International Journal of Advanced Research & Higher Studies (IJARHS)

Studies on Incidence of Surgical Affections of Udder and Teat in Dairy Farms of Bangladesh

Md. Abdur Rashid Miah

ABSTRACT

Various udder and teat affections are most common in high yielding dairy cows which cause huge economic loss to the dairy sectors. This study focuses on the surgical affections of udder and teat in dairy cows to restore the moderate productive performance as well as the morphology of udder and teat through feasible surgical procedures. Fifty-four dairy cows with various surgical affections of udder and teat were experimented. The amounts of milk yield (litre/day), and the morphology of udder (symmetry of quarters and circumference) and teat (size, shape and height) were recorded just before and after 45 days of the relevant surgical approaches to evaluate the changes. The surgical affections included mostly the teat laceration and fistulae (12.96%), moderately the teat sores, udder abscess, gangrenous teat, papilloma of teat and udder; whereas teat canal polyps, gangrenous udder and caseous lump in udder were less frequent (5.56%)individual cases among the selected dairy cows.

Keywords: *Surgical Affections, Udder & Teat, Dairy Farms, Bangladesh*

INTRODUCTION

Bangladesh is an agricultural country. It is characterized by many livelihood factors like low income, high population, malnutrition etc. It is still food deficit area and has to import huge quantity of grain every year. Approximately 40% people are suffering from malnutrition and about 50% do not have their calorie requirement. In Bangladesh total cattle population is about 236 lacs. Milk is our ideal food. Per day 250 ml milk is need per person. But now milk consumption is 122 ml per person per day. (Agriculture Diary 2016, Ministry of Agriculture). Huge amount of powdered milk is imported every year. The most common surgical affections of udder and teat in cows comprises hematoma, abscess, wound, myiasis, mastitis, ringworm, papillomatosis, udder edema, traumatic injury, mange, teat stensosis, teat obstruction, supernumerary teat, teat fistula, crack, fissure etc. These diseases are of great economic and social importance, because they affect seriously milk production as well as calf and public health. There are some reports on these diseases. Osterkamp (1976) Blood et al, (1979), Meischke (1979), O'connor (1980), Kelly, (1984).

Bangladesh has a high number of cattle population (21.5 million) with about 3.33 million cows in milk (BBS, 2004). The udder and its teats are the most important physical assets of milch cow, which play a vital role in sustainable economic milk production. It is also recognized that the udder characteristics are very important in respect to milk production. Due to position, size, shape and anatomical feature of udder, the dairy cows are susceptible to infection and injuries, which results in mastitis (Shukla et al., 1997). The morphology of teat, especially apex and streak canal are recognized as parts of the passive defense mechanisms against intra-mammary infection. Mastitis is defined as an inflammation of the mammary gland and is almost always associated with bacterial infection. It is one of the major problems of the dairy industry worldwide including Bangladesh. It is also predominantly associated

with some other risk-factors described elsewhere particularly on farms and cows (Kivaria et al., 2004; Van Schaik et al., 2005). Experience in mastitis control indicates that while the occurrence of inflammation in the udder may not be entirely preventable in all cows within herd, the intensity of clinical attacks may be reduced significantly through selection and better management. Information on selection (particularly for cross-bred dairy cows in Bangladesh) of genetic characteristics related to individual resistance against mastitis and in establishing management of udder health control is a necessary prerequisite. Study on mastitis like morphological relationship of udder and teats with mastitis (Ahmed et al., 2005) have been carried out in Bangladesh. However, no comprehensive study to find out the prevalence of udder and treat diseases and their association with udder and teat characteristic, milk yield and milk flow rate in dairy cows has performed.

Preval1diseases including surgical affections reduce the fitness, efficiency and productivity of cattle. Dairy areas of Pabna comprise a major part to meet the demand of milk and meat production in Bangladesh. There is a need to investigate the occurrence of surgical diseases to take proper preventive measures. Therefore, the prevalence of surgical affections of cattle was studied in four Upazila of Pabna from December 2012 to May 2013. A total of 2390 cattle from different households were included and surgical affections were recorded. The overall prevalence was 44.3% in stall feeding system, among which surgical affections were more prevalent in Sujanagar Upazila (13.3%), and the highest prevalent surgical affection was foot diseases (8.2%) followed by navel ill (6.3%), myiasis (4.6%), arthritis, hernia and wounds (3.6%). Overall prevalence of surgical affections was slightly higher in female cattle in comparison to males The prevalence of navel ill (11.3%), foot disease (11.1%), hernia (6.1%) and horn affections (4.9%) were found to be higher in male. Whereas, myiasis (5.9%), upward patellar fixation (2.8%) were found to be higher in females. There is significant (P<0.01) difference in the prevalence of hernia, upward patellar fixation, horn affection, foot diseases and myiasis between male and female. It was also observed that cattle of 0-1 year was affected more frequently with surgical affections (18.7%) among which prevalence of navel ill (15.5%), hernia (8.3%), myiasis (5.4%) and foot diseases (5.3%) were higher. In addition, foot disease was more prevalent surgical affection in cattle of more than one year. Moreover, significant variation (P<0.01) was existed in the prevalence of upward patellar fixation, foot diseases, arthritis and wounds among three age groups. However, results of the present study indicate that there is a strong relation among the prevalence of surgical affections, sex and age of animals. Moreover, foot disease is a common occurrence in stall feeding cattle in Pabna.

Effects of Sex on Surgical Affections in Cattle

The data on the prevalence on surgical affections of cattle in relation to sex are presented in the Table 2 and Fig. 2. In this area, the prevalence of navel ill (11.3%), Foot disease (11.1%), hernia (6.1%), horn affections (4.9%), wounds (4.0%) and arthritis (3.9%), were found to be higher in male cattle compared to that in females. This finding is in consistent with the previous work of Sarkar (2012), who reported 15.07% prevalence of navel ill in Pabna-Sirajgonj. Whereas, the prevalence of myiasis (5.9%) and upward patellar fixation (2.8%) was found to be higher in females. It is important to mention that vulva and perineal region become traumatized during parturition and appear to be common sites for maggot infestation in female animals. Moreover, higher prevalence of upward patellar fixation might be related to the intensive care system, cattle breed, availability of green grass and nutrients (Sarkar, 2012). Teat obstruction (5.0%) and crack (4.3%) were also higher in females as sex specific disease. The causes of treat obstruction may be due to the chronic mastitis and rough handling during milking (Gonzalez et al., 1990). Results of the present study indicate that

there was strong relation between the prevalence of surgical affections and sex of animals. Overall prevalence of surgical affections was slightly higher in female in comparison to male (Fig. 3). There is significant (P<0.01) difference in the prevalence of hernia, upward patellar fixation, horn affection, foot diseases and myiasis between male and female. Effects of age on surgical affections in cattle Prevalence of surgical affections in relation to age was investigated, and Table 3 and Fig. 4 show the occurrence of surgical affections of cattle in three age groups at Aarong dairy area of Pabna. Cattle of 0-1 year was affected more frequently with surgical affections (18.7%) among which prevalence of navel ill (15.5%), hernia (8.3%), myiasis (5.4%) and foot diseases (5.3%) were higher. Kibria (2010) reported the prevalence rate of navel ill in Bangladesh to be 6.56%. Most probable cause might be the lack of proper care of newborns. Navels of new born calves after detachment from the umbilical cord remain raw, which become very prone to injury and infection. Cattle of 1-3 years of age affected more with foot disease (7.5%), wounds (6.6%), arthritis (4.5%) and horn affections (3.7%). Whereas, prevalence of foot disease (12.5%) were higher, followed by teat obstruction (9.3%), teat crack (7.3%), horn affection (6.0%) and upward patellar fixation (5.1%) in cattle of more than three years of age.

Moreover, significant variation (P<0.01) was existed in the prevalence of upward patellar fixation, foot diseases, arthritis and wounds among three age groups. The prevalence of foot diseases was (11.1%) in male and (5.9%) in female. When data categorized according to three age groups we observed that foot disease was common in three age groups, which indicate as a common occurrence in stall feeding cattle. Sarkar (2012) has reported foot diseases (10.85%) to be most common surgical affections install fed female. Several predisposing factors such as concrete flooring system, lack of exercise or grazing, and green mass are common in stall feeding system. The incidence of foot diseases might be related with the outbreak of foot and mouth disease, less exercise and prolong stall feeding as described by other workers (Clarkson and Ward, 1991 and Huang et al., 1995).

Therefore, the present observational study in dairy cows was concerned with the objectives to study prevalence of udder and teat diseases in dairy cows, to study association of mastitis with udder and teat skin diseases and indices, and to study association of milk yield and milk flow rate with host characteristics.
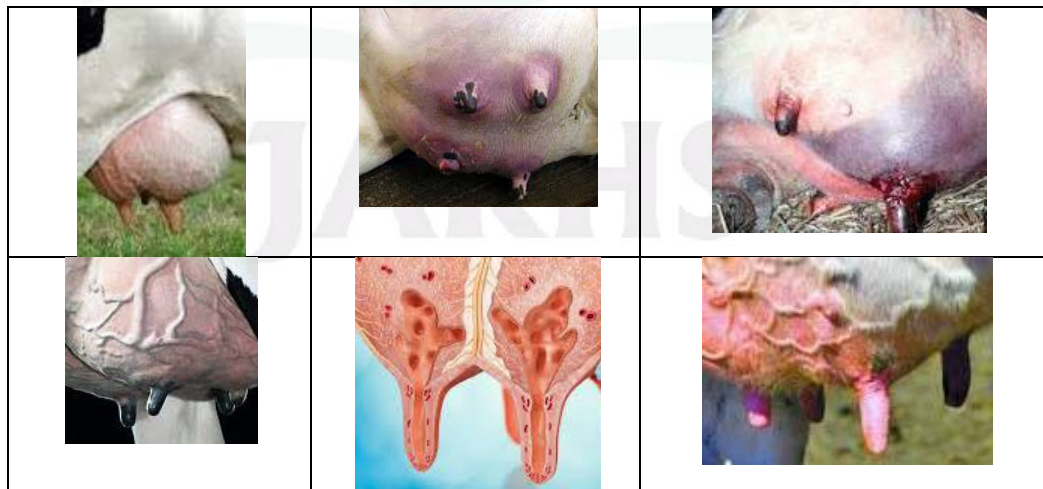
OBJECTIVES OF THE STUDY

The objectives of the study were:
1. To identify the symptoms of surgical affections of udder and teats.
2. To assess the incidence of surgical affection in udder and teat diseases.
3. To determine the techno-economic status of farmers.

MATERIALS AND METHODS

The methods and materials used in the present studies are briefly mentioned here.

Study design: The study designs were techno-livelihood type to visit the dairy farm, physically and clinical examinations mainly comprises of direct visit and detection of incidence of surgical affections of udder and teat in different ages of different size farms.

Study areas: The studies were conducted at livestock rich centers of the country to be selected discussing with Livestock professional and stakeholders. Some Basic data were also be collected from Department of Livestock Service, Dhaka and respective sites.

Variables

1. Respondent:
A. Vet/Graduates-DVM
B. Vet Diploma
C. Trained/skilled Technicians/Attendants

2. Farm size
A. Small- 5-10 animal, family subsistence, no loss no gain
B. Medium- 11- 20 animal minimum persons employed
C. Large->20 commercial cost benefit basis, 3:1

**3. Age of animal**
    A. < 2 calf
    B. 2-4 Calf
    C. >4Calf

Sampling technique: Site selective Random animal sampling technique was adopted for this study.

Sample size: Total 300 respondents were selected for data collection.

Farm sizes were three types, small farm, medium farm and large farm.

From each site, 50-70 small farms, 30-40 medium farms and 10-20 large farms were selected.

Sources of data: Data were collected from primary sources taking help of a questionnaire guideline.
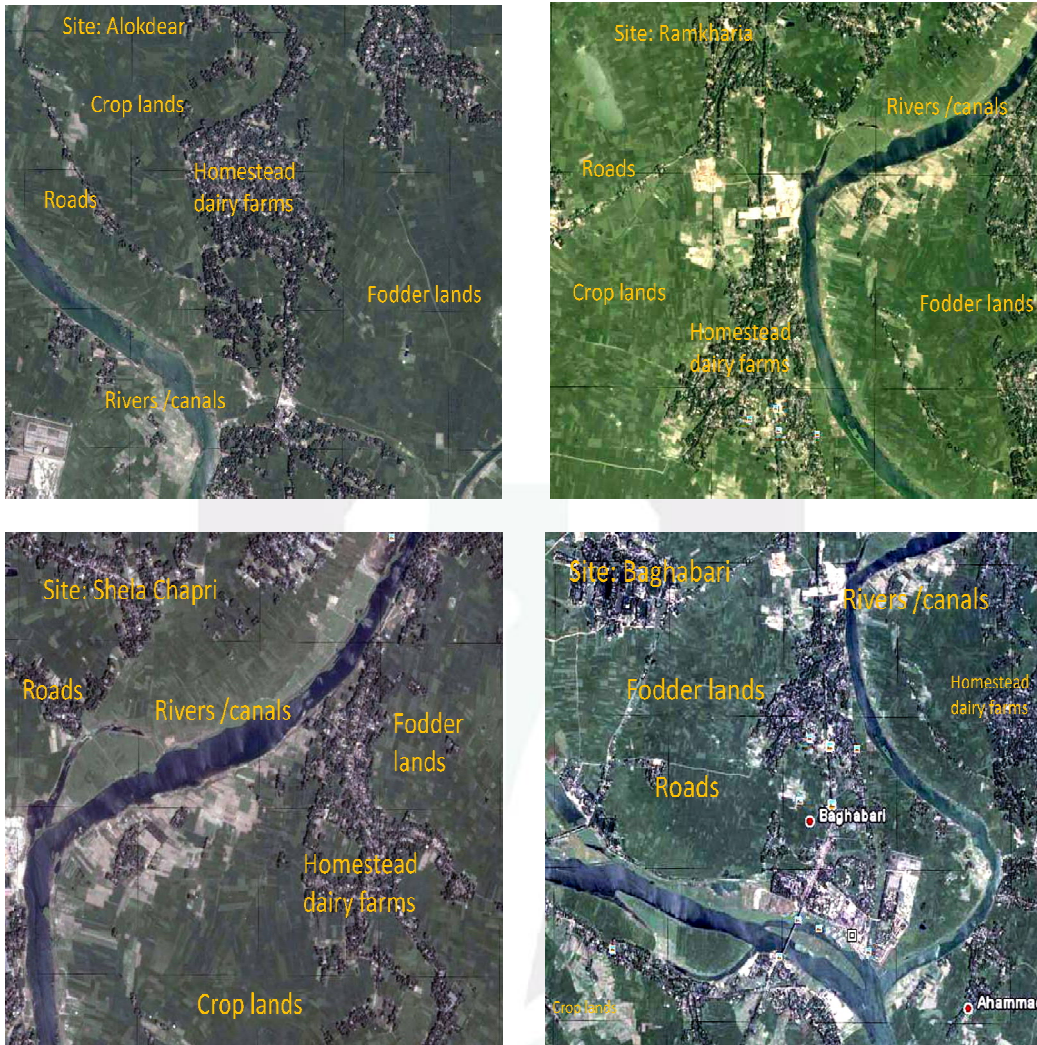
Tools of data collection: Structured Questionnaire was used for data collection. The questions were closed ended supported by clinical evidences and photographs.

Method of data collection: The clinical examination mainly comprises of visual inspection and palpation method by the researcher own taking the help of respective technicians and office records of disease incidences and treatments done.

Research Sites

District: Sirajganj

Village: In the Table

Serial	Farm Size	Village	No. of Far-Farmer	Total	Remarks
1.	Small Farm	Alokdear	17	83	
		Baghabari	53		
		Ramkharia	05		
		Shela Chapri	03		

		Nukali	05		
2.	Medium Farm	Alokdear	05	43	
		Baghabari	33		
		Ramkharia	01		
		Shela Chapri	02		
		Nukali	02		
3.	Large Farm	Alokdear	05	23	
		Baghabari	03		
		Ramkharia	01		
		Shela Chapri	07		
		Nukali	07		

District: Sirajganj

Village: In the Table as number of respondent

Serial	Farm Size	Village	No. of Far-Farmer	Total	Remarks
1.	Small Farm	Number of calf	248	786	
		Number of heifer	146		
		Number of milch cow	318		
		Number of male	74		
2.	Medium Farm	Number of calf	210	612	
		Number of heifer	93		
		Number of milch cow	257		
		Number of male	52		
3.	Large Farm	Number of calf	141	499	
		Number of heifer	67		
		Number of milch cow	238		
		Number of male	53		

RESULTS AND DISCUSSION

The results obtained from the present studies were sequentially presented here entitled as per objectives, sits and parameters. The results collected directly by the researcher was compiled, analyzed and interpreted along with the presentation.

Table 1: Research Sites: District: Sirajganj

Sl	Farm Size	Village	Farmer
1.	Small Farm 5-10 milk cows	Alokdear, Baghabari, Ramkharia, Shela Chapri, Nukali+	166
2.	Medium Farm 11-20 milk cows 1 ha grazing land	Alokdear, Baghabari, Ramkharia, Shela Chapri, Nukali+	86
3.	Large Farm >20 milk cows 3 ha grazing land	Alokdear, Baghabari, Ramkharia, Shela Chapri, Nukali+	48
		Total	300
	No. farming worker 1897		

* 1 ha = 7.5 Bigha

The research sites were 5 villages of shahjadpur Upazila situated in the district of Sirajgonj which were adjacent to the Milk Vita.

Particulars of the study farm

The major characteristics of the Study farms are given in table 2, figure 1 and 2.

Table 2

| Classification	Local	Cross	Improved	Total
Calf	22	62	36	120
Heifer	14	67	30	111
Milking cow	31	119	18	158
Male	19	23	11	53
Others mixed	43	24	13	80
			Total	**622**

The results show there were in all farms studying and these were of 3 breeds and 5 categories where cross breeds were 119 and milch cows were 158 dominated.

Figure 1: As per Breed
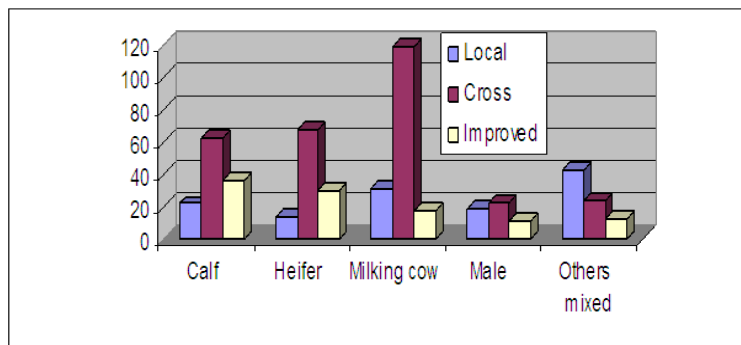
The results show that the farms had milking cows of cross native breeds. Male were mostly at the minimum level.

Figure 2: Farm Characteristics as per Breed Proportion
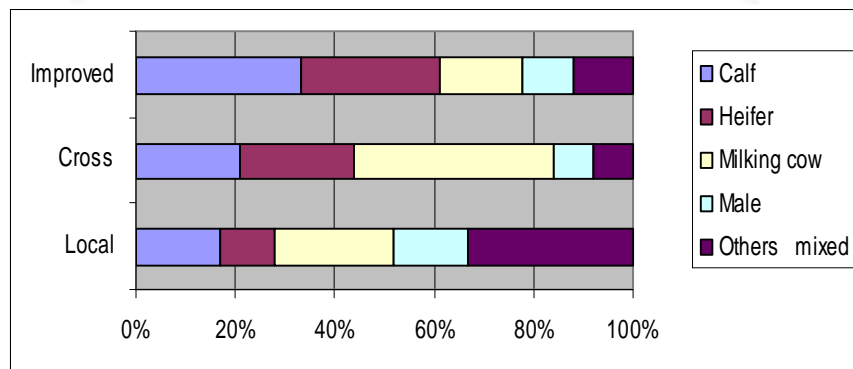
The proportions of breeds were still dominated by cross breeds having less than 40%. Purity of Frizian and Shahiwal. But the calves were mostly of improved breeds. The other mixed mostly were Indian cross breeds namely Sindhi, Hariana and Brahma (gray).

Figure 3: Farm and Animal Characteristics as per Category
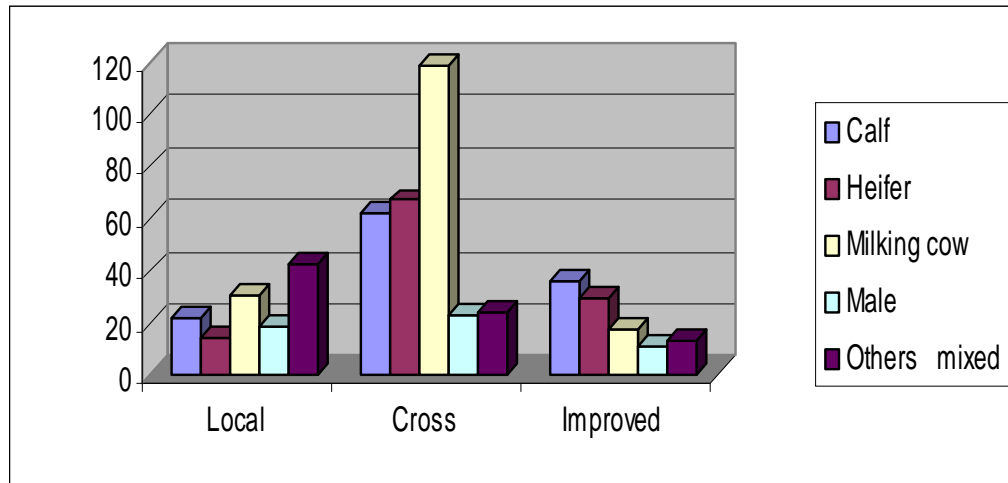
The results show that mixed breeds were mostly local other than Red Chittagong Cow (RCC), Faridpuri Cow (FC, Grayish white), Baghabari Cows (BC, light brown) i.e. old sub-continental breeds.

Table 3: Percent response on main disease problem

	Mastitis	Udder edema	Teat obstruction	Fissure	FMD	Mean
A. Vet/ -DVM	82	73	71	32	11	53.8
B. Vet Diploma	68	79	81	24	15	53.4
C. Trained/skilled	65	81	85	23	19	54.6
Mean	71.6	77.6	79.0	26.3	15.0	53.9

Table 4: Receive information about the diseases

	Small farm	Medium farm	Large farm	Mean
Upazila Livestock Officer	11	23	76	36.6
Veterinary Surgeon	17	29	81	42.3
Field Assistant	69	61	56	62
Trained person	58	53	49	53.3
Friends and neighbors	72	68	45	61.6
Mean	45.4	46.8	61.4	51.2

Table 5: Main clinical Symptoms/ Info source

	Mastitis	Udder edema	Teat obstruction	Fissure	Teat cracks
A. Vet/ -DVM	80	73	71	37	17
B. Vet Diploma	64	81	83	21	19
C. Trained/skilled	60	89	95	28	31

Table 6: Main incidence of the surgical affections/Info source

	Mastitis	Udder edema	Teat obstruction	Fissure	Teat cracks
A. Vet/ -DVM	80	67	72	31	19
B. Vet Diploma	62	83	88	29	25
C. Trained/skilled	55	85	87	33	29

Milk yield and milk flow rate: Information on milk yield was obtained from the farm record made annually and daily. Average daily milk yields in milch was calculated using daily milk yield for 16 day of the current lactation and total annual yield of the previous lactation. In dry cows daily average yield of previous lactation was used in the study. The procedure of obtaining dairy milk yield was described in the literature (Rogers and Spencer, 1991).

Milk flow rate was obtained from milch cows only. Amount (kg) of milk obtained per minute in the first 3 minutes of each milking was considered as milk flow rate. Study of association Statistical Packages for Social Sciences (SSPS) program was used in this study. Chi-square test was performed to have an idea about the association of cow, udder and teat characteristics with mastitis, udder skin and teat diseases (Everitt, 1992). Odds Ratio (OR) and adjusted odds ratio were studied for comparing the risk of developing different diseases. Adjusted odds ratio was estimated by Mantel-Haenszel Method (Schlesselman, 1982). Confidence limits for both the odds ratio and adjusted odds ratio were computed by using Woolf's method (Schlesselman, 1982).

An epidemiologic study was conducted on 581 dairy cows (indigenous and its crosses 371, exotic crosses 210) of 4 government establishments to find prevalence of udder and teat diseases and their association with udder and teat characteristic, milk yield and milk flow rate in dairy cows. Mastitis (25.5%) was most common disease followed by udder skin diseases (15.0%) and teat diseases (12.6%). Prevalence of injuries and other lesions was higher in the skin of fore left udder quarter (22.7%) and teat (17.7%) and rear left teat end (4.5%). Mastitis was found to be associated with Sahiwal and Sindhi cross cow, poor body condition, bottle shaped teat, teat with round end, injuries and other lesions to the udder and teat skin and teat diseases. Udder skin diseases were strongly associated with indigenous cows, cow aged 5-10 years, small milk vein, larger front udder, and bottle shaped teats and flat end teats. Milk flow rate was higher in Sahiwal and Sindhi cross cows, large milk vein, larger front udder, funnel and cylindrical teats and pointed teat ends. Risk factors of udder and teat diseases, milk yield and milk flow rate in high yielding indigenous and its cross cows were not similar to those of exotic cows and their crosses. The relationship of udder and teat diseases; and udder and teat characteristics varies with the genetic composition of the dairy cows. Therefore, further genomic study needs to confirm association of udder and teat diseases with host characteristics.

SUMMARY
Incidence of the clinically identified surgical affection diseases:
Udder tenderness Teat inflammation: 30 *Respondent persons*
Main disease problems: Small farm
Mastitis and teat obstruction: 76

Main disease problems: Medium farm
Mastitis and teat obstruction: 39
Main disease problems: Large farm

Mastitis and teat obstruction: 22

Main disease and clinical symptoms:
Udder tenderness and teat inflammation: 58

Main incidence of surgical affection:
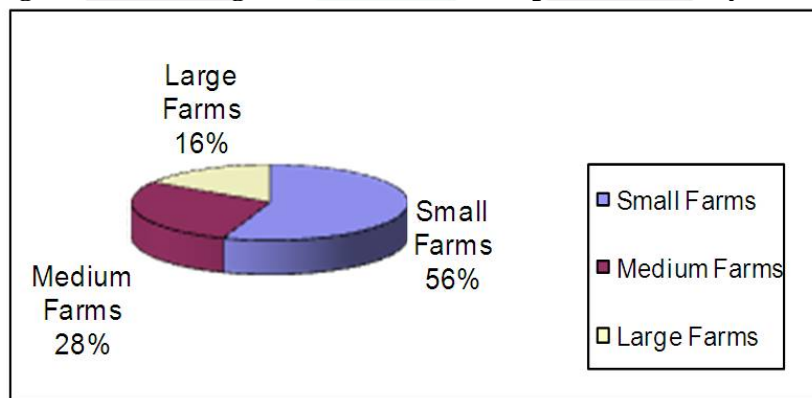Udder tenderness and Teat inflammation: 16

Incidence of the clinically identified surgical affection diseases:
Udder tenderness Teat inflammation: 30

Mastitis and teat obstruction:
- 76 Small Farms
- 39 Medium Farms
- 22 Large Farms

Figure 4: Percentage Disease incidence as per size of Dairy Farms

In summarized results show the Pie Diagram that small farms were very high percentage of diseases incidence i.e. 56%, medium farms were 28% & large farms were 16% diseases incidence, which were lowest due to application of proper technology i.e. Housing, Feeding, Breeding, Prevention & Control.

RECOMMENDATIONS
The study was conducted during 2014 to June 2016 on 350 dairy farm belonging. To four Government establishments viz. Government Cattle Improvement and Dairy Farm, Rajabari, Rajshahi (n=181); Bangladesh Agricultural University Dairy Farm, Mymensingh (n=28); Govt. Central Cattle Breeding Station and Dairy farm, Savar, Dhaka (n=323) and Sylhet Govt. Dairy farm, Tilagar, Sylhet (n=49). Both milch 479 (82%) and dry 102 (18%) cows were included in the study. Of the 581 dairy cowsin this observational study most of them were high yielding indigenous cows and their crosses. There were 208 (35.8%) indigenous cows, 163 (28.1%) indigenous cross cows, 101 (17.1%) Sahiwal and Sindhi cows, 45 (7.7%) Jersey and Friesian cross cows and 64 (11.0%) other breeds of cows. The herds were semi-intensively managed under experimental managerial system. Most of the cows were hand milked. High yielding cows were milked twice daily at 6-7 am and 4-5 pm. The data were collected in sketch cards (for ease of farmers) specifically designed for the purpose. The sketch cards were pre-tested prior to their final use.

Explanatory variables Cow characteristics:

Information on age and breed were collected from farm register. Body condition score was measured as suggested by Radostits and Blood (1985). Thickness of the skin at axilla was graded arbitrarily on the basis of digital palpation into thick, medium and thin. Udder characteristics: Udder balance was judged on the basis of size of the quarters on inspection (Slettbakk et al., 1990). The size of the milk vein was classified arbitrarily into large, medium and small. Teat characteristics: Teat characteristics were recorded after milk ing.

The shape of the teat was classified according to description on Ovesen (1992) as follows: funnel, cylindrical and bottle. The teat end shape was classified as pointed, round and flat. Response variables Udder diseases: Sample of milk from each teat was collected separately and tested immediately for sub-clinical mastitis using modified Whiteside test (Rahman et al., 1997). Record of clinical mastitis was obtained mostly from patient register of the farms. Cases of clinical mastitis were also diagnosed on the cows individually (Nooruddin et al., 1997). Tick infestation and other udder skin diseases or lesions were diagnosed on the basis of physical finding of the lesions (Radostits et al., 1995) as recorded by close inspection.

Teat diseases and defects: The condition in which passage of milk and as a result, the process of milking was any way obstructed was diagnosed as teat stenosis (Roine, 1975). Teat papilloma was characterized by fron (warty, rough, filiform), and round and rice given types (Nooruddin et al., 1997). Teat injuries were characterized according to Rahman et al. (1997) by chapped fissure (cracked skin), acute hemorrhagic lesions and scars. Other teat diseases and defects were identified using physical characteristics of lesions.

The most common cause of disability in animals is the surgical affections, which may be curable if appropriate measures are taken in time. This report on the prevalence of surgical affections of cattle in Aarong area of pabna will be an effective tool for the policy makers to determine appropriate course of action to improve the health status of cattle population. Further study is required in this area to improve the herd health.

REFERENCES

1. Abd El Bary, A. A. G. (2000) Surgical Affection of the Udder and Teats in Friesian Cows. M. Sc. Thesis of Veterinary Medicine (Surgery), Zagazig University, Banha Branch.
2. Ahmed JU, Sutradhar S and Rahman MM (2005). Morphological characteristics of udders and teats in relation to mastitis and milk yield in crossbred dairy cows. The Bangladesh Veterinarian22: 23-28.
3. Ali MH, Bhuiyan MKJ, Alam MM 2011: Retrospective epidemiologic study of diseases in ruminants in Khagrachari hill tract district of Bangladesh. Bangladesh Journal of Veterinary Medicine 9 145–153.
4. Blowey, R.W and Weaver, A.D (1991). A Colour Atlas of Diseases and Disorders of Cattle Publishing Place London provider Nolfe Chapter II udder and teat disorders pages- 177-188.
5. Couture Y and Mulou, P.Y. (2005) Procedures and Surgeries of the Veterinary Clinic Animal, March (2005) Volume 21, pages-173-204.
6. Dobicki A, Juszczak J, Marcinkowski K and Szulc T (1980). Udder health in relation to some udder structure characteristics and milkability of cows. Medycyna Weterrynaryjan 36: 107-110.
7. Everitt BS (1992). The analysis of contingency tables. Ch apman & Hall, London, pp. 6-10.

8. Ganga NS, Ananda KJ, Kavitha RB, Kotresh AM, Shambulingappa BEandPatel SR (2011).Navel ill in new born calves and its successful treatment. Veterinary World, 4:326-327.

9. Gonzalez, R. N., Jasper, D. E., Kronlund, N. C., Farver, T. B., Bushnell, R. B. and Ilinger, J. D. 1990. Clinical mastitis in two California dairy herds participating in contagious mastitis control programs. Journal of Dairy Science, 73: 648-660.

10. Hossain MA, Shahidullah M, Ali MA 1986: Surgical disease and reproductive disorders recorded at the Veterinary Hospital of Bangladesh Agricultural University, Mymensingh, Bangladesh. Bangladesh Veterinary Journal 20 1-5.

11. Hossain, M.S., 2001. Biological aspects of the coastal and marine environment of Bangladesh, Ocean & Coastal Management 44, pp.261-282.

12. Huang, J., Offer, J. E. and Hyslop, J. J. 1995. The cow and her cubicle. Proceeding of the 5th International Symposium on Disease of the Ruminant Digit. J. Br. Vet. Assoc., 7: 276-278.

13. Husain M2007).On farm diagnosis of subclinical mastitis in lactating dairy cows. MS Thesis. Department of Surgery and Obstetrics, Faculty of Veterinary Science. Bangladesh Agricultural University.

14. J. D. Mc Lauchlan, W. M. Henderson 'The Occurrence of Foot-and-Mouth Disease in the Hedgehog under Natural Conditions', The Journal of Hygiene, Vol. 45, No. 4 (Dec., 1947), pp. 474-479

15. Jackson, T., Oliver, M., 2000. The viability of solar photovoltaics, Energy Policy 28, pp.983-988

16. Millikan L 1999: Myiasis. Clinics in Dermatologic 17 191-195. Noman ASM, Juyena NS, Alam MM, Ferdousy RN, Paul S, Haq MM 2013: Prevalence of surgical affections of cattle in Aarong Dairy Area of Pabna. Progressive Agriculture 24 85–92.

17. Miyan, H.A. 1996. Towards sustainable development: The national conservation strategy of Bangladesh. Consultancy report on the livestock sector. Ministry of Environment and Forestry, Dhaka, Bangladesh.

18. Nooruddin M, Rahman MS and Rahman MM (1997). Prevalence a nd distribution of teat papillomatosis in crossbred and exotic dairy cows. The Bangladesh Veterinarian 14: 5-7.

19. Oltenacu PA, Frick A and Lindhe B (1990). Epidemiological st udy of several clinical diseases, reproductive performance and culling in primiparous Swedish cattle. Preventive Veterinary Med 9: 59-74.

20. Oversen E (1992). Milking ability in relation to size and shape of teats. Animal Production 15: 251-257.

21. Rahaman MS, Nooruddin M and Rahman MM (1997). Prevalence and distribution of mastitis in crossbred and exotic cows. The Bangladesh Veterinarian 14: 15-18.

22. Samad, M. A. 1998. Veterinary Clinician Guide. Bangladesh Agricultural University Campus, Mymensingh. Lyric-Epic Prokasoni. pp. 23-45.