Colostrum management of dairy calves in Fenchuganj, Bangladesh

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Abstract

Colostrums management is the single most important factor in determining calf health and survival.In to know about the colostrums management condition of calf in dairy farm of villages, we undertook a survey about calf colostrums at Fenchuganj of sylhet.From the study, we were able to know that most of the farmers of villages were knowledgeable about colostrums feeding but not appropriately. The farmers are owners of their farms and they rear local breed averagely. About 59% farmers education level were between class 6 to 10.They supply colostrums to calf within half hours of birth by dam but they don't record what amount of colostrums is taken from dam. Overall ,they know about colostrums feeding but don't get any source to know about the modern matters related to colostrums supplying to calf.

Introduction

Dairy farming is an important and potential agricultural sector in Bangladesh.Nearly 85% of the population of the country are engaged in agriculture and livestock sector (Raha*et al.*2000). In Bangladesh, there are about 23.78 million cattle (BBS 2017). Among the total of 6 million milking cows, 85–90% of them are indigenous and 10–15% are crossbred (DLS 2013). The crossbreds and purebreds are mostly Sindhi, Sahiwal, and Holstein Friesian breeds (Miazi*et al.* 2007). In Bangladesh, cows are the main source of milk. About 90% of the produced milk in the country comes from cows, 8% from goat, and the remaining 2% from buffalo (DLS 2013). Annual milk production was 3.97 million tons during 2005–2016 with an average annual growth rate of 13.5%. Smallholder producers dominate the dairy sector in Bangladesh. More than 70% of the dairy farmers are smallholders and produce around 70–80% of the country's total milk (Uddin et al. 2012). It is estimated that there are about 1.4 million dairy farms with an average herd size of 1–3 cows (Hemme *et al.* 2008). In recent years, local milk production increased from 2.27 million metric tons in 2005– 2006 to 7.28 million metric tons in 2015–2016 (BBS 2017). Demand expressed as consumption of milk and milk products increased at a faster rate, annually 5% compared to increase in milk production at 4% from cow, buffalo, sheep. For these reasons, dairy development has assumed a position of paramount importance in the rural economy of Bangladesh. It is essential that this sector, like every other sector of tropical agriculture, should be modernized and made more productive as quickly as possible. Dairying is a good source of income to the small and marginal farmers. The feeds required for milk production can be met from their limited land resources as most of the milch animals are

ruminants and the majority of their food can be derived from forages, coarse roughages and by-products not utilised byhuman beings, without incurring much additional cost. Apart from milk production, cows contribute a huge quantity of organic manure, which is one of the major inputs in Bangladesh agriculture. So, dairying is a subsidiary occupation of almost all farmers of Bangladesh. Low productive indigenous cow and lack of good managementpractices are common in the dairy sector (Uddin *et al.* 2011).Low herd yields generally reflect poor management practices and inadequate investment in genetics and veterinary services.Indairy sector of Bangladesh, calf mortality can cause economic loses. Infectious diseases are often considered as the principle cause of calf mortality, specially gastro-intestinal disorders (Svensson and Liberg,2006;Tor sein *et al.*2011; Bahle r*et al.*2012, Daros*et al.*2014) and respiratory problems (Gulliksen *et al.*2009).It is well established that,mortality and morbidity of dairy calf is influenced by management practices.Such as management and feeding of high quality colostrum can lessen calf mortality and fortify immunity(Quigley and Drewry,1998).Accordingly, a survey was conducted to understand colostrum management of calves at Fenchuganj of Sylhet in Bangladesh.Itwas hypothesized that colostrum management practices were not up to the mark in rural areas.For that reason, this study was conducted to know the risk factors of inadequate colostrum management practices to dairy calf in rural areas of Fenchuganj, Sylhet.

Review of Literature

Colostrum ,the cows first milk, is not only important for the health of neonate ,but has aprofound effect on the future performance of the calf all the way through the feeding period. The placenta of the cow separates the blood of the foetus from that of the dam and prevents any transfer of protective immunity while in the uterusduring the gestation period. Therefore, the calf is born completely dependent on the absorption of maternal antibodies from colostrum after birth. A calf's gastrointestinal tract is designed to temporarily allow the absorption of large molecules including antibodies ("immunoglobulins") from the small intestine. This is called "passive transfer" and only occurs during the first 24 hours after birth. Although colostrum contains several different types of immunoglobulins (immunoglobulin G or "IgG", immunoglobulin A or " IgA" and immunoglobulin M or "IgM"), IgG accounts for roughly 85% of the total volume.IgG absorption is most efficient in the first 4 hours of life and declines rapidly after 12 hours of age.At 24 hours, the gut is completely closed and there is no immunoglobulin absorption into the circulation after that time. These absorbed antibodies must

be consumed in order to protect the calf from disease organisms until its own immune system becomes functional (Ace 1973).

Failure of passive transfer of immunity, also called FPT, occurs when a calf fails to absorb an adequate quantity and quality of immunoglobulin. It can be diagnosed with a blood sample drawn between 24 and 48 hours of age; calves are defined as having failure of passive transfer if the calf serum IgG concentration is less than 10mg/mL. FPT has been linked with increased calf morbidity, mortality and a reduction in calf growth rate and feed efficiency. It is estimated that of the calf deaths occurring in the first 3 weeks of life, approximately a third are due to inadequate colostrum intake. Early and adequate consumption of high quality colostrum is considered the single most important management factor in determining health and survival of the neonatal calf. The long term consequences include delayed onset of puberty, decreased first and second lactation milk production, and an increased culling rate of heifers in the first lactation. According to the 2007 National Animal Health Monitoring System survey, approximately 19% of dairy heifer calves in the United states had failure of passive transfer (Appleman and Owen).

There are 4 key factors that contribute to the goal of successful passive transfer of immunity:

1. Feeding high quality colostrum with a high immunoglobulin concentration (>50 g/L of IgG);

2. Feeding an adequate volume (4 quarts) of colostrum;

3. Feeding colostrum promptly after birth (within 1-2 hours and by 6 hours maximum);

4. Minimizing bacterial contamination of colostrum by proper udder preparation, collecting the colostrum in a clean container, and proper storage in a refrigerator or freezer within an hour.

In order to achieve the four important factors listed, it is necessary to examine each one individually and determine what practices can be used by producers to reach this goal.

Many factors come into play in quality colostrum production including breed, age, vaccination status, length of the dry period, season of the year, amount of colostrum produced, and the time it was collected. Although several of these factors are beyond a producer's control, the most important of these is the time of collection. To collect the highest quality colostrum, producers should aim to milk the cow within 1-2 hours after calving with a maximum delay of 6 hours. The concentration of IgG is highest immediately after calving but decreases over time. It is

important not to pool colostrum from multiple fresh cows. Large volumes of low quality colostrum may dilute smaller volumes of high quality colostrum. If a cow produces more than 18 pounds at first milking, the chances are less than 50 percent that it will contain sufficient immunoglobulins. Secondly, with pooled colostrum there is a greater risk of exposing multiple calves to disease pathogens if all of the colostrum is mixed together and fed to all of the new-borns. Watery or bloody colostrum or colostrum from a cow with clinical mastitis should not be used. Additionally, cows with a dry period of less than 45 days often have poor-quality colostrum as well as those animals that experienced poor nutrition or heat stress during the dry period. Older cows tend to have more IgGs than first calf heifers, as they have been exposed to a greater number of pathogens during their lifetimes. There are several tools available for use on the farm to differentiate high and low quality colostrum although none of them are exceptionally accurate. A colostrometer is an instrument that can estimate the IgG concentration by measuring specific gravity (a specific gravity> 1.050 approximates IgG concentration > 50g/L) but the readings are affected by factors such as milk fat content and temperature (Daros et al., 2014).

Feeding an adequate volume is essential especially when colostrum quality cannot be assessed. An average 90 pound Holstein calf should receive a minimum of 100g of IgG in the first feeding or 10-12% of her body weight. Researchers have found that 85% of colostrum samples will be of high enough quality to provide greater than 100 g of IgG if calves are fed 4 quarts in the first feeding. The typical amount in a normal sized calf bottle is 2 quarts so two full bottles must be fed. If possible, feed an additional two quarts to all calves 12 hours after birth. One study illustrated this by measuring serum IgG levels of calves at 24 hours of age. Those fed 4 liters (4.2 quarts) of colostrum at birth and 2 additional liters (2.1 quarts) at 12 hours had an average serum IgG level of 31.1 mg/mL as compared to calves fed 2 litters at birth then 2 additional litters at 12 hours which had an average serum IgG level of 23.5 mg/mL or 24% lower.

The most important factor affecting absorption efficiency is the age of the calf. The aim is to feed all calves within 1-2 hours after birth and by 6 hours at the latest. This is best accomplished by removing the calf from the dam within 1-2 hours of birth then hand feeding a known volume of colostrum using either a bottle or oesophageal feeder. It is generally accepted that either method of feeding achieves acceptable results as long as a sufficient volume in consumed. Calves should not be left on the cow to nurse as these animals experience an exceptionally high rate of failure of passive transfer, mostly due to the delay in suckling. Recent studies have found 46%-61% of calves fail to suckle in the first 6 hours after

birth. Reasons for this delay include a low, pendulous udder, large teats, or poor mothering ability. Calves born in very cold weather or those experiencing a difficult, prolonged birth definitely need to be hand fed promptly due to their delayed ability to stand and nurse (Broughton and Lecce 1970).

Minimizing bacterial contamination is important for two main reasons: 1) bacteria bind up the immunoglobulin in the gut so they do not pass into the bloodstream (decrease efficiency of transport) and 2) contaminated colostrum is one of the earliest potential exposures to infectious agents that cause diarrhoea and septicaemia such as *Salmonella*, *Mycoplasma*, and faecal coliforms as well as the organism which causes John's disease *Mycobacterium avium* subspecies *paratuberculosis* (MAP).Colostrum should have a total bacteria count of <100,000 colony forming units (cfu)/mL and <10,000 cfu/mL total coli form count. Preventing bacterial contamination includes avoiding colostrum from known infected cows, avoid pooling, proper collection from a prepped udder into a clean container, and proper storage. If not fed immediately, it should be frozen or refrigerated within the hour. Frozen samples may be used for up to one year provided there is no freezing and thawing. The IgG in colostrum is considered stable in the refrigerator for approximately 1 week although bacteria counts may reach unacceptable levels if not cooled quickly enough. Refrigerating colostrum in small containers surrounded by frozen water bottles will quickly cool colostrum and decrease the growth of bacteria.An excellent tool to reduce bacterial contamination is pasteurization at 60° C [140° F] for 60 minutes. This is a lower temperature and a longer time than typical milk pasteurization but, is necessary to maintain the IgG activity while still eliminating important pathogens. Immunoglobulins are sensitive to very high temperatures so a warm water bath, rather than a microwave, should be used when thawing frozen colostrum (Corley *et al.,* 1977).

Routine monitoring of the colostrum program allows producers to identify and correct problems to avoid failure of passive transfer in their calves. There are multiple tests available at veterinary diagnostic laboratories to measure blood serum IgG levels (such as radial immune diffusion or the zinc sulphate turbidity test), but the expense and inconvenience of sample submission makes continued compliance difficult. A simple, rapid, and inexpensive on-farm tool that can measure serum total solids (STS) is the hand-held refractometer. The STS is a reasonably good estimation of serum IgG but works best on a herd or group level basis rather than the individual animal. It is recommended to collect blood samples from a minimum of 12 clinically normal (not scouring) calves between 24 hours and 7 days of age. The goal is for 80% or more to exceed an STS of 5.5 g/dL and 90% to exceed 5.0g/dL. Interpreted at the group level, STS results accurately reflect the proportion of calves that have FPT and may

trigger an investigation into the flaws within the colostrum program (FaheyandMcKelvey 1965).

Lastly, producers must be prepared when clean, high-quality colostrum is not available to a new-born calf. The use of a colostrum replacement product offers a convenient method to improve passive immunity by mixing a powdered commercial product containing bovine IgG with water and feeding the calf. A colostrum replacer contains a minimum of 100g of IgG per dose, protein, minerals, vitamins, and energy and is designed to be fed when no maternal colostrum is available. This should not be confused with a colostrum supplement product that is designed to be fed in addition to and after natural colostrum. Colostrum supplements are significantly less expensive than replacement products because they contain less than 50 mg IgG per dose and have no added nutritional value. Calf managers should use supplements as an extender, to fortify poor-quality colostrum, or when inadequate amounts of fresh or frozen colostrumexist (Ace 1973).

In summary, milking the cow within 1-2 hours after calving then feeding the calf the correct amount (4 quarts) of high-quality colostrum immediately (at 1-2 hours of age) are the recommended best management practices for optimal calf nutrition, health, and survival. Colostrum, the milk produced from the mammary gland in the first 24 hours after birth, contains immunoglobulin that, when absorbed by the calf's gut, help protect the calf from common disease challenges. The passing of this protection from dam to calf is called passive transfer. Research has clearly shown that calves with adequate passive transfer grow better, have lower mortality and health cost, and as adults have improved first and second lactation milk production, when compared to calves with failure of passive transfer. Producers should pay close attention to this critical phase of a calf's life through exemplary colostrum management.

Methodology

The questionnaire was developed based on information in the literature and field experiences and addressed issues related to colostrum management such as farmer's education, breed of cows ,herd size, new-born colostrum feeding (timing of first colostrum, volume of colostrum provided),colostrum storage, serum protein monitoring,colostrums quality, checking transfer of passive immunity. The details of questionnaire have been added to the appendix.

Study area and period

Data collection for the present study was performed during November 2019 to December 2019.One distinct geographical area under Sylhet division of Bangladesh was shorted out to conduct this present study. We selected Fenchuganj upazilla under Sylhet district for this study.

Sampling strategy and study population

Farms under Fenchuganj upazilla were selected by using random sampling strategy. A total of 70 farms from 13 villages under the study area was selected for data collection. No biological samples from the study subjects were collected for this present study.

Study design and data collection tool

The survey followed a cross sectional design. Each farm was visited once during the study period.A standard questionnaire was used as data collection tool for the study.

The questionnaire was divided into three sections for data collection i.e., about farmers, farm and herd characteristics and colostrum management systems. The farmers were asked about farm and herd characteristics, timing of first colostrum feeding and amount,volume of extra feeding, monitoring of colostrum quality, method of giving colostrum to calf, storage of colostrums ,checking passive transfer of immunity.

Data management and statistical analysis

Initially data were recorded in paper format questionnaire. Later data were transferred to Microsoft EXCEL sheet. Descriptive statistics were done after compilation of all data.

Results and discussion

A total of 69 questionnaire were finally analysed where response rate was85%. Most of the farmers education level is secondary(Table 1). Most the farmers are main owners of their farm. About 90% farmer's rear local breeds and 85% farmers supply colostrum to calf within half hours of birth as it shows in the table 2. After birth, they hold the calf mouth near to dam and the calf drink the colostrum by sucking. No bottle feeding or bucket feeding of colostrum have been practiced. Farmers don't supply extra colostrum to calf. They have not aware of storage of extra colostrums by frozen method. They also don't know about the passive transfer of immunity, neither about refractometer nor colostrometer to monitor colostrum. If any calf born at overnight, they supply colostrum to calf in next morning.

Table 1. Socio demographic characteristics of respondents and herd size

Variables	percentage %
Education	
Primary (class 1 to 5)	33.33
Secondary (6 to 10)	59.42
Higher secondary or graduate degree	7.24
Farm management	
Own business	80
By other person	20
Herd size	
Less than 5	70
5 to 10	30

Table 2: Colostrum feeding management

Variables	Number	percentage
Colostrum giving		
Yes	59	85
No	10	15
Supplying proper amount		
Yes	0	0
No	59	85

Not supplying colostrums	10	15
Time of supplying first colostrums		
Within half hour	59	85
Within 2 to 4 hours	Not recorded	Not recorded
Supplying method		
By dam	59	85
Bottle feeding	0	0
Bucket feeding	0	0
Not feeding colostrums	10	15
Monitoring colostrums quality after birth		
Screening	30	43
By eye	29	42
Not monitoring and supplying	10	15
In overnight cases feeding		
Other night	35	50
Overnight after birth	24	35
Not supplying	10	15

Our survey highlighted a good overview on colostrum management practices on dairy farms at Fenchuganj in Sylhet. In this study, we see that the herd size of this farms in that village is very small. The average number is 3 to 5 and this indicates small scale farming is most popular in that villages of our study area. The main finding of our study is that vast majority of the farmers provide colostrum to calves after birth. Before conducting the study, our hypothesis was that dairy farm in rural areas may not provide colostrum to their calves due lack of awareness, however, this was not the case. This study also indicates that despite giving

colostrum to calves, farmers are not aware of good colostrum management practices such as proper amount colostrum feeding, timing of colostrum feeding, checking of colostrum quality.

Conclusion

In conclusion, in most the dairy farmers in Fenchugonj provide colostrum to their calves, however, majority do not know the best colostrum management practices which clearly highlight that extension programme needed in rural areas to educate farmers on proper colostrum management practices so that they can practice better colostrum management to minimise dairy calf morbidity and mortality.

Limitations and future direction

Due to time and funding constraint we could not conducted a study with a larger sample size to draw a conclusion with confidence. In future larger scale of study incorporating more upazillas and districts might help to understand the colostrum management practices in dairy calves in rural dairy farming systems in Bangladesh.

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Appendix

Questionnaire

Section 1: About farmers

1. What is your role in the dairy business? (Tick all that apply)

o I am the owner of the farm and involve with day to day management of the farm

o I am the owner of the farm, but management of dairy farms are supervised by

employed person

o Others (please specify)

2. Education of the farm owner

3. Education of employed person who involve with day to day farm activity

1 .Primary 2. Secondary 3.Higher secondary

Section 2: Farm and herd characteristics

4. Which breed do you mainly have on your farm?

o Holstein-Friesian and local cross

o Local breed

o Other dairy breeds (Please specify if applicable)

5. Herd size?

o<5

o 5-10

o 11-50

o>50

Section 3: Colostrums management

6. When you usually fed first colostrums?

o Within 2 h post-natal

o Within 4 h post-natal

o Within 4-6 h post-natal

o Later than 6 h post-natal

o Not recorded, calf drinks from cow

o We do not give colostrums to calf

o Others (please specify)

7. The colostrums amount within the first 12 hours usually

o<2 litres

o 2-4 litres

o >4 litres

o Ad lib

o Unknown, calf drinks from cow

8. Volume of extra colostrums given during 12-24 h

o 1-1.5 litres

o 2-2.5 litres

o 3 litres

o 4 litres

o Ad lib

o No extra colostrums fed

9. Do you monitor colostrums quality?

o Yes

o No

10. How do you monitor colostrums quality?

o Colostrometer

o Refractometer

o By eye

o Others- please specify

11. How is colostrums stored after milking?

o Frozen

o Refrigerated

o Stored without refrigeration

o Not stored

12. Methods of administration of colostrums

o Bucket

o Bottle teat

o Suckling

o Combination of both

o Oesophageal tube

o By dam

o Not recorded

13. Do you have system of monitoring colostrums ingested at first feeding?

o Yes

o No

14. Do you check adequate passive transfer of immunity in calves?

o Yes

o No

15. How do you check passive immunity in calf?

o Direct measuring antibody level in blood

o Indirect measuring antibody level in blood

16. Time to receive first colostrum (overnight calving)

o<4 h

o Other morning

o Dam

o Not recorded