	79	21.2		
	Total	373	100.0		

Lack of refrigerator	strongly Disagree	40	10.7	3.50	1.215
	disagree	36	9.7		
	neutral	67	18.0		
	agree	158	42.4		
	strongly Agree	72	19.3		
	Total	373	100.0		
Lack of fast and easy transportation means	strongly Disagree	27	7.2	3.74	1.120
	disagree	24	6.4		
	neutral	61	16.4		
	agree	169	45.3		
	strongly Agree	92	24.7		
	Total	373	100.0		

Source: Analysis of Survey data 2020, using SPSS 20

According to table 8, we can see from the response values Milk storing (container) material that majority of the participants 44.5% agreed that Milk storing (container) material has a constraining factor on postharvest milk quality. About 19.6% of the milk supplier respondents strongly agreed that Milk storing (container) material has constraining factor on postharvest milk quality. The mean value of the results obtained for item one is 3.54with standard deviation of 1.199.

For Lack of refrigerator, 42.4% of the respondents showed their agreements on the Lack of refrigerator while 19.3% strong agreed that it has constraining factor on postharvest milk quality. The mean value of the item is 3.50 with standard deviation of 1.215. Therefore lack of refrigerator has constraining effect on cow milk postharvest quality.

4.4.5 Measurement items that describe Sanitation

The five measurement items Sanitation and their results are discussed below.

Table 9 measurement items of sanitation situation and their results

Measurement items	Scale	Frequency	Percent	Mean	Standard Deviation
Uncleanness of container	strongly Disagree	33	8.8	3.59	1.171
	disagree	28	7.5		
	neutral	82	22.0		
	agree	147	39.4		
	strongly Agree	83	22.3		
	Total	373	100.0		
Accidental contamination of milk	strongly Disagree	45	12.1	3.55	1.255
	disagree	25	6.7		
	neutral	68	18.2		
	agree	148	39.7		
	strongly Agree	87	23.3		
	Total	373	100.0		
Mixing of milk with extraneous stuffs to increase the volume	strongly Disagree	17	4.6	3.58	1.120
	disagree	51	13.7		
	neutral	88	23.6		
	agree	131	35.1		
	strongly Agree	86	23.1		
	Total	373	100.0		
Mixing of milk with extraneous stuffs to maintaining milk properties	strongly Disagree	29	7.8	3.54	1.192
	disagree	43	11.5		
	neutral	86	23.1		
	agree	127	34.0		
	strongly Agree	88	23.6		
	Total	373	100.0		
Intentional adulteration of milk	strongly Disagree	42	11.3	3.46	1.223
	disagree	34	9.1		
	neutral	79	21.2		
	agree	146	39.1		
	strongly Agree	72	19.3		
	Total	373	100.0		

Source: Analysis of Survey data 2020, using SPSS 20

According to table 9, we can see from the response values uncleanness of container that most of the participants 39.4% agreed that uncleanness of container has a constraining factor on postharvest milk quality. About 22.3% of the milk supplier respondents strongly agreed that uncleanness of container has constraining factor on postharvest milk quality. The mean value of the results obtained for item one is 3.59 with standard deviation of 1.171.

4.4.6 Measurement items that describe price

The four-measurement items price and their results are discussed below.

Table 10 measurement items of price and their results

Measurement items	Scale	Frequency	Percent	Mean	Standard Deviation
Absence of incentive	strongly Disagree	29	7.8	3.61	1.151
	disagree	28	7.5		
	neutral	90	24.1		
	agree	139	37.3		
	strongly Agree	87	23.3		
	Total	373	100.0		
Low milk pricing	strongly Disagree	25	6.7	3.73	1.161
	disagree	30	8.0		
	neutral	74	19.8		
	agree	135	36.2		
	strongly Agree	109	29.2		
	Total	373	100.0		

Low profit	strongly Disagree	26	7.0	3.69	1.196
	disagree	40	10.7		
	neutral	66	17.7		
	agree	133	35.7		
	strongly Agree	108	29.0		
	Total	373	100.0		
Dissatisfaction with low milk price	strongly Disagree	27	7.2	3.67	1.086
	disagree	19	5.1		
	neutral	83	22.3		
	agree	166	44.5		
	strongly Agree	78	20.9		
	Total	373	100.0		

Source: Analysis of Survey data 2020, using SPSS 20

According to table above more than half of the total respondents which was 37% of agreed respondents and about 23% of strongly agreed that absence of incentive has a constraining effect on postharvest milk quality. The mean value of the results obtained for item one is 3.61with standard deviation of 1.151.

The final measurement item dissatisfaction with low milk price on which 44.5% of respondent suppliers agreed and 20.9% respondents strongly agreed that dissatisfaction with low milk price has a constraining effect on postharvest milk quality. The mean value of the item is 3.67 with standard deviation of 1.086.

4.5 Qualitative Phase

From quantitative data collected from milk suppliers, in general they indicated their agreement in the order of factors constraining postharvest milk quality in the quantitative phase. Similarily milk collectors mentioned as a factors constrain postharvest milk.

Milk collector Respondents indicate that postharvest milk are sensitive to price variations and as the price offered improved the milk quality supplied become healthier and as the price offered

decline the milk quality deteriorate. Further participants indicated that as the price offered dropped the milk supplied have a potential of exposing to addition of extraneous stuffs like water, salt and flour and sometimes its expossed to addition of chemicals which is not officially recommended for hosehold suppliers and directly eatable stuffs.

Regarding market distance activities, participants argue that market distance have a potential influence on postharvest qualities. Participant address that milk collection is done at the main road and circles. They said that collecting only in the main rod and circles have farness the market distance and consequently it constrains postharvest milk quality.

Concerning bulking time (retained time before collection), almost all milk suppliers address that they collect milk early morning. Participate indicate that early morning milk collection have forced the milk suppliers to retained longer and results in potential constraining effect on postharvest milk quality. However, participants indicate late morning milk collection have a good timing in order to maintain milk quality supplied to collectors but more disastrous quality loss for milk collectors while collectors supply to diary firms.

In similar participants addresses sanitation and logistic facility as a significant factors which constrain milk quality. Participants believe that logistic facility like refrigerator and containers are potential elements of logistic facility which can constrain postharvest milk quality. Beside to these the participant identified lack of cleanness of container and contamination as an elements of sanitation condition that constrain postharvest milk quality.

5. Conclusion and Recommendation

5.1 Conclusion

The problem statement part of the study postharvest cow milk quality were believed to be constrained due to various reason. However, the constraining factors and extent of the factors effect are was not studied well. By considering many reasons, key explanatory variables were identified. These explanatory variables were bulking time, market distance, price, sanitation condition and Logistic facility. The study used multiple regression models to identify the relationship among the explanatory variables and the dependent variable.

Using SPSS influences of the independent variables on postharvest milk quality were discussed in detail and the results were tested using Multivariate Assumptions of Classical Linear Regression Model. Base on Classical Linear Regression Model used for the study have tested and fit the assumption.

The regression results showed that all of the independent variables are significant and have an influence on postharvest milk quality. Out of these independent variables market distance, logistic facility, sanitation situation and retained time before bulking have negative influence on postharvest milk quality. These four explanatory variables have coefficients of 0.009, 0.015, .010 and 0.008 respectively in the regression model. One variables milk price have positive effect influence on postharvest milk quality with coefficient 0.022. Since all values are significantly different from zero, the researcher is in a position to conclude that these explanatory variables have significant influences on the dependent variable, postharvest milk quality. Thus, the study reject the null hypotheses and accept alternative hypothesis.

According to agreement level collected data from milk supplier respondents for the constraining factors with 20 measurement item, the overall Cronbanch's alpha value is .736 which is above the standard threshold level 0.70. More than 55% of the respondents showed their agreement and strongly agreement on aggregate on each measurement item scale of the constraining factors. Hence, the more than half of the respondents believe that bulking time, market distance, price, sanitation situation and logistic facility have constraining effect on postharvest milk quality.

5.2 Recommendations

The researcher recommended the following based on the findings and literature review conducted.

- Establishing quality based payment system in which high quality milk rewarded higher and parallel establishing the minimum milk price based on cost milk producer incurred to producing/supplying milks.
- Encouraging dairy farms to establish the factories and bulking centers near to milk suppliers. This will enable milk supplier to immediately sold there milks after harvesting in the nearest market.

- Establishing rules and regulations which enforce milk suppliers to maintain postharvest milk quality like prohibition of use of plastic cans and traditional grass container for supplying of milk and forcing use aluminum cans.
- Food and drug agencies should enforce using tight regulation which restricts gambling towards economic gain by intentional adulteration. In addition the agencies should take action against addition of chemicals to milk.
- By analyzing the economic loss incurred due to milk qualities stakeholder like MA and MOFED should convey milk storing, cooling and transporting equipment's with low cost.
- Arranging convenience milk collection strategies in order to minimize hours the milk suppliers retained at home before supplying to the milk collectors.
- Facilitating immediate milk collection mechanism In order to overcome inconvenience of bulking time.
- Doubling of the daily milk collection frequency also minimizes the retaining time of milk by of milk suppliers.

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Annex 1: Regression Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.757[a]	.573	.567	.05431

a. Predictors: (Constant), Situation of sanitation, Time retained before bulking, Market distance , Milk Price, Logistic facility

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.452	5	.290	98.438	.000[b]
	Residual	1.082	367	.003		
	Total	2.534	372			

a. Dependent Variable: Milk quality

b. Predictors: (Constant), Situation of sanitation, Time retained before bulking, Market distance , Milk Price, Logistic facility

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.627	.031		20.471	.000
	Time retained before bulking	-.008	.001	-.473	-13.667	.000
	Market distance	-.009	.002	-.166	-4.756	.000
	Milk Price	.022	.002	.395	11.437	.000
	Logistic facility	-.015	.002	-.213	-6.129	.000
	Situation of sanitation	-.010	.002	-.145	-4.230	.000

a. Dependent Variable: QuMlkRt