Impact of COVID-19 on Dairy Farming Sector of Noakhali, Bangladesh.

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Session 2015-2016

The report submitted in the partial fulfillment of the requirements for the Degree of Doctor of Veterinary Medicine (DVM)

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Abstract

The COVID-19 has affected the livestock sector very badly. It has created many negative impact on dairy farming sector of Bangladesh. This study was performed at Noakhali sadar upazilla aiming to identify the impacts of COVID-19 pandemic on the commercial dairy farming. To satisfy the intention 60 dairy farms of the upazila were selected for the study. It reveals that the farmers were experienced so many difficulties and farms were in underperforming condition and undergo minimum to maximum losses. Among all the 60 farms 73% farms were running throughout the study time, 13% farms were temporarily closed and 13% farms were permanently closed. 83% farms experienced lack of demand of their farm products (milk) in the market which leads them to sell their products in a loss price. It also leads them to waste a certain amount of milk daily which was 38.1 L/day in active farms and 51.43 L/day in temporarily closed farms. To compensate the ongoing loss many farmers had to sell their animals in a decrement price. Most of the farms experienced an increased cost of feed. The feed cost increased almost 29% and 3.24% during lockdown and after lockdown, respectively. The other costs also increased in the same way as there was lack of supply, lack of transport and labor. Farms also mentioned about the decreasing number of animals at farms as they had to sell animals to reduce the farm cost. During corona lockdown the daily farm activities and monitoring were hampered which made animals weak and prone to many diseases. Animals at certain number of farms developed mastitis, LSD, FMD, pneumonia during the pandemic due to poor management. For almost all the farms the COVID-19 was a curse that hampers the economic stability of most of the farmers and badly disrupt the dairy farm management.

Keywords: COVID-19, Dairy farm, Pandemic, Farmers, Production, Economic loss.

Chapter I

Introduction

COVID-19 Pandemic is the ongoing Global pandemic which is one of the deadliest pandemics in history. COVID-19 is an infectious disease caused by SARS-COV 2 virus. People infected with the virus experience mild to severe respiratory illness which includes severe pneumonia. Older people and people having comorbidity like high blood pressure, cardiovascular disease, diabetes, chronic respiratory disease, cancer are more likely to develop severe illness which can leads to death.

The first case was identified in Wuhan, China in December 2019.The province failed to stop the virus from spreading to the other parts of China and then the virus spread around the world. World Health Organization (WHO) declared a public health emergency of international concern on 30 January 2020. It was declared global pandemic on 11th March 2020. Till October 2021, more than 244 million cases are recorded and 4.9 million deaths have been confirmed (WHO Coronavirus (COVID-19) Dashboard, 2021), (Dong, Du and Gardner, 2020).

Like other countries corona virus affects Bangladesh as well. The first case was identified on 8 March, 2020. Till October total 1.57 million cases have been recorded and 27823 deaths have been confirmed. For safety measures Gov't of Bangladesh imposed a lot of restrictions on the movement of people and gave strict lockdown all over the country (IEDCR, 2021).

That lockdown affected all the aspect of life and livelihood. It caused many negative impact to the life of people. Each and every sector was affected more or less by it. Among all the sector livestock sector was affected badly.

In Bangladesh total Livestock population is 4221.80 lakh. The total cattle population is 245.45 lakh. Contribution of livestock sector in total GDP is 1.4%. It also contributes 13.10 % into total Agriculture GDP. This sub sector generates 20% of direct employment and

50% partly which plays an important role in the national economy of Bangladesh (DLS-livestock economy, 2021).

More than 70 % of rural household are engaged in livestock that contributes a greater share to livelihood of smallholders and landless household.

Dairy farming sector is one of the major sub sector of the livestock sector. At Noakhali sadar upazila the dairy farming sector was extending day by day. More than 300 farms were registered in Noakhali sadar. As COVID-19 affected badly the livestock sector it also affected the dairy farming sector of Noakhali sadar upazila. The main product of dairy farm is milk which is highly perishable substance and have a short shelf life. The marketing chain of milk was disrupted due to the lockdown so it was difficult to sell milk as well as milk products. So that demand of milk and milk products deceased during lockdown. On the other hand due to lockdown the transportation was banned so the feed supply chain became discontinued. It results in increased feed, transportation, labor and other maintenance cost. At that time most of the farms were facing continuous loss at moderate to severe level.

This study was conducted to identify the impacts of COVID-19 at dairy farming sector of Noakhali, Bangladesh. Following objectives were considered for the study,

- To identify the changes and the losses experienced by the farmers during COVID19
- To get an idea about the impact of COVID 19 on commercial dairy farming.
- To evaluate the pre COVID and post COVID scenario of the commercial dairy farming.

Chapter II

Materials and Method

2.1 Study area: This study was conducted about the impact of COVID-19 at dairy farming sector of Noakhali, Bangladesh. The study area was commercial dairy farms of sadar upazila.

2.2 Study period: The whole study period was divided into three time period for the better analysis of the study. Those were before COVID-19 (December 19- February 20), during COVID-19 lockdown (March 20 - October 20) and after COVID-19 lockdown (November 20 to….). It helped to make a comparative analysis between before and after pandemic situation on the impacts of corona at the farms.

2.3 Data collection: For the study a questionnaire was developed to collect the data from farmers about how they run their farms before Corona pandemic and at the time of corona pandemic. The data was collected by visiting the farms and by telephone interview with manager or owner of the farm.

2.4 Data analysis: After collecting the data the farms were classified into large, medium and small scale according to the number of dairy cows they had for the easy analysis. Then the data was put into Microsoft excel and further analyses were done. (Figure 1)

Figure 1: Data collection from the farms.

Chapter III

Results

3.1 Status of the farms

Among the selected farms 44 (73%) farms were open till now, 8 (13%) farms were temporarily closed during COVID-19 lockdown period, and 8 (13%) farms were permanently closed due to COVID-19. (Table 1)

Table 1: Status of the farms with the percentage during COVID-19 Pandemic.

Status of the farms	**No. of farms.**	**Percentage**
Has been active since before COVID -19 pandemic started till now	44	73%
Closed permanently since COVID-19 pandemic started	8	13%
Temporarily closed due to COVID-19 pandemic but active now.	8	13%

3.2 Reasons that were responsible for closing farms

Those were the same reasons for why some farmers had to close their farms temporarily or permanently. Among 60 selected farms 30% (18) farms experienced difficulty to continue their labors salary, 3% (2) farms had lack of available labor due to lockdown, 65% (39) farms were almost unable to bear the cost of feed, 5% (3) farms had excess no. of sick or dead animals, 83% (50) farms experienced lack of demand of the products at market and 2% (1) farm mention about the anxiety of getting affected by Corona Virus. (Table 2).

Table 2: Reasons mentioned by the No. of farms with percentage that makes the farms difficult to run or to close the farms permanently or temporarily

Reasons mentioned by the farmers.	No. of active farms			No. of temporarily closed farms	No. of permanently closed farms	Total No. of farms	%
	Large scale Farms:	Medium scale farms:	Small scale farms:				
Inability to continue the labors salary	0	1	7	6	4	18	30 %
Lack of availability of labor due to lockdown	0	0	1	1	0	2	3 %
Inability to continue the cost of feed	3	7	13	8	8	39	65 %
Excessive sickness/death of animals	0	0	2	0	1	3	5 %
Lack of demand of the products in the market	4	13	18	8	7	50	83 %
Due to anxiety of getting affected by Corona Virus	0	0	1	0	0	1	2 %

3.3 Categories of the farms

Among the 44 farms that were open during the lockdown period were divided into 3 categories in which 11% (5) were large scale farms (having >20 dairy cows), 36% (16) were medium scale farms (10 to 19 dairy cows), 52% (23) were small scale farmers (having <10 dairy cow), (Table 3).

Table 3: Categories of the farms according to the No. of dairy cows they had.

Types of farms.	No. of dairy cow	No. of farms	Percentage
Large scale Farms:	20 or more than 20 dairy cow	5	11%
Medium scale Farms:	10-19 dairy cows	16	36%
Small scale farms:	less than 10 dairy cows	23	52%

3.4 Recurrent expenditure of the active farms

All the three categories of farms experienced many changes in their recurrent cost throughout the period of COVID-19 pandemic. Among 44 active farms the average cost of per kg feed before COVID-19 was 30, 31 and 30 taka (BDT) in case of large, medium and small scale farms, respectively. But during COVID-19 lockdown the price increased to 40.2, 39.5, and 37.8 taka (BDT) in case of large, medium and small scale farms, respectively. After COVID-19 lockdown the price further increased into 43.4, 39.125 and 38.78 taka (BDT) in case of large, medium and small scale farms, respectively. Average cost of medicine was 16200, 13031, 7578 taka before COVID-19 , during lockdown it was 60000, 18781, 16000 taka and after lockdown it was 18400, 20438 and 9391 taka (BDT) at large, medium and small scale farms, respectively. Average labor cost (taka/month) at large, medium and small scale farms was 36600, 35000, 15385 taka (BDT) before pandemic, 36600, 25800, 12400 taka during lockdown and 36600, 28572, 12364 taka after lockdown. Average cost of electricity, water (taka/month) was 6625,4833,2258 taka (BDT) before pandemic, 7175, 5750, 2300 taka (BDT) during lockdown and 6875, 5716, 4508 taka (BDT) after lockdown.(Table 4)

Table 4: Overview of recurrent cost of active farms throughout the COVID-19 pandemic.

Parameters	Before COVID-19(December 19- February 20)			During COVID-19 lockdown (March 20 - October 20)			After COVID-19 lockdown (November 20 to….)		
	Large scale farms	Medium scale farms	Small scale farms	Large scale farms	Medium scale farms	Small scale farms	Large scale farms	Medium scale farms	Small scale farms
Average cost of feed (Taka/ kg)	30	31	30	40.2	39.5	37.8	43.4	39.125	38.78
Average cost of medicine (Taka/month)	16,200	13,031	7,578	60000	18781	16000	18400	20438	9391
Average fees of the employees (Taka/month)	36600	35000	15385	36600	25800	12400	36600	28572	12364
Average cost of electricity, water (Taka/month)	6625	4833	2258	7175	5750	2300	6875	5716	4508

Therefore among all 44 active farms the average Cost of feed was increased up to 29% during COVID lockdown situation then the pre COVID period. After lockdown it was 40.4 taka/kg which results further 3.24% increase in price per kg of feed. Similarly the monthly medicine cost was 12269.8 taka before the pandemic started, 31593.7 taka during lockdown which results 157% increased treatment cost compares to pre COVID period and currently it comes down to 49.12% lower cost than the lockdown period. The monthly labor cost, electricity and water cost was 28994.9 taka and 4572.0 taka, respectively before starting of pandemic which was then 24933.3 taka and 5075 taka, respectively during the lockdown period. The labor cost was decreased by 14% and the electricity cost was increased by 11% during the lockdown and after withdrawal of lockdown it was 25845.3 taka and 5699.7 taka which was 3.66% and 12.31% increased compare to lockdown phase. (Table 5)

Table 5: Changes in the recurrent cost with the percentages.

Parameter	**Before COVID-19(December 19-February 20)**	**During COVID - 19 lockdown (March 20 - October 20)**	**Percent increased/ decreased in cost during lockdown**	**After COVID - 19 lockdown (November 20-)**	**Percent increased /decreased in cost after lockdown**
Average Cost of feed(Taka Per kg)	30.3	39.2	29% ⇧	40.4	3.24% ⇧
Cost of medicine (TK/ month)	12269.8	31593.7	157% ⇧	16076.3	49.12% ⇩
Labor cost (TK/ month)	28994.9	24933.3	14% ⇩	25845.3	3.66% ⇧
Electricity, water(TK / month)	4572.0	5075.0	11% ⇧	5699.7	12.31% ⇧

(⇧ Increased, ⇩Decreased)

3.5 Animal population overview

In total 44 active farms there were changes in the number of animals and data related to the animals throughout the study period.

Among 5 large scale farms the number of dairy cows were 28 at before COVID-19, 23 during lockdown phase which is 17.80% less than previous time and 21 at after lockdown phase which is 8.70% less compared to the lockdown phase.

In case of 16 medium scale farms the number of dairy cow average was 12 at before the starting of pandemic, 10 during the lockdown phase which is 16.6% decreased in number and 8 after the lockdown phase which also shown 16.6% decreased in number.

Similarly in 23 small scale farms the number of dairy cows during the pre pandemic phase was on average 6 which decreased into 5 during lockdown results 16.6% decreased in number of animals and further decreased into 4 at after lockdown. (Table 6)

Table 6: Changes in the number of dairy cows in large, medium and small scale farms at different period of COVID-19 pandemic

parameter	**Large scale Farms (N=5)**			**Medium scale Farms (N=16)**			**Small scale Farms (N=23)**		
Time period	Before covid-19	During COVID-19 lockdown	After COVID-19 lockdown	Before covid-19	During COVID-19 lockdown	After COVID-19 lockdown	Before covid-19	During COVID-19 lockdown	After COVID-19 lockdown
Number of dairy cows/ farm	28	23	21	12	10	8	6	5	4
Percent decreased in number of dairy cows	no	17.80%	8.70%		16.6%	16.6%		16.6%	16.6%

3.6 Health status, veterinary and vaccination facilities

Before COVID-19 pandemic among 44 farms adequate veterinary facilities were available at 5 large scale farms, 16 medium scale farms and at 20 small scale farms. During COVID-19 lockdown the facilities were limited to 4 large scale farms, 13 medium scale farms and 8 small scale farms, when the lockdown was over the all farms had the vet facilities. The proper vaccination status was found at all the farms at pre pandemic period. During lockdown the vaccination was done in 4, 12, 16 large, medium and small scale farms, respectively. After lockdown all the 44 farms maintain proper vaccination. (Table 7)

Table 7: Overview of health status, veterinary and vaccination facilities before pandemic, during and after lockdown

Parameter	**Large scale farms (N=5)**			**Medium scale Farms (N=16)**			**Small scale Farms (N=23)**		
Time period	Before covid-19	During lockdown	After lockdown	Before covid-19	During lockdown	After lockdown	Before covid-19	During lockdown	After lockdown
Increased Number of diseased animals in number of farms (n)	0	4	0	0	5	0	0	10	1
Adequate veterinary facilities available in Number of farms (n)	5	4	5	16	13	16	20	8	23
Adequate vaccination facilities available in number of farms. (n)	4	4	5	16	12	16	23	16	23

3.7 Farm income overview

Among all the 44 active farms there are many observed changes on data related to production and income throughout the study period. Before COVID-19 the income generating sources of the farms were milk in case of 75% farms, milk+ biogas in 11.36% farms, milk+ cow dung in 11.36% farms, milk+ cow dung+ gas in 2.27% farms. During COVID-19 lockdown the sources were milk, milk+ biogas, milk+ cow dung, milk+ animals, milk+ animals+ biogas was 56.8%, 6.81%, 4.5%, 29.5%, 2.27% of farms, respectively. After lockdown the ways were milk, milk+ biogas, milk+ cow dung, milk+ animals, biogas was 59%, 4.5%, 6.81%, 25%, 4.5% of farms, respectively. (Table 8)

Table 8: Sources of income in active farms

	Before COVID-19	%	During COVID-19 lockdown	%	After COVID-19 lockdown	%
Income Source	Number of farms (n)					
Milk	33	75%	25	56.8%	26	59%
Milk+ Biogas	5	11.36%	3	6.81%	2	4.5%
Milk+ cow dung	5	11.36%	2	4.5%	3	6.81%
Milk+ cow dung+ Gas	1	2.27%				
Milk+ animals			13	29.5%	11	25%
Milk+ animals+ biogas			1	2.27%		
Biogas					2	4.5%
Total	**44**		**44**		**44**	

Average milk production at large scale farms was on average 138 liters, 142 liters and 113 liters at before COVID-19, during lockdown and after lockdown period, respectively. The milk production increased 3% during lockdown period compare to previous time and then decreased 20.4% after the lockdown period compared to before. Average selling price of milk before COVID pandemic was 63 taka (BDT) on average, during lockdown it was 35 taka on average and after the withdrawal of lockdown it was 56 taka on average. The price decreased 44% during lockdown andincreased60% compared to the lockdown situation. Among 16 medium scale farms before corona pandemic the average milk production was 103 liters, during COVID-19 lockdown it was 94 liters and after lockdown it was 70.13 liters. The production decreased 8.73% and 25.4% during lockdown and after lockdown, respectively. The average selling price of milk was 70, 41 and 62 taka at before COVID pandemic, during lockdown and after lockdown period, respectively. During lockdown the price was 41% decreased and after lockdown it was 51% increased than before.

Similarly among 23 small scale farms before COVID-19, during lockdown and after lockdown the average milk production was 49, 50 and 32.3 liters. During corona lockdown the production was 2% decreased than before and after lockdown it was again increased 35.4% compared to lockdown phase. At before COVID-19, during lockdown and after lockdown the selling price of milk was on average 59, 34 and 57 taka, respectively. The price decreased 42% during lockdown and further increased 64% after lockdown.. Average price of buying a new animal was on average 220000, 194615 and 145667 taka in large,

medium and small scale farms. But during COVID-19 lockdown period the selling price of one adult animal was on average 95000, 100000 and 149400 taka (BDT). And after lockdown it was on average 96670 taka in case of medium scale farms and 101250 taka (BDT) in small scale farms. (Table 9)

Table 9: Comparison of income in active farms before COVID-19 pandemic, during lockdown and after lockdown

		Average amount of milk produced(Liter)	**% changed in milk production**	**Average Selling price of milk(Per kg)**	**% change in price of milk**	**Average selling price of one adult animal (tk)**	**Average Cost of buying a new animal (tk)**
Large scale Farms:	Before covid-19	138		63		no	220000
Total 5	During lockdown	142	3% increased ⇧	35	44% decreased ⇩	95000	
	After lockdown	113	20.4% decreased ⇩	56	60% increased ⇧	no	
Medium scale Farms:	Before covid-19	103		70		no	194615
Total 16	During lockdown	94	8.73% decreased ⇩	41	41% decreased ⇩	100000	
	After lockdown	70.13	25.4% decreased ⇩	62	51% increased ⇧	96667	
Small scale farms:	Before covid-19	49		59		no	145667
Total 23	During lockdown	50	2% increased ⇧	34	42% decreased ⇩	149400	
	After lockdown	32.3	35.4% decreased ⇩	57	68% increased ⇧	101250	

(⇧ Increased, ⇩ Decreased)

3.8 Unsold milk

In total 44 active farms many farms had unsold milk during lockdown phase at small to large amount. Those were 15%, 20%, 50%, 60%, 70%, 80%, 100%, 10% and none at 5%, 5%, 7%, 23%, 2%, 7%, 9%, 34% and 9% farms, respectively. Average unsold milk including all the active farms was 38.1 L/day. (Table 10)

Table 10: Percentage of unsold milk in different numbers of farms during lockdown and average amount of unsold milk L/day in total.

Time	Amount of unsold milk (% of production)	Average	Unsold milk in number of farms (n)	Percentages
Before covid-19	**none**		**none**	
During COVI-19 lockdown	15%		2	5%
	20%		2	5%
	50%		3	7%
	60%		10	23%
	70%	40%	1	2%
	80%		3	7%
	100%		4	9%
	none		4	9%
	10%		15	34%
After COVID-19 lockdown	**none**		**none**	

Average milk production in total 44 farms	Average unsold milk/day	Average milk loss
95.3 L/ day	40% of production	38.1 L/ day

3.9 Average inactive period of the temporary closed farms

In case of 8 farms which were temporarily closed during the COVID-19 pandemic the farms were closed 154 days on average.

Name of farm	If the farm was temporarily closed, was it closed(Days)
Mohamadur Dairy Farm	120
ZohirulHaque Dairy Farm	90
Ms. Naim Dairy Farm	90
Sakib Agro Complex	240
Alauddin Dairy Farm	150
Shohag Dairy Farm	240
Monjura dairy farm	180
Shafik Dairy	120
Days closed on average	154

3.10 Changes in recurrent cost of temporarily closed farms

Several changes were observed at the recurrent cost of the farms throughout the study period. Before COVID-19 pandemic average Cost of feed was 35.5 taka/kg, during COVID-19 lockdown it was 45 taka/kg and after lockdown it was 44.375 taka/kg. The feed cost was increased 27.1% during lockdown period compared to pre pandemic situation and decreased to 1.38% after lockdown. Average Cost of buying new animals was 157500 before the corona pandemic. Cost of medicine was on average 12000, 26500 and 10875 at the prepandemic, lockdown and after lockdown phase, respectively. The cost increased 1.6% during lockdown and 59% decreased after lockdown. Average labor cost was 29500, 3000 and 7000 taka at before COVID-19, during lockdown and after lockdown phase, respectively. The labor cost decreased 90% during the lockdown stage and further increased 133% after lockdown compared to the previous phase. Average cost of electricity before corona pandemic was 2975 taka, during and after corona pandemic lockdown it was 2542.857 taka. Therefore the cost increased 14% during lockdown phase. Miscellaneous cost was 4000, 5000 and 4000 taka at the three time period, sequentially.

Table 11: Overview of changes is recurrent cost of temporarily closed farms throughout the study period

Parameters	Before COVID-19(December 19-February 20)	During COVID -19(March 20 - October 20)	After COVID -19(November 20-)
Average Cost of feed(Taka Per kg)	35.5	45	44.375
% change in feed cost		27.1% increased ⇧	1.38% decreased ⇩
Average Cost of buying new animals(Taka Per head)	157500	none	none
Cost of medicine(TK/ month)	12000	26500	10875
% change in medicine cost		1.6% increased ⇧	59% decreased ⇩
Average labor cost (TK/ month)	29500	3000	7000
% change in labor cost		90% decreased ⇩	133% increased ⇧
Average electricity, water (TK/ month)	2975	2542.857	2542.857
% change in electricity, water cost		14% decreased ⇩	same
Others (TK/ month)	4000	5000	4000

3.11 Changes of animal population in temporarily closed farms

Average number of dairy cows per farm was 22 before covid-19, 15 during lockdown, and 6.875 after lockdown. Number of diseased or sick animals increased at 7 farms during corona pandemic lockdown. Adequate veterinary facilities available in all 8 farms before and after pandemic. But in lockdown it was available at 7 farms. Adequate vaccination facilities were available before, during and after lockdown at 6, 2 and 6 farms, respectively.

Table 12: Overview of farm animals with changes during pandemic of temporarily closed farms.

Parameter	Temporarily closed farms (n=8)		
Time period	Before covid-19	During lockdown	After lockdown
Average number of dairy cows/ farm	22	15	6.875
Increased Number of diseased animals in number of farms (n)	0	7	0
Adequate veterinary facilities available in Number of farms (n)	8	4	8
Adequate vaccination facilities available in number of farms. (n)	6	2	6

3.12 Changes in income of temporarily closed farms

The ways of income of the farms throughout the study period was milk in 50% farms, milk+cow dung in 50% farms during pre pandemic situation. During COVID-19 lockdown the income was selling milk+ animals in 50% farms, selling only animal at 35% farms, selling milk+cow dung+animals at rest 25% farms. After lockdown 75% farms earn by selling only milk and rest 25% by selling both milk and cow dung. (Table 13)

Table 13: Sources of income in temporarily closed farms.

	Before COVID-19	%	During COVID-19 lockdown	%	After lockdown	%
Ways of earning	Number of farms (n)					
Milk	4	50%	0	0.00 %	6	75 %
Milk+ cow dung	4	50%	0	0.00 %	2	25 %
Milk+ cow dung+ animals	0	0%	2	25%	0	0%
Milk+ animals	0	0%	4	50.00 %	0	0%
Animals	0	0%	2	25.00 %	0	0%
Total	**8**	100 %	**8**		**8**	

3.13 Changes in milk production of temporarily closed farms

Among all temporary closed farms average milk production was 85 liters before COVID pandemic. During COVID lockdown it decreased 6% than previous and reached 79.75 liters/day. After lockdown it further decreased 43.75% compared to pre pandemic and reached 43.75 liters/day. The average selling price of per liter milk was 60 taka before COVID situation. During COVID pandemic lockdown price decreased 33% and reached 40 taka/liter. After the lockdown the price further increased 50% than before and reached 60 taka/liter as before. Average selling price of per animal was 68750 taka during lockdown and 90000 taka after lockdown. (Table 14)

Table 14: Changes % in the production of farms before COVID-19, during and after pandemic

		Average amount of milk produced(Liter/day)	% changed in milk production	Average Selling price of milk(Per L)	% change in price of milk	Average selling price of one adult animal (tk)
	Before covid-19	85		60		no
Total farm (n=8)	During lockdown	79.75	6% decrease ⇩	40	33% decreased ⇩	68750
	After lockdown	43.75	45% decreased ⇩	60	50% increased ⇧	90000

3.14 Unsold milk in temporarily closed farms

All the temporarily closed farms had surplus milk during lockdown. 12.5% farms had 10%, 37.5% farms experienced 60%, 37.5% farms had 80% and rest 12.5% farms had 90% unsold milk . So total amount of unsold milk was 51.8 L/ day (Table 15)

Table 15: Percentage of unsold milk in temporarily closed farms during lockdown.

Amount of unsold milk %		**No. of farms**	**Percentage of farm**
10 %		1	12.5%
60%		3	37.5%
80%		3	37.5%
90%		1	12.5%
Average	65%		

Average milk production	Average unsold milk/day	Average loss of milk
79.75 L/ day	65% of production	51.43 L/ day

3.15 Disease prevalence

Among all the 60 farms changes were seen in disease prevalence on animals.(Table 16)

Table 16: Overview of disease prevalence in animals during Corona pandemic.

Diseases	**Before COVID-19(December 19-February 20)**	**During COVID – 19 lockdown (March 20 - October 20)**	**After COVID-19 lockdown (November 20-)**
	Number of farms		
Mastitis	1	18	13
Foot and mouth disease(FMD)	0	8	1
Lumpy skin disease(LSD)	0	20	3
Diarrhoea	0	2	1
Pneumonia	1	9	1
Milk fever	0	1	0
Others	30	29	32

3.16 Cumulative effect on farmers

Most of the farms mention that the pandemic was more or less damaging for their farming operation. 26 farmers mention that COVID pandemic was highly damaging. In 23 farmers said it was moderately damaging for them, in contrast 5 farmers felt it was less damaging for them and rest of the farmers said it was not damaging for them due to long their long time experience in farming. (table 17)

Table 17: The level of damage in number of farms.

Level of damage by COVID-19 pandemic	**Response in number of farms**
Highly damaging	26
Moderately damaging	23
Less damaging	5
Not damaging at all	6

Chapter IV
Discussion

As COVID-19 has affected all the sectors of life dairy farming sectors is no exception. The dairy farming sector has experienced serious negative impact of corona pandemic. At Noakhali sadar upazila there was more than 350 registered dairy farms among those 60 farms were included in the study. Outcome of the study revealed that, due to pandemic 8 farms out of 60 were found temporarily closed (average 154 days) and 8 farms were found permanently closed because of the continuous loss. Other 44 farms were in an underperforming condition. These findings also supported by the findings of (Rahman & Chandra Das, 2021).They stated that, dairy farmers experienced many obstacles compensating the loss.

Feed cost of the farms were increased in most of the farms seen in their study. This was due to supply chain was disrupted badly because the transportation was banned by the government at the time of lockdown during COVID pandemic. Therefore the feed supply and other logistics were decreased which result in an increased feed price. It was hard to bear the feed cost which were seen in 65% farms. Along with this due to lockdown the demand of farm products decreased because all the hotels, restaurants, sweet shop were closed and different social programs were forbidden by the Bangladesh Gov't so the demand of the milk and milk products decreased which was experienced by 83% farms. The fall on demand brought a massive loss at most of the farms. Because of lockdown the availability of labor was low which was mentioned by 30% farms, these results resembles the findings of (Hasan, 2021).

The 44 farms which were open throughout the pandemic experienced a massive change on the recurrent cost of farm. The cost of feed increased 39.2 taka from 30 taka which was approximately at 29% increase rate during the lockdown. When the lockdown was over the price further increased from 39.2 taka to 40.4 taka which is further at 3.24% increase rate. In 8 temporarily closed farms the cost reached 45 taka from 35 taka during lockdown which as 27.1% increased rate. Later it decreased 1.38%. These was due to supply chain was

disrupted badly because the transportation was banned by the government at the time of lockdown during COVID pandemic.

The cost of medicine in 44 farms increased at the rate of 157% during, and in 8 temporarily closed farms increased 1.6% during lockdown because there was increased rate of diseases at farms resulting from decreased vet facilities and the farmers were using more medicine to protect their animals from death. The monthly labor cost at active and temporarily closed farms were decreased at the rate of 14% and 90% during lockdown phase because in almost all the farms there was shortage of labor due to lockdown and the farmers couldn't took the labor cost as before and some farms were closed. After lockdown is over the cost was again increased. The other cost increased in certain level during lockdown and after lockdown.

The number of animals were decreased in Large, medium and small scales of farms which were active throughout the pandemic at the rate of 16.6% to 17.80% during lockdown. Then further decreased at the rate of 8 to 16.6%. It was similar in temporarily closed farms. This was due to the farmers sold their animals in certain numbers to decrease the cost of feed and to compensate the loss of the farms.

Among all 60 farms during lockdown 18 farms had mastitis in their farms, 20 farms had Lumpy skin disease, 9 farms had animals affected with pneumonia, 8 farms had FMD and etc. This increased number of disease incidence was might be due to, inadequate veterinary facilities and vaccination status along low level of nutrition due to high feed cost.. The cause of increased mastitis during pandemic was lack of proper monitoring, irregularities in milking, less milking to prevent milk loss etc. The increased LSD, FMD, pneumonia was because of the season and poor vaccination (Marchant-Forde & Boyle, 2020).

The milk production increased from 138 L to 142 L during lockdown at large scale farms which was 3% increase in production. After lockdown it decreased to 113 L from 142 L which was 20% decrease in production. The result was more or less similar in case of medium and small scale farms. In 8 temporarily closed farms the production decreased 6% during lockdown and 45% decreased at alter phase. The reason behind low production was lower level of nutrition and poor management. The selling price of milk was 60 taka before pandemic which decreased into 35 taka which was 44% decrease rate. The price was

increased from 35 to 56 taka after lockdown which was 60% increased. It was similar to the farms which were temporarily closed during pandemic which had 33% decreased in lockdown and 50% increased after lockdown. This was might be due to lower demand of milk and milk products (Datta, Haider & Ghosh, 2018).

All the farms had surplus or unsold milk at certain amount. So the milk loss was seen during corona pandemic. Among 44 active farms 38.13 L milk was remain unsold daily during lockdown. Among temporarily closed farms 51.43L milk was unsold daily (WANG et al., 2020). The ways of income were mainly milk before the pandemic. But during the pandemic almost all farms had to sell their animals to compensate the farm cost. At active farms the average buying price of one animal ranges from 220000 to145667 taka but during lockdown they had to sell similar animals at 100000 to 140000 taka. In temporarily closed farms farmers bought one adult animal on average 157500 taka before pandemic but during pandemic they sold one adult animal on average 68750 taka and after lockdown 90000 taka.

Almost all the farms mention COVID-19 was so devastating for their farming.26 farms mention it had been highly damaging,23 farms said it was moderately damaging, 5 farms classify it as less damaging, 6 farms considered that not damaging at all for them due to long their long time experience in farming.

Chapter V

Limitation

There were many limitations of the study. There were more than 300 farms at Noakhali sadar including large, medium and small scale farms. But the study includes 60 farms. The sample size was small so the actual scenario of the farms may differ from the present findings. The study couldn't include all the farms which were permanently or temporarily closed.

Because of lockdown the data was collected mainly through phone calls so it was not possible to reach each and every farmer besides the farmers were not sharing all the data correctly which was another limitation of the study. If all the data were taken correctly the actual result might be found.

Chapter VI

Conclusion

The study was performed to identify an overall scenario of hardships that were experienced by the commercial dairy farmers to run their farms during the adverse situation of corona pandemic. Despite of their losses they had to rear the animals, feed them and run their farms. The study helped to understand the lacking of farmers, lacking of the management and planning of farm. It might help to find new alternative ways to keep the farm stable in such difficult situation and it might help to develop new policies for the farmers to prevent such kind of losses in future. Future researchers will get a basic idea from the study which will help them to perform better analysis about farm economy.

Chapter 7

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Acknowledgements

I would like to express my gratitude to my supervisor "Professor Goutam Kumar Debnath" sir for his best support and guidance in completing the production report.

I would also like to thank Dr. Goutam Kumar Das, Upazila Livestock Officer, Sadar, Noakhali for his full cooperation, Inspiration regarding the study.

I also like to extend my thankfulness to Dr. Md. Shah Poran, Veterinary surgeon, Sadar, Noakhali and Dr. Md. Sahidur Rahman, Livestock Extension officer, Sadar, Noakhali for supporting and helping me in data collection, management, analysis of the data.

I also like to thank all the dairy farmers who gave their best co-operations by sharing all the facts about their farms and helped me taking the data.