

A Report on
IMPACT OF COVID-19 ON SMALL HOLDER
DAIRY FARMERS IN COX'S-BAZAR DISTRICT



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Registration No: 01645

Session: 2015 – 2016

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List of Abbreviations

Abbreviation and symbol	Elaboration
BBC	British Broadcasting Corporation
BCR	Benefit Cost Ratio
BDT	Bangladeshi Taka
CI	Confidence Interval
COVID-19	Corona Virus Disease 2019
CVASU	Chattogram Veterinary and Animal Sciences University
CVH	Central Veterinary Hospital
d.f.	Degrees of freedom
DLS	Department of Livestock Service
Dr	Doctor
DVM	Doctor of veterinary Medicine
Etc.	Et cetera
et al.	et alia (and others)
GDP	Gross Domestic Product
Govt.	Government
SAQTVH	Shahidul Alam Qudery teaching Veterinary Hospital
SARS	Severe Acute Respiratory Syndrome
SSC	Secondary School Certificate
STD DEV	Standard Deviation
Tk	Taka
TTPHRC	Teaching and Training Pet Hospital and Research center
ULO	Upazila Livestock Officer
USD	The United States Doller
UVH	Upazila_Veterinary_Hospital

VS

Veterinary Surgeon

WHO

World Health Organization

%

Percentage

ABSTRACT

COVID-19 has created a serious negative impact in all sectors of the country. This study was conducted to understand the impact of COVID-19 on small holder dairy farms in Cox's-bazar District, Bangladesh. On the basis of available information, a total of 31 dairy farms were selected following random sampling technique from Cox's-bazar Sadar, Ukhia and Ramu upazila under Cox's-bazar district of Bangladesh through a pre-designed questionnaire. Descriptive, statistical and econometric methods were used to achieve the objectives.

The result showed that, maximum (41.94%) dairy farmers of Cox's-bazar were adult aged (41 and above), 45.16% farm owner were enough educated (above SSC) and maximum (77.42%) farmers started dairy farming by their own money. About 51.61 percent farm owner earned Tk 51000-100000 as monthly income. This study identified a remarkable change in net return, gross margin and BCR of the selected farms. Net return of the farms decreased from Tk 22748.43 to Tk 9937.442 where gross margin reduced from Tk 11483.43 to Tk 3038.71 during COVID-19 period than before COVID-19 period. This result also revealed that, the average difference of feed cost between during COVID-19 period and before COVID-19 period was Tk 1531.08 and average reduction in milk price due to COVID-19 was Tk 12810.99. The differences were statistically significant ($p < 0.0001$). This study also identified 12 major problems faced by farmers due to COVID-19 which were ranked according to problem indices and where milk price fall down due to COVID-19, constraints on marketing of products and high cost of concentrate feed were highlighted. However, in this situation, government and other agencies should concentrate on multipurpose cash support to COVID-19 affected vulnerable dairy farmers to minimize their loss.

Key words: BCR, Constraints, COVID-19, Dairy- Farming, Net return, Small holder.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Global pandemics have become the greatest risk for the sustainability of human race. Mankind has perceived many pandemics over the course of human history that slayed millions of people and demolished the global economy. The world is facing now another pandemic as Corona Virus Disease of 2019 (COVID-19). COVID-19 is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The first confirmed case of COVID-19 was detected in Wuhan (capital of China's Hubei province) which was declared as epicenter of corona virus outbreak by WHO. Because of uniqueness of this virus strain, the disease was spreading between people at a very high rate. On March 11, 2020, WHO (World Health Organization) declared COVID-19 outbreak as global pandemic (Cucinotta and Vanelli 2020).

Corona Virus Disease (COVID-19) has an unpredictable threat on societies and economies. There has been created a heavy impact on agricultural sectors around the world by this pandemic. (Barichello 2020). Widespread health crises severely affected the economy through various means, it shut down production (Keogh- Brown *et al.*, 2010) Consumers become panicked during buying which creates an unstable change in consumers habits, (Siu and Wong, 2004), contraction in producers' operative margins (Park *et al.*, 2008) and unpredictable effects on national and international trade flows, due to logistic rules and variability in exchange rates (Schmidhuber *et al.*, 2020).

Dairy sector has suffered most among all other sectors (BBC, 2020) due to two reasons: Firstly, milk and dairy products are highly perishable. Secondly, milk has a specific shelf life and act as a good media for bacteria so it depends on integrated and time sensitive supply chain. The economy of Bangladesh mostly depends on agriculture. Livestock sub sector contributes 13.45% into overall agricultural GDP in Bangladesh (DLS, 2021). This subsector generates 20% direct employment and 50% partly which plays an important role in the national economy of Bangladesh (DLS, 2021). More than 70% rural people are engaged in rearing large animal that contributes a greater share to the livelihoods of the smallholders and landless households (The World Bank,

Livestock based dairy revolution and Meat production project, 2018). The COVID-19 pandemic has started in Bangladesh since the 2nd week of March, 2020. After the COVID-19 outbreak began in early March in Bangladesh, the Government had locked-down people's movement to the spread of disease. Day by day affections have been increasing geometrically. The lockdowns have had a significant and still not well understood impact on the livestock sector. According to recent survey published by BRAC, though the lockdown was useful to prevent the spread of the disease as it forced people to stay at home, the average household income reduction was 75% which was caused by sudden shut down.

Cows are the main source of milk in Bangladesh. Cows produce about 90% of the total produced milk in the country (DLS, 2013). In Bangladesh the dairy sector is dominated by smallholder producers. More than 70% of the dairy farmers are smallholders who produce around 70–80% of the country's total milk (Uddin *et al.*, 2012). There is an estimation that there are about 1.4 million dairy farms with an average herd size of 1–3 cows (Hemme *et al.*, 2008). As all of the sectors, dairy also farmers faced severe pressure from supply and market disruptions. The dairy sector faced multidimensional losses due to lockdown on reason of COVID-19 and dairy farm owners faced losses both in production and milk marketing.

1.2 Justification of The Study

The role of livestock sub-sector is crucial in respect of nutrition, employment, and income in the economy of the country. The necessary draught power for various agricultural operations and transport is contributed by the livestock sub-sector. Dairy cows produce milk and meat for human consumption, which are very rich in nutrient contents. It provides cash income and creates employment opportunity for the rural people particularly for small farmers and landless laborers through sale of animals and various animal products. The people with small means rear dairy cows as the major source for their family income and that's how, dairy farming helps in poverty alleviation.

This study was carried out at Cox's-bazar district which is a coastal region of Bangladesh. Cox's-bazar is a mega city as well as the most famous tourist spot in Bangladesh and that's why is a very populated city. Due to the overpopulation

prevalence of COVID-19 was very high in this city and lockdown procedure was highly maintained here. This strict lockdown created a heavy impact on the economy of Cox's-bazar specially on the dairy sector. It increased unsold milk, feed cost, transportation instability etc. These regions were also important as there are a large number of dairy farms in this coastal area due to high demand of protein source of tourist as well as local people.

A few research has been done to determine the effects of pandemic on the dairy farmers. But no studies have been performed small holder dairy farmers in coastal region of Bangladesh. So, this study is helpful to create a complete scenario on direct or indirect impact of COVID-19 specially on the small holder dairy farmers of coastal region (Cox's-bazar), Bangladesh and expand the existing knowledge about the effects of the pandemic on dairy sector.

1.3 Objectives of The Study

- i. To find out socio-economic impact of COVID-19 on small holder dairy farmers of Cox's-bazar, Bangladesh.
- ii. To estimate the comparative profitability of dairy farm owners before and during COVID-19 pandemic period.
- iii. To identify the problems faced by dairy farmers during COVID-19 pandemic period.

CHAPTER 2

MATERIALS AND METHODS

2.1 Study Area Selection

This study was performed to find out impact of COVID-19 on small holder dairy farmers of Cox's-bazar, Bangladesh. The study was conducted in mainly three upazilas named Cox's-bazar Sadar, Ramu and Ukhia under Cox's-bazar district, Bangladesh which are indicated in the following maps,

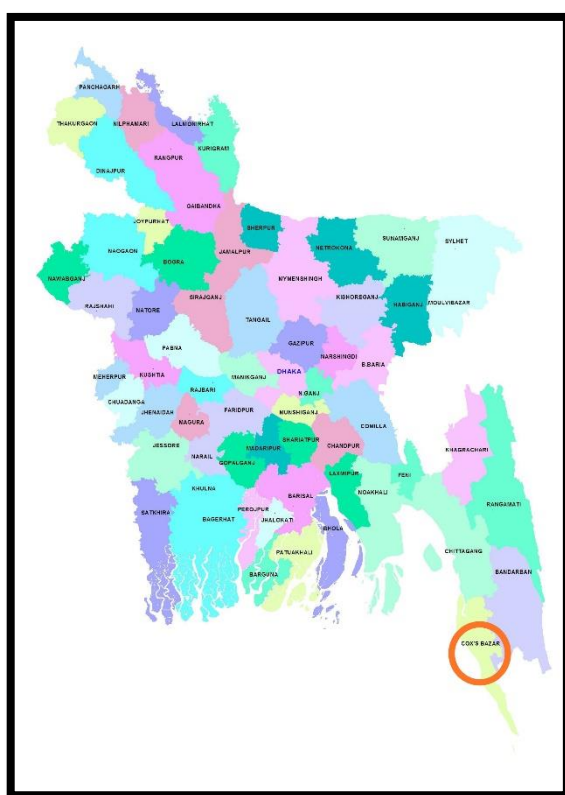


Fig :1 Map of Bangladesh

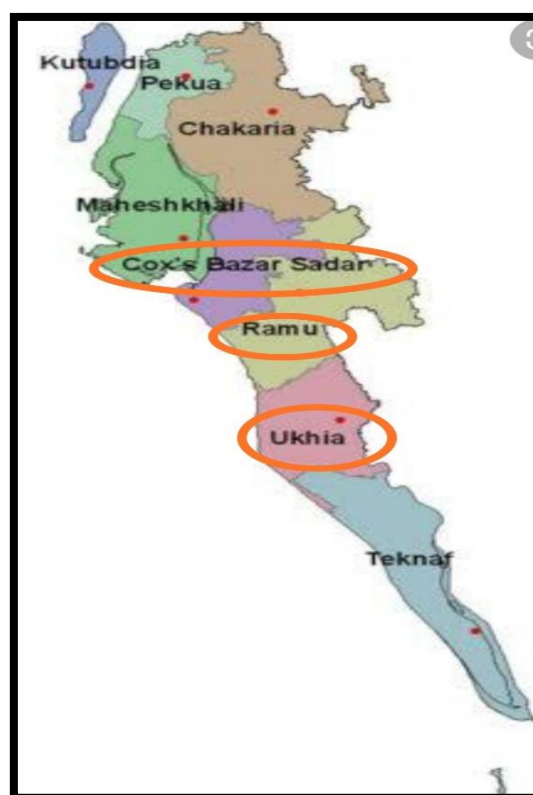


Fig: 2 Map of study area of Cox's-Bazar

Selection was done based on the following reasons:

1. Most of the dairy farms were located in this area.
2. Objectives of the study can be fulfilled from here because in this area dairy farmers faced more difficulty during COVID-19 situation in milk marketing, collection of feed, availability of milk and other managerial terms.
3. Communication facilities are good in these areas.

2.2 Sampling Procedure

2.2.1 Definition of the population

The first step of sampling procedure is to define the population, namely, the sector or element under investigation, the sampling unit, the area or extent of investigation, and the duration of investigation (Kinnear and Taylor, 1987). All the dairy farms located in Cox's-bazar district were classified as population of this study.

2.2.2 Sample Size

A suggestion of Casely and Kunnar (1988) was sample should have minimum sampling and standard error which can be obtained by unlimited resources. But sample size depends on some points like finance, time and data management (Poate and Daplyn, 1993). Here, a total of 31 dairy farms were selected randomly from Cox's-bazar district due to short study period where each dairy farm has at least 4 dairy cows.

2.3 Survey Schedule Preparation

A preliminary survey schedule was prepared for recording desired information along with confirmation of the objectives of the study. Then the survey was modified and rearranged on the basis of experience gathered in preliminary test. Through this survey the following information was collected:

1. Personal Information of the farmers
2. Land asset of the farmers
3. Livestock asset of the farmers

4. Housing, feeding, labor and treatment cost, deworming, Biosecurity, transport cost of the farms
5. Milk yield of the farms
6. Disease management procedure of the farms and
7. Major problems faced during COVID-19 period

2.4 Data Collection Period

The data were collected from 5th February 2021 to 9th May 2021 through an appropriate pre-designed questionnaire.

2.5 Data Collection

Data collection was performed by using prepared questionnaire arranged in very simple manner with explanation from selected dairy farm owners. Several information regarding personal information, livestock asset, feed cost, housing cost, treatment cost, labor cost and major problems faced during COVID period were collected from the farmers through direct interview and recorded in questionnaire.

2.6 Photo Gallery





Fig: 3 Collection of required information from different dairy farms

2.6 Analytical Process

After data collection, the questionnaires were checked for completeness, cleaned, organized, coded and then entered into MS-Excel and STATA (Stata 14, Stata Statistical Software, Stata Corporation, College Station, Texas 77845 USA) for analysis. Descriptive, statistical and econometric methods were used to achieve the objectives.

- Descriptive method was used to identify socio-economic characteristics of dairy farm owners.
- To determine profitability of per dairy cow production, the following algebraic equation was followed,

$$\begin{aligned} \text{Net return/ Profit } (\pi) &= \text{TR}-\text{TC} \\ &= \sum (Q_y P_y + Q_z P_z) - \sum P_{xi}.X_i - \text{TFC} \end{aligned}$$

Where,

TR and TC represent Total Return and Total Cost, respectively.

π = Profit/Net return from per dairy cow (Tk);

Qy= Total quantity of milk yield (litre)

Py= Per unit price of milk (Tk/litre);

Qz=Total unit of calf selling;

Pz=Per unit price of calf;

Xi= Quantity of the concerned ith inputs;

Pxi= Per unit price of the relevant ith inputs;

TFC= Total fixed cost involved in production;

i= 1,2, 3.... n (number of inputs).

Cost estimation:

a) Operating cost: Feed cost, Labor cost. Medicine and treatment cost, Electricity, gas etc. are included under operating cost.

b) **Interest on operating capital and Total Variable Cost:** The Bank interest rates (4%) were used to estimate the cost of capital which was provided by them and used as working capital.

Interest on operating capital= (Operating capital*0.04)/2

Total Variable Cost (TVC) =Operating capital + Interest on operating capital

c) **Fixed Cost:** Cost on poultry houses and equipment were included under fixed cost.

i. **Cost of Housing and Equipment:** The cost of housing was calculated by taking into account the depreciation cost of housing. Cost of equipment was expressed as equipment cost, which was calculated by taking into accounts the depreciation cost of equipment.

Depreciation cost on house and equipment was worked out as follows:

$$\text{Depreciation} = \left[\frac{\text{Original value} - \text{Salvage value}}{\text{Life of the house or equipment}} \right]$$

Return Estimation

i. Gross Margin=Total Return-Total Variable Cost=TR-TVC

ii. Benefit Cost Ratio (BCR) (Full cost basis) = Total Return / Total Cost= TR / TC

iii. BCR (Cash cost basis) = Total Return / Total Variable Cost=TR / TVC

- c) Paired t test was used to comparison the mean value of feed cost, milk price of per dairy cow and monthly income of dairy farm household before (2019) and after (2020) covid-19 effect.

Hypotheses:

The null hypothesis is:

H0: There is no difference in mean after and before covid-19 effect.

And the alternative hypothesis is:

H1: There is a difference in mean after and before covid-19 effect.

The test value t formula is with d.f. (n-1).

$$t = \frac{\bar{D} - \mu_D}{S_D / \sqrt{n}}$$

n= Sample size

\bar{D} =Differences of the values of the pairs of data

S_D =the standard deviation of the difference

The expected value μ_D is zero if the hypothesis is $\mu_D = 0$. The confidence interval of the difference in the paired mean difference.

- d) For measuring the **problem index** of the dairy farmers during COVID-19 situation, a 4-point Likert Scale was used. The scales were weighted in order of importance from; high=4, moderate=3, low=2 and very low=1. The respondents were asked to indicate problems in dairy farming. Ranking of different problems faced by dairy farmers, the frequency of responses from each of the four-point continuum of a specific activity under major activity was tabulated and multiplied by concerned score. Then they were added together to get the total score for each specific activity for the purpose of their ranking (Sailaja and Reddy, 2003).

Problem faced by each respondent was calculated by using the following formula,

$$\text{Problem Indices (PI)} = 4 \times H + 3 \times M + 2 \times L + 1 \times VL$$

Where, H= High, M=Moderate, L= Low, VL=Very low

CHAPTER 3

RESULT AND DISCUSSION

This section reports the impact of COVID-19 on the small holder dairy farmers of Cox's-bazar district.

3.1. Demographic & socio-economic status of the respondents:

The socio-economic characteristics of the farmers like age, marital status, education, family size, occupation, monthly family income, experience of farming, training on farming, source of credit etc. were presented in table 1.

Table 1: Socio economic characteristics of dairy farm owners

Parameter	Category	Frequency	Percentage	Mean	Std. dev.
Age (years)	Young age up to 30	8	26.00		
	Middle aged (30-40)	10	32.26	42	12.84
	Adult aged (41 and above)	13	41.94		
Marital status	Married	26	83.87		
	Unmarried	5	16.13		
Education	Primary	8	25.81		
	Secondary	9	29.03		
	Above SSC	14	45.16		
Occupation	Only Dairy Farming	17	54.84		
	Business + Dairy Farming	7	22.58		
	Service + Dairy Farming	6	19.35		
	Student + Dairy Farming	1	3.23		
Household size(no)	Small family (up to 5)	15	48.39		
	Medium family (6-8)	15	48.39	5.9	1.35

	Large family (>8)	1	3.23		
Monthly Family Income (BDT)	20000-50000	8	25.81		
	51000-100000	16	51.61	25719.35	
	Above 100000	7	22.58		
Experience(years)	Below 5 years	13	41.94		
	5-10 years	12	38.71	7.3	5.6
	Above 10 years	6	19.35		
Source of credit	Own	24	77.42		
	Own + Loan	4	12.90		
	Loan	3	9.68		
Training	Yes	10	32.26		
	No	21	67.74		

Source: Field survey, 2021.

From the above table it is seen that most of the farmers (42%) were adult (41 and above aged) and married (83.87%) and also completed their education above SSC level (45.16%). Meseret *et al.*, (2021) found that, most of the respondents were between the age of 31 and 50 years where 75% were male. Here. Most of the farmers depended on only dairy farming (54.84%) to maintain their medium type family (48.39%) with the income range 51000-100000 (51.61%). Most of the farmers had lower experience of faming (41.94%) and 77.42% farmers started their farms with their own money. Most of the farmers (67.74%) have no training experience about dairy farming. (**Table 1**).

3.2. Cost and return measurement per dairy cow per month in the study areas: In dairy farms production cost is consists of variable cost and fixed cost of the farms. The cost of various inputs such as feed cost (concentrate & roughage), labor cost, medicine & treatment cost, transportation, electricity, water cost and interest on operating cost are considered as variable cost. Fixed cost includes depreciation cost of house and equipment, (Alam *et al.*, 2020).

In this section return of the farms at per dairy cow per month level was measured. Cost and Return were compared between before COVID-19 and during COVID-19 period.

Table 2: Cost and return of per dairy cow per month in the study areas

Cost and Return		Before COVID-19 (2019)		During COVID-19 (2020)	
		Amount (Tk)	Percentages	Amount (Tk)	Percentages
Cost Items					
Feed Cost	Roughages	3325.41	23.62	4605.65	29.17
	Concentrate	4027.67	28.61	4278.51	27.10
Labor		2410.37	17.12	2427.88	15.38
Medicine and Treatment		476.80	3.39	546.43	3.46
Electricity, Transportation and Others		804.18	5.71	863.25	5.47
Operating Capital		11044.43		12721.71	
Int. on Operating Capital		220.89		254.43	
Total Variable Cost (TVC)		11265.32	80.03	12976.15	82.19
Depreciation of House		1575.50		1575.50	
Depreciation of Equipment		1235.83		1235.83	
Total Fixed Cost (TFC)		2811.33	19.97	2811.33	17.81
Total Cost (TVC+TFC)		14076.65	100.00	15787.48	100.00
Total Return Item					
From Milk Selling		22748.43	100.00	9937.442	100.00
Total Return		22748.43	100.00	9937.442	100.00

Source: Field survey, 2021.

From the table 2, it is observed that most of the cost of the farms of the study area were involved in feed cost specially cost of concentrate which was 28.61% of the total cost. The percentage of other cost of the farms were cost of roughage (23.62%), labor cost (17.12%), medicine & treatment cost (3.39%), electricity, transportation and others (5.71%) of the total cost before COVID-19 pandemic. But all those costs increased during pandemic situation due to outbreak of COVID-19 and where cost of concentrate (27.10%), cost of roughage (29.17%), labor cost (15.38%), medicine & treatment cost (3.46%), electricity, transportation and other cost (5.47%) of the total cost were observed. Total cost per cow per month was Tk 14076.65 before COVID-19 which increased into Tk 15787.48 due to COVID-19. But most destructive change was found in case of farm return due to increase unsold milk along with lesser milk price. and return per cow per month was Tk 22748.43 before COVID-19 which decreased into Tk 9937.44 during COVID-19, (Table 2).

After declaration of lockdown system, transportation was banned which caused shortage of animal feed supply, labor supply and limitation of veterinary services. Besides this, dairy food outlets, restaurants and all types of social and cultural programs closed due to lockdown for which decreased the market demand of milk, egg and meat. Additionally, various unverified social network circulated that, SARS-CoV-2 could transmit via domestic animals to human which was also responsible for reduction of demand for dairy products. (Dhaka tribune, 2020). From some previous studies it was known that, SARS-CoV-2 can replicate in dog, chickens and ducks poorly where cats, ferrets, mink, cattle and sheep are permissive to infection. (Enserink and Kupferschmidt, 2020; Manes *et al.*, 2020; Oreshkova, 2020; Molenaar, 2020; Schlottau, 2020; Gaudreault, 2020; Teodoro, 2020; Shi, 2020). All these uncertain situations discouraged farmers to continue farming which decreased livestock production as well as profit of the farms.

COVID-19 pandemic also affected the supply chain. Due to absence of transportation facilities farmers hampered to distribute farms' products which caused deterioration of farms' products and severe price down at producer level. But in case of milk marketing, the problem was found at very early on this situation because milk is perishable item. It was also revealed from some reports that, farmers threw their milk on the street as a sign of protest because there was no alternative way to sell milk. Bangladesh dairy Farmers' association claimed that, about 12-15 million liters milk remained unsold which caused an estimated daily loss of 570 million Bangladeshi Taka (BDT) (6.7 million USD) (The Financial Express, 2020).

Similar findings were found specially in milk price reduction. In this case, it was found that, for cows' milk price got a Rs. 16 to 25 per liter which was almost Rs.10/liter lesser than regular price, which ultimately decrease net return of farms, (Popat *et al.*, 2020).

3.3 Profitability of the dairy farm owners

It is very important to check the profitability of a farm to determine the farm progress level. In this section monthly profitability of per dairy cow in the study area were calculated at two periods such as before COVID-19 and during COVID-19.

Table: 3 Monthly profitability of per dairy cow in the study areas

Part	Before covid-19 effect (2019)	During covid-19 effect (2020)
(A) Total Return (Tk)	22748.43	9937.442
(B) Total cost (Tk)	14076.65	15787.48
(C) Cash Cost (Tk)	11265.32	12976.15
(D) Net Return (Tk)(A-B)	8671.78	-5850.04
(E) Gross Margin (Tk) (A-C)	11483.43	-3038.71
(F) BCR (Cash cost basis, A/C)	2.01	0.77
(G) BCR (Full cost basis. A/B)	1.62	0.63

Source: Field survey

In table 3, it is seen that, net return and gross margin of per dairy cow per month before covid-19 effect were Tk 8671.78 and Tk 11483.43, respectively which was found as loss (Tk 5850.04 and 3038.71), during COVID-19. On the contrary, total cost and cash cost increased from (Tk 14076.65 to 15787.48) and (Tk 11265.32 to 12976.15) than before, respectively. During COVID-19 net loss per dairy cow per month was Tk 5850.04. **(Table 3)**

Benefit Cost Analysis (BCR):

BCR were 2.01 and 1.62 which indicated that if a dairy farm owner invested Tk 1, he would get return of Tk 2.01 and 1.62, for cash cost basis and full cost basis, respectively before COVID-19 period. On the other hand, during COVID-19 period, BCR were 0.77 and 0.63 which meant that, if a dairy farm owner invested Tk 1, he would loss Tk 0.23 and Tk. 0.37 for cash cost basis and full cost basis, respectively due to negative impact of COVID-19. **(Table 3)**

Since the selling of milk is the major source of dairy farm income in Bangladesh and dairy farms all over the world (Uddin *et al.*, 2010; Hemme *et al.*, 2014), decreasing

milk yield per day per cow causes an immediate decrease in farm turn-over. This has a direct effect on the profit and loss account to reduce the farm income. Farm income is reduced due to increased farm inputs and decreased farm output. Translating the change in economic loss for the dairy farmers in Bangladesh due to higher cost, lower milk price, and higher feed price, the changes in the farm income are used as an indicator before and during COVID-19 pandemic for household and family farms.

Uddin *et al.* (2020) found that, cash costs increased due to Corona by 4% (from 58 to 62 percent).

3.4 Paired T Test: In this section paired t test is performed to compare the different aspects of the farm such as feed cost , milk price & per cow monthly income between the period before COVID-19 and during COVID-19 period.

Table 4: Paired Sample Test

Variable pair	Mean	Std. Error	Std. deviation	95% Confidence Intervals		T	d.f.	Sig (2-tailed)
				Lower	Upper			
Feed cost'20- Feed cost'19	1531.08	208.48	1160.76	1105.30	1956.84	7.34	30	0.0001
Milk price' 20- Milk price' 20	-12810.99	967.89	5389.04	- 14787.71	- 10834.28	-13.24	30	0.0001
Per cow Monthly income'20- Per cow Monthly income'19	-12810.99	967.89	5389.04	-14787.71	- 10834.28	-13.24	30	0.0001

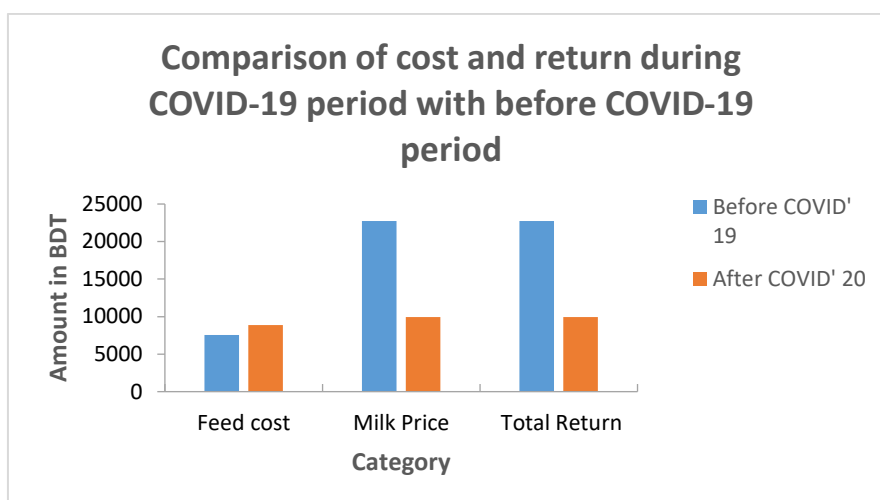


Figure 4: Comparison of cost and return during COVID-19 period with before COVID-19 period.

In table 4 and graph 1 show that there is a significant difference in feed cost, milk price as well as monthly household income between before COVID-19 periods and during COVID-19 period. The average feed cost increases Tk 1531.08 during covid-19 which was statistically significant ($p < 0.0001$) (**Table 4**). Feed cost was increased during COVID-19 due to movement restriction imposed by govt. to control COVID-19 infections. As people could not move, feed delivery became quite impossible. That's why feed transportation cost was increased which eventually increased feed supply cost as well as feed cost, (Rahman and Das, 2021). In some cases, feeds which are imported from abroad were not available as import from abroad was not possible then for restriction to pass border. It was also known that, as a result of failure to sell milk, many small and marginal farmers faced troubles to buy feed for their cows. Similar findings also found in India, where it was told that, farmers were facing more problem in getting cattle feed than fodder. This was mainly because the cattle feed industry had shut down their production temporarily due to irregular supply of raw materials, labor shortage and transportation issues. Hence, Feed supply decreased and feed cost increased in different parts of India, (Bhandari and Ravishankar, 2020).

Since the milk price is external and beyond the farmer's intervention, it is rather important to focus on decreasing the cost of milk production which in turn increases the profit margin (Hemme *et al.*, 2014). Corona as an effect on the decreasing milk yield,

increasing feed price (Table 2) and increasing amount of unsold milk, reduce the return of farm than before.

From table 4 it is also seen that there was a huge difference in milk price as well as total return of the farm between before COVID-19 periods and During COVID-19 period and the difference was Tk 12810.99. It was also statistically significant ($P < 0.0001$). Similar findings also reported in Ethiopia where it was found that 64% of the dairy farmers reported that milk volume sale to processors and local market had decreased. The surplus milk was being used for home consumption by majority of dairy producers (74%), (Meseret *et al.*, 2021). It is also reported by Uddin *et al.*, (2020) that, 8.9% milk yield was decreased during COVID-19 pandemic compared to before.

CHAPTER 4

PROBLEMS and LIMITATIONS

4.1 Major Constraints Faced by Farmers During Covid 19 Situation: In this section major problems faced by the farmers during COVID-19 situation are discussed in two different ways. At first, percentages of farms which faced each problem in different level is shown. Then, the problems are brought into different rank at the basis of problem indices. (Table 5)

Table 5. Problems faced by dairy farmers during COVID-19 situation

Problems	Extent of Problem				Problem indices	Rank
	Very low	Low	Moderate	High		
Economic constraint of the farmer	6 (19.35)	3 (9.68)	10 (32.26)	12 (38.71)	90	6
Shortage of space for housing and rearing	22 (70.97)	2 (6.45)	3 (9.68)	4 (12.90)	51	10
Insufficient pasture land	20 (64.52)	5 (16.13)	3 (9.68)	3 (9.68)	51	10
Unavailability of green fodder at the surrounding region	4 (12.90)	2 (6.45)	3 (9.68)	22 (70.97)	105	4
High cost of concentrate feeds	2 (6.45)	3 (9.68)	6 (19.35)	20 (64.52)	106	3
Management problem	9 (29.03)	3 (9.68)	4 (12.90)	15 (48.39)	87	7
Insufficient/Inadequate veterinary services	15 (48.39)	4 (12.90)	3 (9.68)	9 (29.03)	68	8
Fall down of production	22 (70.97)	5 (16.13)	2 (6.45)	2 (6.45)	46	11
Decline in the consumption of milk,	5 (16.13)	3 (9.68)	2 (6.45)	21 (67.74)	101	5

dairy products and
meat

Constraints on marketing of the products	1 (3.23)	3 (9.68)	7 (22.58)	20 (64.52)	108	2
High disease prevalence	(18 (58.06)	7 (22.58)	2 (6.45)	4 (12.90)	54	9
Milk price fall due to COVID-19	1 (3.23)	2 (6.45)	8 (25.81)	20 (64.52)	109	1

Source: Field survey, 2021.

Table 4 and figure 5 show ranking of different problems faced by dairy farm owners of Cox's-Bazar district during COVID-19 period are specified on the basis of problem indices (PI). In ranking, milk price fall down due to COVID-19 was found in 1st position which meant that, maximum respondents (64.52%) said that, milk price reduced highly due to COVID-19.

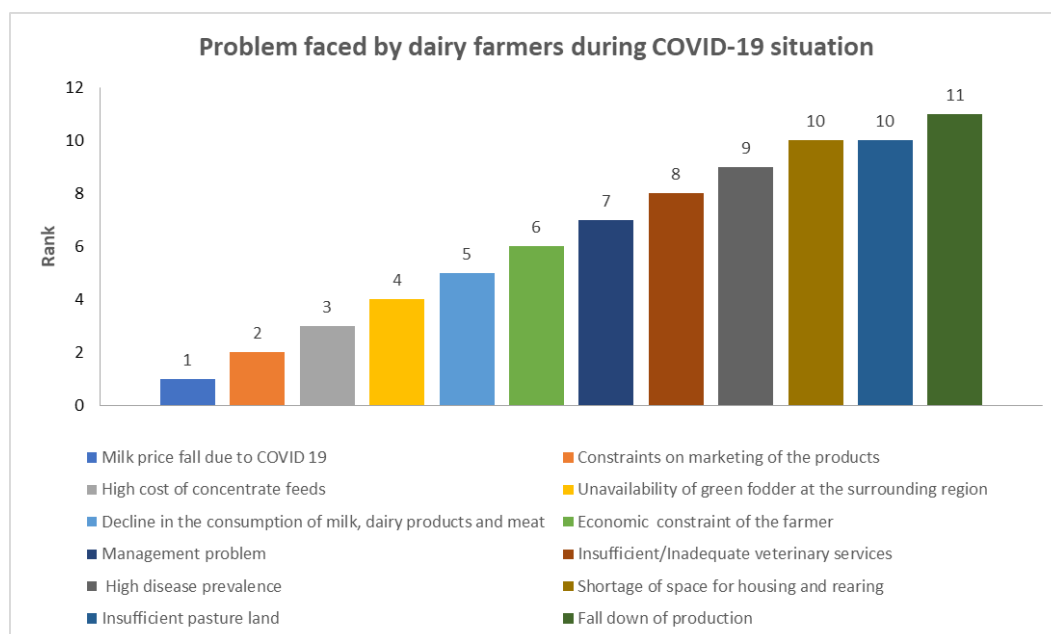


Figure 5: Problems faced by farmers during COVID-19

As dairy farm owners could not reach to consumers level to sell milk due to lockdown system, amount of unsold milk increased during COVID-19 period. Hence, milk price of per cow per month decreased highly in maximum farms of study area. In 2nd position, constraints on marketing of products were ranked which indicated that maximum number of farms (64.52%) were faced marketing problem highly due to movement restriction imposed by govt. High cost of concentrate feed was in 3rd position in ranking where 64.52% farm owners faced this problem highly. This problem was faced highly because feed industry was closed which created unavailability of concentrate feed during COVID-19 period. Unavailability of green fodder was in 5th rank where 70.97% respondents faced it highly. The problem which was in 6th position, is economic constraints of the farmers which was for reduction of milk price. In 7th position, managerial problems which was faced by 48.39% farm owner highly during COVID-19 period. Insufficient veterinary services were found in 8th position which was faced by 29.03% farm owners. It also caused for movement restriction during COVID-19 period. 12.90% farm owners faced high disease prevalence which was in 9th position in ranking. Shortage of space for housing and rearing and insufficient pasture land were in 10th position. Finally, in 11th position fall down of production was seen which was faced by smaller number of farms (6.45%).

To overcome these problems government should allocate needy farmers properly and provide subsidies along with relaxed agricultural loans for adapting within a short time. If government and non-government organizations along with academic institutions and industries could come in collaboration to check this situation, it would be a great support for the exaggerated farmers to minimize the situation. However, there were zoonotic emerging and reemerging diseases of humans which had direct threat to animal health. That's why veterinary service is considered distinctive internationally to ensure global health security. Hence, recognition of veterinary services as an emergency service is also important in Bangladesh. By creating proper network among stakeholders and rapid sharing of information as well as use of other agricultural technologies and cost-effective farm management could overcome the impacts of any future disasters like COVID-19. Finally, government could introduce evidence-based

strategies and implement dairy and livestock development projects to build sustainable capacity which could cover the emerging needs of the future.

LIMITATIONS

Though the study was done carefully, there were some limitations. The limitations are given below:

1. The study was conducted in a short period of time.
2. There was a small amount of fund which created limitation in this study.
3. The study was limited to particular district whose result can't reflect the situation of whole country.
4. Some farms didn't maintain recoding system which made difficulties to collect valid data.
5. In case of some farm's transportation facilities were not well which made difficulties to collect data.
6. Some farmers were not cooperative to share information of the farms.
7. Some farmers didn't allow to farms due to COVID-19 infection.
8. Movement restrictions measure taken by government was another barrier to collect more data from more farms.

CHAPTER 5

CONCLUSION

The study found that, the major impacts of COVID-19 on the small-scale dairy farms were in four major areas. Firstly, the pandemic significantly increased the price of feed which reduced feed supply. Cost of concentrate feed increased and milk price decreased during COVID-19 period than before COVID-19 period which reduced per cow monthly income. Secondly the pandemic situation caused a smaller number of labor supply and increased labor cost. Thirdly, the COVID-19 situation increased medicine, treatment especially transportation cost due to movement restriction imposed by government to control the prevalence of COVID-19. Finally, the COVID-19 had negative impact on the return of the farms due to increased amount of unsold milk. Average difference of per cow monthly income between during COVID-19 period and before COVID-19 period was Tk 12810.99 and it was statistically significant.

During COVID-19 period, dairy farm owners of coastal region (Cox's-bazar) faced some major constraints. Milk price fall down due to COVID-19, Constraints on marketing of products and high cost of concentrate feed with unavailability of green fodder were the most prominent problems faced by the farmers. These problems were created especially for lockdown system imposed by govt. to control COVID-19 infection. Though some measurements were taken by govt. to mitigate the problems, it was quite tough for farmers to fulfill their loss by the subsidy given by the govt. As a fruitful mechanism, collaboration of government, non-governmental organizations, farmers association and cooperative are necessary to mitigate the negative effects of the pandemic on this sector.

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APPENDIX

QUESTIONNAIRE

Impact of COVID-19 on Small-Scale Dairy Farmers at Southern Region of Chattogram

1. Identity:

Name		Cell no.	
Age		Education	
Village		Family size	
Union		Occupation	
Upazila & District		Income/ Month (Approx.)	
Personnel		Experience of farming	

2. Land Ownership Information (Decimal)

Own land for farming		Leased in for farming		Grazing field/ Pasture	
Rented in		Leased out		Cultivation Land	
Rented out		Household size		Ponds	

3. Livestock Assets

Livestock	No (2020/21)		Purchase price/unit (BDT)	Selling price/unit (BDT)
	Before COVID	After COVID		
Dairy cows				
Local breeds				
Cross Breeds				
X HF				

X Sahiwal				
X Red Sindhi				
Dry cows				
Pregnant cows				
Heifer(s)				
Bull/ox				
Calf				

4. Daily Milk Yield/Production

Date or Month	Morning	Afternoon	Total
Grand Total			

5. Husbandry practices

A. Housing

Placements	a) South facing	b) North facing	c) East facing	d) West facing
Design	a) Face in	b) Face out	a) Single Row	b) Double Row
	a) Shed type	b) Gable type	c) Half Brick type	d) Combination
Floor	a) Earthen (Mud)	b) Brick	c) Cemented	
Bedding	a) Rubber Pad	b) Jute bag	c) Straw	d) Dry leaves
Roof	a) Wood/Bamboo	b) Tin	c) Building	d) Traditional Thatch
Rearing system	a) Free range	b) Intensive	c) Semi-intensive	
Breeding	AI/ Bull			

B. Feeding History:

Collection of feed	Storage of feed	Types of feed		Frequency of feed supply/day
		Roughages	Concentrates	
		Silage: Straw: Napier: Napier (Hybrid): Para: German: Maize Grass: Road-side Grass: Kaun Grass:	Maize: Rice husk: Wheat bran: Mustard cake: Til oil cake: Protein Concentrate: Gram's husk: Soyabean Meal:	

C. Water supply:

Water source	Water storage (If any)	Frequency of water supply/day
Deep Tube-well/ Pond/ Marine	Tank/ Bucket/ Drum	Adlibitum/ Number (.....)/ Infrequent

D. Other husbandry practices:

- Ventilation: Sufficient/ Insufficient
- Foot bath used: Yes/No
- Other Biosecurity Management:
- Drainage facility: Sufficient/ Insufficient
- Electric fan used: Yes/No (Numbers:)

E. Common Diseases faced

LSD/ FMD/ BVD/ Bacterial Diarrhea/ BQ/ HS/ Mastitis/ Myiasis/ Hump sore/
Pneumonia

- Management of disease condition: Self-management/ Quack/ Veterinary doctor (Phone/Visit)
- Frequency of calling Veterinary Doctor: Actively/ Occasionally/ Critical Situation/ Not at all
- Vaccination History: FMD/ BQ/ HS/ Rabies/ Tetanus/ Pox
- Anthelmintic History: Yes/ No (If Boostering: 6 months/ 1 year)

6. Major Constraints faced by farmers during COVID-19 situation (Grading: 1. Very Low, 2. Low, 3. Moderate, 4. High)

No.	Traits	4	3	2	1
a.	Economic constraint of the farmer				
b.	Shortage of space for housing and rearing				
c.	Insufficient pasture land				

d.	Unavailability of green fodder at the surrounding region				
e.	High cost of concentrate feeding				
f.	Management problem (Lack of personnel, Door to door medication service, Vaccination, Deworming problem)				
g.	Insufficient/ Inadequate Veterinary services				
h.	Fall down of production				
i.	Decline the consumption of milk, dairy products and meat				
j.	Constraint on marketing of the products				
k.	High disease prevalence				

7. Farm Costing:

Category	Tk/ Week	Tk/ Month (2019 and 2020)	Tk/ Annum (2019 and 2020)
Roughage			
Concentrate			
Medication			

8. Gross Income:

Category	From milk	From heifer	From culled cow	From ox	From calf	From cow dung
Monthly income in 2019						
Monthly income in 2020						

.....

(Signature and date)

Name of the interviewer

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Author, November 2021

BIOGRAPHY

Homaira Pervin Heema, Daughter of Shamsul Alam and Mostofa Begum, was born on 1st July, 1997. She passed her Secondary School Certificate Examination from Kutubdia Model High School, Chattogram in 2012 (GPA 5.00). Then she passed her Higher Secondary School certificate examination from Chattogram college, Chattogram in 2014 (GPA 5.00). Now she is completing her one-year long internship program for fulfilling the requirement of Doctor of Veterinary Medicine (DVM) degree in Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh. During her internship period she received her clinical training on Veterinary Medicine from UVH Sadar Cox's bazar, SAQTVH, CVASU, Teaching & training Pet Hospital and research Center (TTPHRC), CVASU, CVH, FV & FC, Dhaka, Chattogram and Dhaka Zoo and managerial training from Chattogram based farm and Chattogram based Pharmacy etc.

Her primary research interest is in wild animal parasites specially parasites of captive animals. But she feels much interest to work on coccidiosis of different animals. She also feels immense interest to explore new techniques to contribute in development of veterinary field in Bangladesh.