A study on factors affecting reproductive performances of Dairy cow in Rangpur

Submitted by:

Most Nushrat Jahan Nigar

Roll N0: 18/68

Reg. No: 03032

Intern Id: 59

Faculty of Veterinary Medicine

Chattogram Veterinary and Animal Sciences University

Khulshi, Chattogram-4225, Bangladesh

August, 2023

A study on factors affecting reproductive performances of Dairy cow in Rangpur

Approved by

_____

Dr. Azizunnesa

Professor

Department of Medicine and Surgery

Faculty of Veterinary Medicine

Chattogram Veterinary and Animal Sciences University

Khulshi, Chattogram-4225, Bangladesh

August, 2023

Table of Contents

List of Figures

List of Tables

List of abbreviations and symbol

Abbreviations	Elaboration
CR	Conception rate
Etc.	Et cetera
et al.	And others
AI	Artificial insemination
PL	Pregnancy loss
HF	Holstein Friesian
RBS	Repeat Breeding Syndrome
UVH	Upazila Veterinary Hospital
CVASU	Chattogram Veterinary and Animal Sciences University

Abstract

This study was conducted in the Rangpur district of Bangladesh to comprehensively assess the factors influencing the reproductive performance of dairy cows, with a specific focus on metestrous bleeding, parity, the timing of artificial insemination, age, breed, and repeat breeding incidents. The study revealed some significant findings. Metestrous bleeding was identified as a critical factor ($P<0.00$) significantly reducing the conception rate in dairy cows. Parity was found to play a pivotal role ($P<0.038$) in determining conception rates, with heifers exhibiting the highest fertility, while older cows experienced a decline in their reproductive performance. The timing of artificial insemination ($P<0.026$) in relation to the onset of estrus was very important, with insemination around 12-16 hours after onset estrus resulting in a remarkable high conception rate. Moreover, age of cow was identified as influential factors, with older cows at a higher risk of repeat breeding ($P<0.048$).

Keywords: Metestrous bleeding, Conception rate, Dairy cows, Factors

Chapter 1

Introduction

Bangladesh has a significant livestock population, but its dairy sector lags behind other Asian countries. Despite substantial efforts to enhance dairy cow productivity, the results have been unsatisfactory due to various factors such as suboptimal nutrition, failure of conception, improper heat detection, inadequate farm management and different reproductive diseases eg: repeat breeding syndrome (Lemma and Kebede., 2011).

The profitability of a herd is primarily influenced by the reproductive performance of dairy cows. Fertility, particularly the ability of dairy cows to conceive, holds significant importance in meeting the modern-day goal of obtaining one calf per cow each year (LeBlanc *et al*., 2007). Significant factors that influence reproductive performance comprise aspects of animal care, the accuracy of detecting estrus, the precise timing of insemination, cows age, RBS, cases of repeat breeding (RB), milk production, and genetic attributes (Lucy *et al*., 2001; Hudson *et al*., 2012). Lower pregnancy losses are all vital for boosting the additional income potential per cow annually in a dairy setting (Thurmond *et al*., 1990). Age of the cow, delayed initial services, misjudged estrous cycles and improper timing of AI also lead to reduced conception rates in dairy cow (Stevenson *et al*., 1983). Several studies have highlighted the importance of the timing between artificial insemination (AI) and the occurrence of ovulation in affecting fertility outcomes. Notably, they indicate that the timing of AI concerning ovulation is associated with conception rates. The findings demonstrated that cows inseminated 12 to 16 hours after the onset of estrus experienced reduced pregnancy losses and higher conception rates (Parsley et al., 1998).

In Bangladesh, repeat breeding syndrome in cattle can result in delayed pregnancies, leading to economic losses due to longer non-productive periods, more unsuccessful breeding attempts, extended calving intervals, and increased culling rates. Managing this condition is crucial for maintaining herd productivity (Bartlett *et al*., 1986; Lafi and Keneene, 1992). Repeat breeding rates in dairy cows can vary depending on their age. Younger cows may be prone to repeat breeding due to factors like reproductive immaturity or incomplete reproductive development, while older cows might encounter difficulties associated with the aging of their

reproductive organs or other health concerns. Repeat breeding in cattle is primarily caused by problems such as failure in fertilization and early embryonic loss. These issues can be influenced by factors like uterine infections, genetics, difficulties in ovulation, errors in detecting estrus, and improper timing of mating (Shamsuddin *et al*., 2001).

Several previous studies had been conducted to asses the factors affecting the reproductive performance of both large and small-scale dairy farms (Amene *et al*., 2010, Habtamu *et al*., 2010; Tadesse *et al*., 2010). However the reproductive performance, particularly the conception rate of dairy cows, has been considerably hampered by the influential economic factors such as metestrous bleeding, the timing of artificial insemination (AI), occurrences of repeat breeding, the parity of cows, and the age of cows. As the conception rate is very important economical reproductive parameter of dairy industry, the researcher has realized that there is significant need for conducting more detailed and comprehensive studies on this particular topic. To address this need, the current study was initiated with the primary objective of closely evaluating all the factors that impacted the reproductive performance of dairy cows in Rangpur.

This study was covered the following objectives:

1. To identify the factors affecting reproductive performances in dairy cows

2. Evaluation the effects of factors on conception rate in dairy cow.

3. To investigate the factors contributing repeat breeding incidents in dairy cows.

Chapter 2

Materials and Methods

2.1 Study area

The study was carried out in the Rangpur district, specifically in the regions of Palichara, Haragach, Baniyapara, Kaunia and Mominpur. This particular area was chosen due to the high involvement of its residents in dairy farming, which allowed for the collection of ample data relevant to the study's questionnaire.
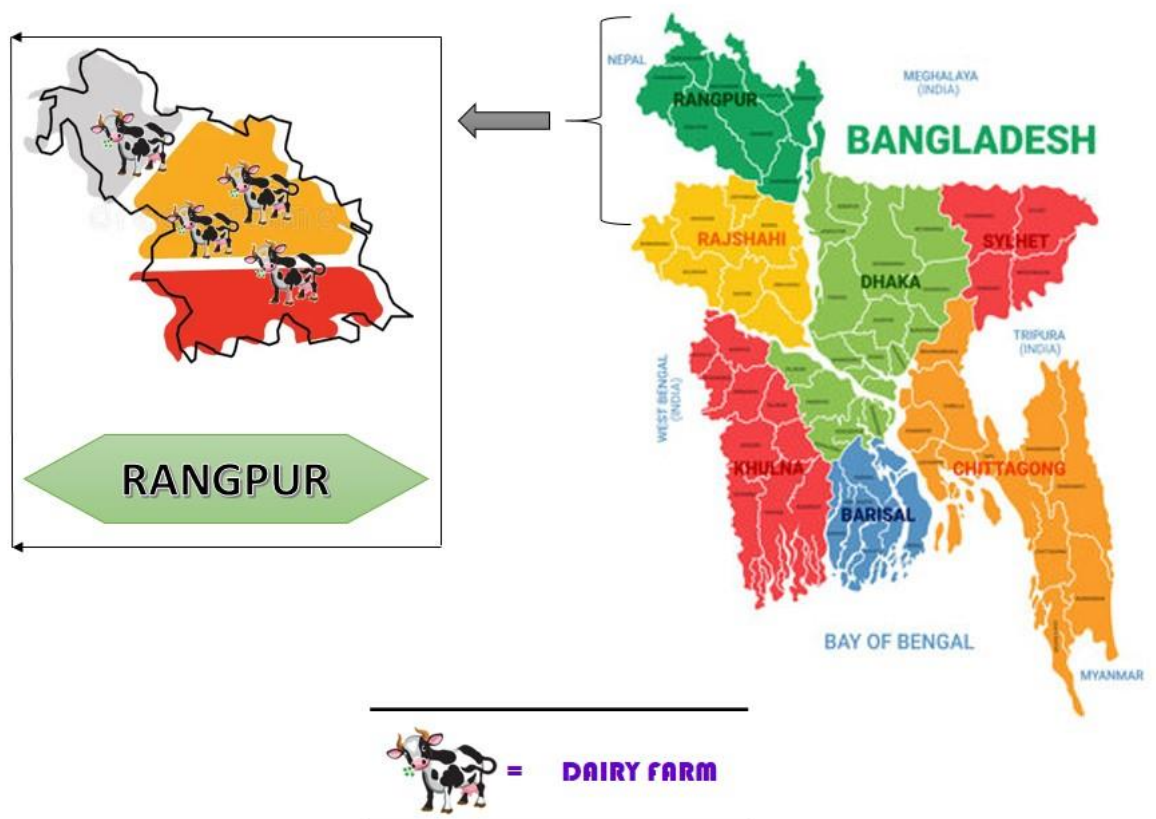

Figure 1: Picture shows the study area

2.2 Study Period

The data was collected for this study during a specific period, from April 16th to June 30th, 2023. This study was conducted during my internship placement at the Upazila Veterinary Hospital (UVH), Rangpur. And it has facilitated the completion of the research work easily as dairy farm visit was the routine duty of internship placement.

2.3 Data Collection

A well-designed questionnaire was used to collect the data for this study. The questionnaire was prepared having to collect different information covered; the time of heat, time of artificial insemination, semen sources, history of diseases if any like repeat breeding, anestrus, metestrous bleeding, abortion, dystocia, etc and conception rate. The information according to the questionnaire was collected from record book of the farm and face to face interviewing the farm, manager.

For ensuring the questionnaire's effectiveness, it went through an initial pre-testing phase. During this phase, a subset of farms was selected, and data was collected using the questionnaire. Based on the feedback and findings from this preliminary data collection, necessary adjustments or corrections to the questionnaire were made. Subsequently, with the final questionnaire in hand, data collection was carried out through a door-to-door survey conducted at the owners' residences in various villages within the Rangpur Sadar area. Farmers filled out the questionnaire on their own, with a survey conductor available to explain and translate questions into the native language if required. Approximately 31 questionnaires were completed by dairy farmers. The data collection process was conducted randomly, encompassing the available dairy farms in the designated area. No specific prerequisites or criteria were imposed when selecting farms for in the data collection.

After collecting the data, the dairy farms were categorized into three groups: small (<20), medium (21-40) and large (>40) scale for getting better result, the age group was divided in two groups (2-3 years and >3-4 years of age), the time of AI was also categorized in two: one was 12-16 hour and another one was >16-24 hours.

2.4 Statistical analysis

The data was initially recorded within Microsoft Excel 2016. Subsequently, the data was compiled and organized in a manner conducive to statistical analysis. This involved arranging the data based on variables for the purpose of objectives of this study. For the analysis, a statistical program (STATA-15) was utilized (Chi-Square test), and the findings were presented in tabular format.

Chapter 3

Results

3.1 General information of dairy farms

Table 1: General information of dairy farms (N=31)

Variable	Categories	Number	Percentage (%)
Farm size	Small (<20)	07	22.58
	Medium (21-40)	14	45.16
	Large (>41)	10	32.26
Breed	HF	20	65.50
	Shahiwal	11	35.50
Service	Natural service	00	0.00
	AI	31	100.0
Anestrous history	Yes	25	80.60
	No	06	19.40
Dystocia history	Yes	03	9.70
	No	28	90.30
Abortion history	Yes	00	0.00
	No	31	100.0
Source of semen	Brac	08	25.80
	Lal Teer	15	48.40
	Govt	08	25.80
Non return heat after AI	No	23	74.20
	Yes	08	25.80

The Table 1 represented the data related to dairy farms were collected, specifically highlighting several key variables and their associated categories, along with the number of occurrences and the corresponding percentages for each category. According to the dairy farm category, the result should that small, medium and large size of farms consist with (7)22.58%, (14)45.16% and (10)32.26% cows, respectively. The data revealed 2 types of breeds on different farms and they were HF & Shahiwal. The number of HF was 20 cattle making up

65.50% of this breed and Sahiwal was11 belong to this breed comprising 35.50% of the total. None of the farms used natural service in the Rangpur area. All the studied farms (31) allowed to breed their dairy cows AI for giving service which accounts for 100.0%. The table 1 studied the history of diseases in dairy cows. Recorded data on anestrous in dairy cows represented that the cows have a history of anestrus 80.60%. It was showed that, only 3 farms had history of dystocia which covered 9.70% of total and 28 farms was not have any a history of dystocia representing 90.30% of total. It was fortunate that the studied area reported none of the farms suffered from abortion. Study found that there were 3 categories of source of semen used in different farms. 15 number of farms used semen from Lal teer which representing 48.40% and (8)25.80% farms used semen from Govt and BRAC. The research also observed that the non return to heat after AI was 74.20%.

3.2 Effect of metestrous bleeding on conception rate

Table 2: Effects of metestrous bleeding on conception rate (N=31)

Metestrous bleeding	No of cows	Conception (%)		P value
		Yes	No	
Present	08	02 (25.00%)	06 (75.00%)	0.00
Absent	23	22 (95.65%)	01 (4.35%)	

Based on the findings in Table 2, the presence of metestrous bleeding has a pronounced effect on the conception rate of dairy cows. The data showed, the cows with metestrous bleeding history have a considerably lower conception rate (25%) but cows without history of metestrous bleeding have a substantially higher conception rate of 95.65% (*P< 0.00*).

3.3 Effect of parity on conception rate

Table 3: Relationship between parity and conception rate (N=31)

Parity	No of cows	Conception (%)		P value
		Yes	No	
1st	11	10 (90.91%)	01 (9.09%)	
2nd	16	07 (43.75%)	09 (56.25%)	0.038
3rd	04	01 (25.00%)	03 (75.00%)	

The Table 3 represented, the link between cows parity and its conception rate, alongside with the corresponding P value (P< 0.038). Data showed that, 90.91% conception rate was found in cows those were in 1st parity and 43.75% in 2nd parity but the conception rate was notably decreased (only 25%) in the cows were in 3rd parity. So the result revealed that increasing the parity significantly decreased the conception rate of dairy cow.

3.4 Effect of time of AI on conception rate

Table 4: Relation between time of AI and conception rate (N=31)

Time of AI after onset of estrous (hrs)	No of cows	Conception (%)		P value
		Yes	No	
12-16	27	16 (59.26%)	11 (40.74%)	
				0.026
>17-24	04	01 (25.00%)	03 (75.00%)	

Table 4 presented the data regarding artificial insemination (AI) was conducted in relation to the end of estrus and its impact on the conception rate in dairy cows. Time of AI after onset of estrous was influenced the conception rate in dairy cows. It was found that the conception rate was statistically increased (59.26%) in those cows were performed AI within 12-16 hours of onset of estrous than those cows were considered to AI within >17-24 hours of onset of estrous (25%) (*P< 0.026*).

3.5 Relationship between age and conception rate

Table 5: Effects of age on conception rate (N=31)

Age	No of cows	Conception (%)		P value
		Yes	No	
2-3	24	13 (54.16%)	11 (45.84%)	0.047
>3-4	07	01 (14.29%)	06 (85.71%)	

Table 5 provided the message on effects of the age of dairy cows in their conception rate. It showed that, younger cows positively increased the conception rate. The study found that the cows with the aged within 2-3 years of old having higher conception rate 54.16% than the cows those were in the aged within >3-4 years old (14.29%) (*P<0.047*).

3.6 Relationship between breeds and repeat breeding

Table 6: Relationship between breeds and repeat breeding (N=31)

Breed	No of cows	Repeat breeding (%)		P value
		Yes	No	
HF	20	08 (40.00%)	12 (60.00%)	0.706
Shahiwal	11	03 (33.33%)	08(66.67%)	

The Table 6 showed the effects of breeds on the occurrence of repeat breeding rates in dairy cows. It was observed that HF cows were in more risk to occurred RB (40.00 %) than the Shahiwal cows showed 33.33% RB and it was statistically differed (*P< 0.706*).

3.7 Relationship between ages and repeat breeding

Table 7: Effects of age on repeat breeding (N=31)

Age	No of cows	Repeat breeding (%)		P value
		Yes	No	
2-3	24	07 (29.16%)	17 (70.84%)	0.048
>3-4	07	04 (57.14%)	03 (4.86%)	

The study also evaluated the effects of age on RB in the dairy cows. In the Table 7 the data represented that, increased the cows' age positively influenced to occurre RB. The results revealed that the cows within the age of 2-3 years old having 29.16% RB while the cows those were in >3-4 years of old were suffering from RB 57.14% and the difference between these two age categorized cows was significant (*P<0.048*).

Discussion

The study focused on evaluating factors that affect the reproductive performance of dairy cows in the Rangpur, Bangladesh. It identified several key factors that have direct effects on the conception rate of dairy cows. These factors include: metestrous bleeding, time of AI, age of cows, parity, repeat breeding etc.

In this study, the dairy farms were classified into three categories based on their size: small, medium, and large. Additionally, there were two distinct cattle breeds found on these farms, namely HF and Shahiwal. All of these farms (100%) employed Artificial Insemination for breeding, and they sourced semen from providers such as BRAC, Lal Teer, and the government. Approximately 80% of the farms had a history of anestrous and about 10% of the farms had a history of dystocia. Luckily, none of the farms had a history of abortion cases.

According to this study result, cows that had previously experienced metestrous bleeding displayed a notably lower conception rate (25%), in contrast to cows without any prior instances of metestrous bleeding, which achieved a considerably higher conception rate of 95.65%. ($P < 0.00$) this underscored the significant influence of metestrous bleeding on the conception rate of dairy cows. Metestrous bleeding in dairy cows, occurring during the metestrus stage with reduced estrogen and increased progesterone, is typically associated with lower conception rates. This bleeding can signal uterine inflammation or infection, which can harm fertility by creating an unfavorable environment for sperm and embryo implantation. The researcher stated that, there were no observable effects of metestrous bleeding on the conception rate of dairy cow. However, the study findings reveal that, at the practical field level, the occurrence of metestrous bleeding can indeed reduced the conception rate of dairy cows. Unfortunately, there is no established research papers addressing this specific topic.

In this study, after evaluating the relationship between the timing of insemination and the conception rate yielded $P < 0.026$. Importantly, observed a marked increase (around 60%) of successful conceptions when insemination took place 12-16 hours after the onset of estrus while it was only 25% in >16-24 hours after onset of estrous. So, this study has not only unveiled a compelling connection between the timing of insemination and reproductive success but has also rigorously demonstrated the strength of this relationship through robust statistical

analysis. The previous study's findings provide strong evidence that extending the time between the end of estrus and insemination (18 to 24 hours) doesn't result in a higher chance of successful conception. In other words, delaying insemination within this specific timeframe following the end of estrus does not notably improve the conception rate (Stevenson *et al.,* *1983*). More recent investigations have indicated that achieving better conception rates per AI was associated with inseminating cows 12-13 hours after onset of estrus. The results align with findings from previous study, which showed that cows inseminated 12/13 hours after the end of estrus had lower pregnancy losses and higher CR (Parsley *et al., 1998*).

The effects of the age and parity of dairy cows on their conception rates was very remarkable. Heifers tend to have superior fertility while older, multiparous cows may face specific reductions in conception rates. From this study the age of 2-3 years of old having around 55% of conception rate but its only 14.29% in >3 years of old cows. Here P<*0.047* that means age have very significant effects on conception rate. This study also contributes that, in 1st parity the conception rate was 90% while it was notably reduced (25%) in 3rd parity and the *P<0.038* carried a significant result. Some previous study conducted that, heifers consistently maintained the highest conception rates. Notably earlier study stated that, the first lactation conception rate for heifers stood at a robust 55.2%. But second and third lactation cows experienced considerably lower conception rates around 26%. Conversely, cows in their fourth lactation or older witnessed substantial declines in fertility as the service number increased, resulting in a reduced conception rate of about 15.4%. Numerous studies consistently reported a decrease in reproductive performance with advancing age. One plausible explanation for this decline could be the increasing incidence of reproductive diseases as cows age (Gwazdauskas *et al., 1986*) *(Hillers et al., 1984).*

According to this study, within the 2-3 years age 29% of cows had a history of Repeat Breeding Syndrome (RBS). However, a notable concern arises when looking at cows older than 3 years, where around 58% had a history of RBS. The statistical significance (*P<0.048*) underscores a strong relationship, highlighting that younger cows face a lower risk of RBS and these findings strongly suggest a gradual and notable increase in the incidence of repeat breeding as cows mature. Cows that are older and have a parity >3-4 face an increased risk of experiencing repeat breeding syndrome (RBS) compared to other cows, in line with the previous research (Bartlett *et al.,* 1986). This elevated risk in older cows may be attributed to a higher incidence of conditions like milk fever, dystocia, and retained placenta in aging cows,

as observed in earlier study (Dohoo *et al.,* 1984 ; Erb *et al.*, 1985 ; Curtis and Lean, 1998) These particular health issues have been identified as significant risk factors for RBS, as noted in the earlier study (Lafi and Kaneene, 1992) Additionally, older cows tend to have lower conception rates and delayed uterine involution, which could potentially contribute to the occurrence of RBS (Curtis and Lean, 1998). Previous research has pointed out that in older dairy cattle, there was a considerable reduction in the duration of their fertile period, leading to a disease of cows (RBS), which was a genuine challenge in terms of cow fertility (Gwazdauskas *et al., 1986*). Research has consistently demonstrated that age influences fertility, with older cows experiencing higher rates of repeat breeding (Hewett *et al.*, 1968). A researcher noted that the incidence of repeat breeding was more common in cows >4 years of age, while it was less frequent in cows <3 years (Sarder *et al.*, 2008).

Chapter 4

Conclusions

In conclusion, this study conducted in the Rangpur district of Bangladesh examined various factors affecting the reproductive performance of dairy cows. It highlighted the crucial role of metestrous bleeding, cow age, and the timing of artificial insemination in determining conception rates. Key findings include the negative impact of metestrous bleeding on conception rates, the influence of cow age on reproductive success, and the significance of insemination timing in relation to estrus. The research underscores the importance of effective management practices for improving dairy cow fertility. Furthermore, it identifies the increased risk of repeat breeding in older cows and emphasizes the need for careful consideration of insemination timing to enhance reproductive outcomes. These insights provide valuable information for the dairy farming industry in the region, contributing to improved practices and, ultimately, increased productivity.

References

Chebel, R.C., Santos, J.E., Reynolds, J.P., Cerri, R.L., Juchem, S.O. and Overton, M., 2004. Factors affecting conception rate after artificial insemination and pregnancy loss in lactating dairy cows. Animal reproduction science, 84(3-4), pp.239-255.

Coleman, D.A., Thayne, W.V. and Dailey, R.A., 1985. Factors affecting reproductive performance of dairy cows. Journal of dairy science, 68(7), pp.1793-1803.

Galon, N., Zeron, Y. and Ezra, E., 2010. Factors affecting fertility of dairy cows in Israel. Journal of Reproduction and Development, 56(S), pp.S8-S14.

Gwazdauskas, F.C., Whittier, W.D., Vinson, W.E. and Pearson, R.E., 1986. Evaluation of reproductive efficiency of dairy cattle with emphasis on timing of breeding. Journal of Dairy Science, 69(1), pp.290-297.

Hewett, C.D., 1968. A survey of the incidence of the repeat breeder cow in Sweden with reference to herd size, season, age, and milk yield. British Veterinary Journal, 124(8), pp.342-352.

Hillers, J.K., Senger, P.L., Darlington, R.L. and Fleming, W.N., 1984. Effects of production, season, age of cow, days dry, and days in milk on conception to first service in large commercial dairy herds. Journal of dairy science, 67(4), pp.861-867.

Khan, M.R.K., Uddin, J. and Gofur, M.R., 2015. Effect of age, parity and breed on conception rate and number of service per conception in artificially inseminated cows. Age (year), 2(3), p.19.

Moss, N., Lean, I.J., Reid, S.W.J. and Hodgson, D.R., 2002. Risk factors for repeat-breeder syndrome in New South Wales dairy cows. Preventive Veterinary Medicine, 54(2), pp.91-103.

Nishi, S.A., Sarder, M.J.U., Islam, M.H., Kamruzzaman, S.M., Islam, M.A. and Khaton, R.,

2018. Factors affecting the incidence of repeat breeding in dairy cows in Rajshahi district, Bangladesh. International Journal of Livestock Research, 8(10), pp.90-96.

Pursley, J.R., Silcox, R.W. and Wiltbank, M.C., 1998. Effect of time of artificial insemination on pregnancy rates, calving rates, pregnancy loss, and gender ratio after synchronization of ovulation in lactating dairy cows. Journal of dairy science, 81(8), pp.2139-2144.

Stevenson, J.S., Schmidt, M.K. and Call, E.P., 1983. Factors affecting reproductive performance of dairy cows first inseminated after five weeks postpartum. Journal of dairy science, 66(5), pp.1148-115.

Acknowledgements

Biography of author

This is Most Nushrat Jahan Nigar, the eldest daughter of Mamunur Rashid and Akhitara Begum. Currently, she is a student in the Doctor of Veterinary Medicine (DVM) program at Chattogram Veterinary and Animal Sciences University, specializing in the Faculty of Veterinary Medicine. In 2015, she achieved a perfect GPA of 5.00 in her Secondary School Certificate Examination (SSC) at Khalashpir High School, Pirganj-Rangpur, and she continued to maintain this exceptional GPA in her Higher Secondary Certificate Examination (HSC) in 2017 at Rangpur Govt. College, Rangpur.

Currently, she is deeply involved in a year-long internship to enhance her practical skills and prepare herself for the modern scientific landscape. Her strong passion for her field and dedication to improving her practical abilities underscore her journey toward becoming highly proficient in veterinary science.