

# **Evaluation of the Chemical Quality (Fat, moisture, and acidity) of Powder Milk Sold in Open Markets in Chattogram**



**A production report submitted in partial satisfaction of the requirement for the  
Degree of Doctor of Veterinary Medicine (DVM)**

**By:**

**Shodipta Sharma Urmi**

**Roll No: 17/29**

**Reg No: 01855**

**Intern ID: 22**

**Session: 2016-17**

**Faculty of Veterinary Medicine**

**Chattogram Veterinary and Animal Sciences University**

**Khulshi, Chattogram – 4225, Bangladesh**

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**Approved By:**

**(Dr. A.K.M. Humayun Kober)**

**Professor**

**Department of Dairy and Poultry Science**

**Faculty of Veterinary Medicine**

**Chattogram Veterinary and Animal Sciences University**

**Khulshi, Chattogram – 4225, Bangladesh**

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## **Abstract**

The present study was performed to determine some chemical composition of powdered milks that are available in Chattogram Metropolitan area. Powder milk samples of 7 different brands named Dano, Marks, Ama, Fresh, Diploma, Greenland and Starship were collected from local market. In this study the fat, moisture and titrable acidity percentage were examined by standard methods. In this study we have found that the average fat content in powdered milk is in the range of 5.06 -26.9 %. The huge variation in fat percentage was because of having both skimmed and full creamed powdered milk in the samples. In our study the average moisture percentage of the powdered milk is within the range from 3.10 - 3.75 %. The average acidity % in our study was in the range from 0.11 - 0.15 %. This study indicates that most milk powders can be considered of fair quality. The quality of milk powder sold in the market can be considered to be good for human consumption.

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Key Words: Powdered Milk, Fat, Moisture, Titrable Acidity

# Chapter 1: Introduction

Dried milk or milk powder is the product obtained by the removal of water and fat from whole milk, usually fat percent of whole milk powder is minimum 26% and maximum 40%, for partially skimmed milk powder minimum 1.5% and maximum 2.5%. For all types of powder milk water content ranges from 3-5% , titrable acidity not more than 0.17%, 3-5% moisture, minimum 34% protein, minimum 34% lactose, 6.6-6.8 pH on the basis of dry matter, maximum 7.3% ash (Spreer, 1995) Under any circumstances water percent of dry milk should not exceed 5%. Powdered milk is manufactured by following some steps like collection of milk, standardization, pasteurization, evaporation and spray drying (Hols & Mil, 1991). The removal of water from the milk takes place in two stages. The first stage is concentration by vacuum evaporation and the second stage is drying. Ninety percent of the water in the milk is removed in the evaporator and only ten percent in the spray dryer (Pijanowski et al., 1975)

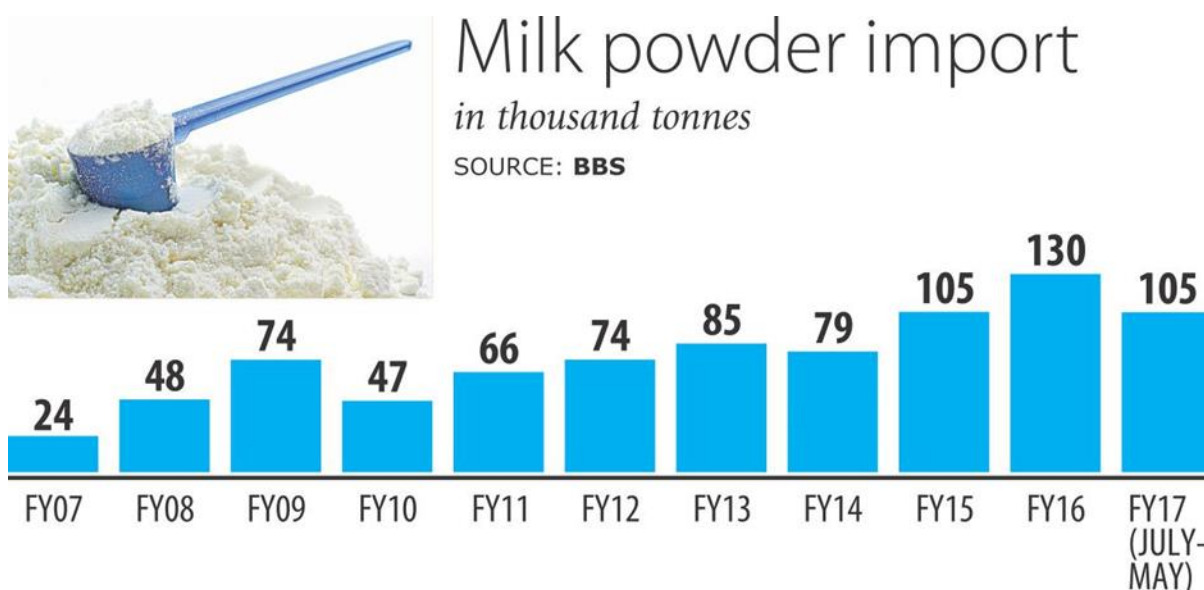
The two principal processes for the manufacture of milk powder are the roller or the drum process and the spray process. Other systems are the format process and the freeze drying process. More recently, equipment in which combinations of these fundamental processes are found has been developed (Pugliese et al., 2017) Powder milk has a much longer keeping quality and can be held in un-refrigerated storage condition. Much less storage space is required per unit of solids. Distribution is possible to the countries particularly those with unfavorable conditions of the perishable dairy products to be impractical. Consequently, dry milk has superiority both in economy and convenience.

Powder milk have advantages for its concentrated source of many essential nutrients. The quality of milk powder is affected by the quality of raw milk used in its manufacture, and the self-life can be extended from six months at room temperature. Now-a-days in rural and urban areas along with city areas the use of milk powder is increasing day by day (Lapar et al., 2010) as shortage of fresh milk. Different pack sizes and various prices with multiple brands (Table 1) are selling powdered milks in Bangladesh.

**Table 1: Marketed powder milk in Bangladesh**

	<b>Brand Name</b>	<b>Country of Origin</b>	<b>Marketed by</b>
<b>01</b>	Dano	Denmark	Arla Foods
<b>02</b>	Nido	New Zealand	Nestle Bangladesh
<b>03</b>	Red Cow	New Zealand	New Zealand Dairy Products Ltd.
<b>04</b>	Anchor	New Zealand	New Zealand Dairy Products Ltd.
<b>05</b>	Diploma	New Zealand	New Zealand Dairy Products Ltd.
<b>06</b>	Farmland	New Zealand	New Zealand Dairy Products Ltd.
<b>07</b>	Kwality	Australia	Sanowara Corporation
<b>08</b>	Marks	Australia	Abul Kair group
<b>09</b>	No 1	Australia	Meghna group
<b>10</b>	Fresh	China	Tanvir Foods ( Meghna Group)
<b>11</b>	Milk Vita	Bangladesh	BMPCUL





**Figure 1:** Import of powdered milk in Bangladesh in recent years

From the above figure, it is clear that Bangladesh has almost doubled its import of powdered milk, driven by increased industrial use and home consumption, said industry operators (Belewu et al., 2009).

In Bangladesh consumers have a poor idea of better quality powdered milk as very few studies have been done regarding its quality (Kajal et al., 2012). To best of my knowledge very limited work has been conducted in our country regarding the quality powdered milk (Uddin et al., 2011). Considering the above facts, the present study was conducted to evaluate the chemical quality (Fat, Moisture and Titrable acidity %) of milk obtained from the open market and to compare the quality with standard quality and the values written on the label of each sample (Karmaker et al., 2020).

The present study was designed to evaluate some chemical parameters of powder milk available at local market in Chattogram Metropolitan town.

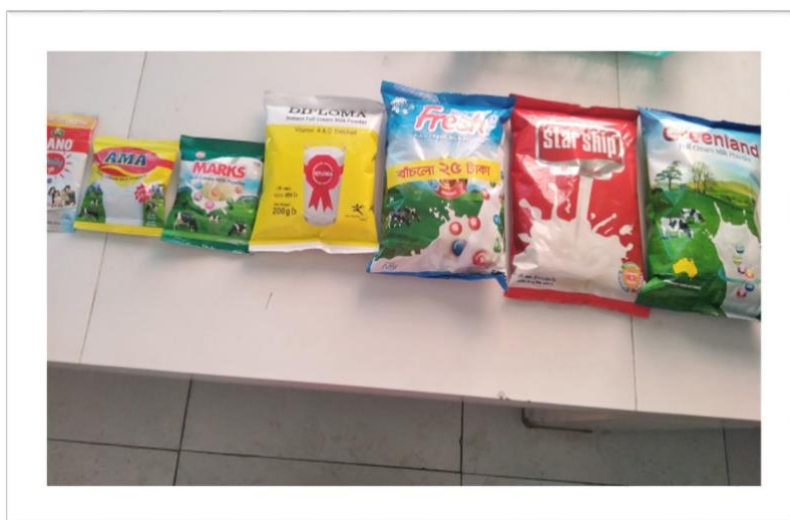
## Chapter 2: Materials and Methods

### 2.1 Experimental site

The present study was performed in the Dairy Science Laboratory under the Department of Dairy and Poultry Science, Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram.

## ***2.2 Samples collection***

For performing the experiment, seven well known commercial brands of powdered milk (Dano, Diploma, Marks, Ama, Starship, Fresh and Greenland) were chosen. Total 35 poly packets of powdered milk from seven brands (5 packets for each brand) were bought from local shops and Super shop (Basket) at Khulshi town during January-February 2022.



**Figure 2.1: 7 different branded powdered milk**

## ***2.3 Reconstitution of powdered milk***

Reconstituted milk is simply made by dissolving whole milk powder in water to obtain liquid milk that is similar in composition with whole milk. For reconstitution, 13g milk powder was added to 100ml water of 45°C

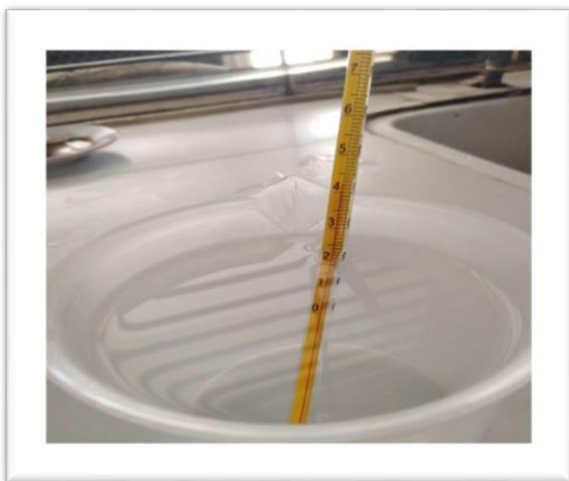
First of all 1000ml (1L) distilled water was heated up to 100 °C. 7 clean and dry beakers of 300 ml were taken and labelled them according to brand name of the powdered milk as Dano, Marks, Ama, Greenland, Star-ship, Diploma and Fresh. 13gm powdered milk from each packet were added to the beaker according to the labelling. 100 ml water of 45 ° C temperatures was added to each beaker and agitated with a clean stirrer for 90 seconds until having any lumps.



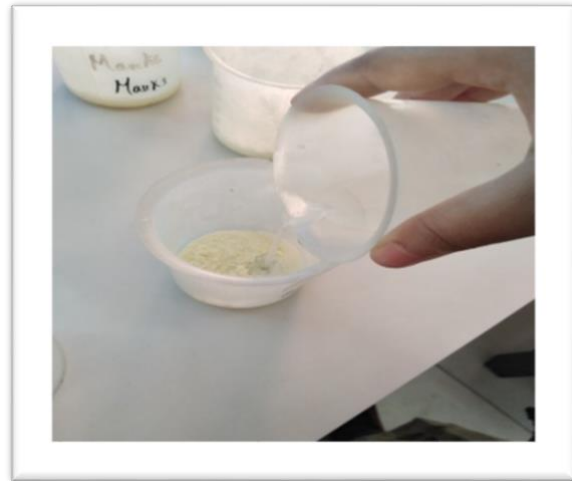
**Figure 2.2:** Weighing of milk powder



**Figure 2.3:** Labelling of beaker



**Figure 2.4:** Checking of water temperature



**Figure 2.5:** Adding warm water to make reconstitute milk

#### ***2.4 Determination of Fat %***

In this study fat % from the reconstituted milk was done by Gerber Method. For doing this the equipment and reagents needed are:

1.  $H_2SO_4$
2. Iso-amyl alcohol
3. Reconstituted milks
4. Butyrometer with cap
5. Test tube rack
6. Centrifuge machine

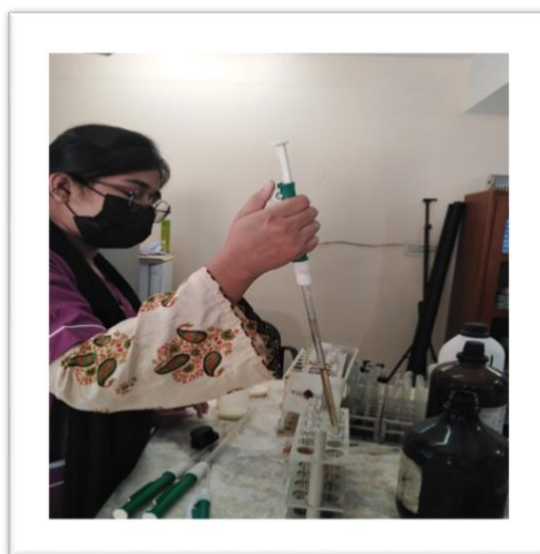
7. Water bath
8. Pipette (3)
9. Permanent marker

#### ***2.4.1 Test procedure of Fat Determination***

First of all the butyrometers were labelled as the brand name of the powdered milk and placed them in the test-tube rack. Then 10ml  $H_2SO_4$  was taken in each butyrometer. 11ml reconstituted milk from the labelled beaker were added to the butyrometers according to the labelling. After then, 1ml Iso-amyl alcohol was added in each butyrometers. After closing the caps, the butyrometers were agitated carefully until the curd is dissolved as the milks were being digested in acids and heat was producing by the reactions. Then the butyrometers were added to the centrifuge machine at 1100 rpm for 5 minutes. After completing centrifugation, those butyrometers were kept in water bath at  $65^{\circ}C$  for 3 minutes. Next by removing from there the golden layer were observed as the fat percentage (Kleyn et al., 2001).



**Figure 2.6:** Labelling of the butyrometers and arranged in the test-tube rack



**Figure 2.7:** Adding reagents and milk the butyrometers



**Figure 2.8:** Observing the Fat percentage

### ***2.5 Determination of moisture %***

In this study moisture % was determined by using **PMB 202** moisture analyzer. Equipments required for this procedure are:

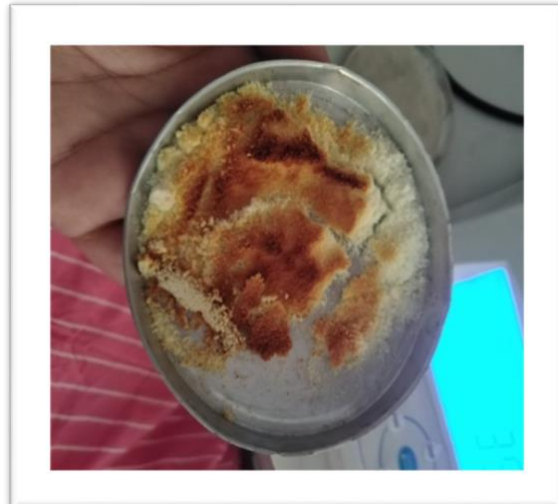
1. Milk sample (5gm from each)
2. Petridish
3. Moisture analyzer

#### ***2.5.1 Test procedure of Moisture Determination***

5gm of milk powder from each sample were weighed and spread in the analyzer disk. Next the disks were placed one after another in the analyzer by setting the time 2 minutes 15 second and temperature for 117°C. The results were recorded in notebook.



**Figure 2.9:** Moisture analyzer machine



**Figure 2.10:** After burning of the powdered milk in the analyzer

## ***2.6 Determination of acidity %***

Acidity percentage was determined by titration method. Equipment and reagents required for this study are:

1. Reconstituted milk (10 ml for each test)
2. Deionized water (10 ml for each)
3. 0.1 N NaOH
4. Phenolphthalein (indicator)
5. Burette and pipette
6. Porcelaine beaker

### ***2.6.1 Test procedure of Acidity Determination***

First of all 10 ml reconstituted milk was taken in beaker and equal amount (10 ml) deionized water was added in the beaker and mixed by pipetting. 1 ml phenolphthalein was added into it. Then 0.1 N NaOH was added in burette and the initial reading was recorded. Then carefully titration was done until faint pink color appeared. It determines the end point of the titration. The final reading was recorded from the burette (Fahmid et al., 2016). Same

procedure was done for three times from all brands reconstituted milk and the mean value was observed



**Figure 2.11:** Performing titration for determining acidity percentage



**Figure 2.12:** Faint pink color of milk at the end of titration

### ***2.7 Statistical Analysis***

Data related to chemical composition of powdered milk were compiled by Microsoft Excel 2010. The Mean and SD were analyzed by STATA 14.2

## **Chapter 3: Results**

### ***3.1 Fat Content***

Fat of milk powder obtained from Dano, Marks, Ama, Fresh, Diploma, Greenland and Starship were  $5.06 \pm 0.09$ ,  $8.45 \pm 0.02$ ,  $6.92 \pm 0.01$ ,  $26.92 \pm 0.01$ ,  $18.46 \pm 0.02$  and  $18 \pm 0.01$  g/100g, respectively (Table 2) and the difference were statistically significant. Among those seven brands the average fat content of Diploma is higher ( $26.92 \pm 0.01$ ) and the average fat content of Dano is lower ( $5.06 \pm 0.09$ ).

### ***3.2 Moisture Content***

Moisture of milk powder obtained from Dano, Marks, Ama, Fresh, Diploma, Greenland and Starship were  $3.65 \pm 0.04$ ,  $3.74 \pm 0.01$ ,  $3.60 \pm 0.01$ ,  $3.55 \pm 0.02$ ,  $3.10 \pm 0.01$ ,  $3.55 \pm 0.01$ ,

3.75 ± 0.01 g/100g, respectively (Table 2) and the difference were statistically significant. Within these seven brands the average Moisture of Starship is higher (3.75 ± 0.01) and the average Moisture of Diploma is lower (3.10 ± 0.01).

### 3.3 Acidity Content

Moisture of milk powder obtained from Dano, Marks, Ama, Fresh, Diploma, Greenland and Starship were 0.11 ± 0.01, 0.15 ± 0.02, 0.15 ± 0.01, 0.12 ± 0.02, 0.11 ± 0.01, 0.11 ± 0.02, 0.11 ± 0.02 % respectively (Table 2) and the difference were statistically significant. The average acidity of Marks and Ama (0.15 ± 0.02, 0.15 ± 0.01) are higher and the average acidity of Dano, Greenland and Starship is lower (0.11 ± 0.01, 0.11 ± 0.02) among all brands.

The results are shown in a tabular form below.

**Table 2: Chemical Parameters of Milk Samples Available in Chattogram Area (Mean ± SD)**

Parameters	Dano	Marks	Ama	Fresh	Diploma	Greenland	Starship	Level of significance
Fat (g/100g)	5.06 ± 0.09	8.45 ± 0.02	6.92 ± 0.01	24.62 ± 0.01	26.92 ± 0.01	18.46 ± 0.02	18.46 ± 0.01	*
Moisture (g/100g)	3.65 ± 0.04	3.74 ± 0.01	3.60 ± 0.01	3.55 ± 0.02	3.10 ± 0.01	3.55 ± 0.01	3.75 ± 0.01	*
Acidity %	0.11 ± 0.01	0.15 ± 0.02	0.15 ± 0.01	0.12 ± 0.02	0.11 ± 0.01	0.11 ± 0.02	0.11 ± 0.02	*

\*= Significant at 0.05% level



## Chapter 4: Discussion

### *4.1 Fat Content*

It is the main and most important source of flavor in milk/milk powder. In full cream milk powder the range of its percentage should be 26-42% and in skimmed milk powder it is 1.5-2.5% (Pugliese et al., 2017). It has a vast role in reconstituting the powdered milk and related hazards during the drying of the powder.

In our study we have found that the average fat content in powdered milk is in the range of  $5.06 \pm 0.09$ - $26.92 \pm 0.01$  (Table 2). The lower fat content is in Dano. This is because it is skimmed powdered milk (Pugliese et al., 2017). The average fat content of full cream powdered milk was 25.4% (Pijanowski et al., 1975). According to BSTI the average fat content should be minimum 26% in dried whole milk powder. In the packaging form of the Dano, Marks, Ama, Fresh, Diploma, Greenland and Starship the mentioned fat percentage were respectively: (not mentioned), 26%, 26.70%, 26.7%, 28.4%, 26%, 20%. But in our study we found some deviation from the mentioned values (Table 2). Such as in the packaging of Marks the fat was mentioned as 26% but in our study it was  $8.45 \pm 0.02$  %. In the same way the fat % of Ama was  $8.45 \pm 0.02$  % instead of 26.70%, fat % of Fresh was  $6.92 \pm 0.01$  % instead of 26.7%, fat % of Diploma was  $26.92 \pm 0.01$  % instead of 28.4%, fat % of Greenland  $18.46 \pm 0.02$  % instead of 26% and fat % of Starship was  $18.46 \pm 0.01$  % instead of 20%. In a study of (Kajal et al., 2012) it was observed that the fat content of Diploma was  $27.26 \pm 0.95$  % and the fat content of Starship was  $26.30 \pm 0.60$ . These values differ from our observed values (Table 2). These differences may be due to the changes in packaging, not maintaining proper storage or using different way of measuring fat %.

### *4.2 Moisture Content*

Moisture percentage refers to the term that is used to define the water content in any substances. In milk powder the moisture percentage should not exceed 5% (Gasmalla et al., 2013), because the increased moisture would create a humid area, that is suitable for the growth of molds or some anaerobic bacteria. Again low moisture content would represent that the procedure of manufacturing may have gone through over drying as a result the taste would be hampered.

In our study the average moisture percentage of the powdered milk is within the range from  $3.10 \pm 0.01$  -  $3.75 \pm 0.01$  g/100g (Table 2). In this study the lower moisture content is in Diploma and it is  $3.10 \pm 0.01$  g/100g and the moisture content in Starship is higher and that is  $3.75 \pm 0.01$  g/100g but in the study of (Kajal et al., 2012) they found that the average moisture content in Diploma was  $4.49 \pm 1.04$  % and the average moisture content of Starship was  $3.74 \pm 0.81$  %. So we found that there is no significant difference between the moisture content of Starship according to (Kajal et al., 2012) and Starship of our study (Table 2). In the packaging form of the Dano, Marks, Ama, Fresh, Diploma, Greenland and Starship the mentioned moisture percentage were respectively: (not mentioned), (not mentioned), maximum 3.50%, maximum 3.5%, (not mentioned), maximum 3%, maximum 3.5%. But in our study we found some deviation from the mentioned values (Table 2). Such as we observed the moisture content of Ama was  $3.60 \pm 0.01$  instead of maximum 3.50%, the moisture content of Fresh was  $3.55 \pm 0.02$  instead of maximum 3.5%, the moisture content of Greenland was  $3.55 \pm 0.01$  instead of maximum 3%, the moisture content of Starship was  $3.75 \pm 0.01$  instead of maximum 3.5%. So we can say that the values (Table 2) are slightly higher from the values mentioned in the packaging. The average moisture % in whole milk powder should be 2.74% (Pijanowski et al., 1975). On the other hand according to the BSTI the moisture content of whole milk powder can be maximum 4%. So our study agrees with the statement.

#### ***4.3 Acidity Content***

Acidity denotes the presence of hydrogen ion concentration in a solution. Acidity percentage means, the amount of hydrogen ion in 100 ml of solution which is expressed in percentage. Normal acidity percentage of powdered milk is 0.17% variation from this will indicate improper processing (Priyanka et al., 2022).

The average acidity % in our study was in the range from  $0.11 \pm 0.01$  -  $0.15 \pm 0.02$  % (Table 2). In this study the acidity percentage of all branded powdered milk was in the normal range. So it can be said that the acidity percentage was perfect (Kajal et al., 2012)

## **Chapter 5: Conclusion**

From the results the fat percentage in Diploma is higher and moisture percentage is lower and the acidity percentage was in the range so it can be chosen as daily basis consumption as substitute to liquid milk. Others can also be chosen. Again most of the brands have sufficient similarities with their packaging forms.

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The author would like to express her sincere gratitude and gratefulness to staffs of Department of Dairy and Poultry Science, Chattogram Veterinary and Animal Sciences University

## **Biography**

I am Shodipta Sharma Urmi, daughter of Dilip Kumar Sharma and Kalpona Rani Sharma. I am from Pekua, Cox'sbazar. I passed Secondary School Certificate examination (S.S.C.) in 2014 (G.P.A.-5.00) from Pekua Govt. Model G.M.C Institution and Higher Secondary Certificate examination (H.S.C.) in 2016 (G.P.A.-4.83) from Chattogram Cantonment Public College. I am a student of 22<sup>nd</sup> batch and now an intern student under the Faculty of Veterinary Medicine in Chattogram Veterinary and Animal Sciences University. In the future I would like to work in the field of Genetics.