Reproductive Performances and Management Effects on Productions of Indigenous Dairy Cows Raised at *Char* Areas in Northern Bangladesh

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Abstract- **The study was conducted to assess the existing reproductive performances and the effect of nutritional supplementation on productions of indigenous cows in *Char* areas (remote river Jamuna sand islands) in northern part of Bangladesh from October 2009 to March 2010. The study also projected the frequency and determinants of long calving interval (LCI), retention of foetal membrane (RFM), dystocia (D), and abortion (A) in indigenous cattle and explored production trends. Fifty seven dairy households (average breedable cows = 2, range 1 to 3) were visited and data on reproductive, breeding and management histories were collected and statistically analyzed. Overall, 125 breedable indigenous cows were observed to be alive at different stages. The mean (±SE) calving interval were 492 ± 15days and the interval between calving and the initiation of ovarian activity were 143 ± 6.7 days. Birth rate was 53.7 per 100 cows year, with birth been reported to occur in all over of the year. Of the 87 cows that were reported to have calved more than once in their lifetime, 6(6.9%) and 5(5.7%) were associated with abortion and dystocia, respectively. Eight (9.2%) of the animals suffered RFM. All cows were dewormed and supplemented with vitamin-mineral premixes. The body weight of 125 cows and the milk yield of 71 lactating cows were recorded. The mean (± SD) body weight and daily milk yields of the cows during initial and end of veterinary interventions were 121.1 ± 21.0 kg, 1.5 ± 0.1 litres; 165.0 ± 14.0kg and 2.3 ± 0.02 litres, respectively. After productive veterinary interventions, there was an apparent effect of improved health on body weight gain (80g/cow/day) and the average milk yield increased from 1.5 to 2.3 litre/cow. It was concluded that, the present estimate of LCI, birth rate, prevalence of peripartum disorders attributes as the indicators of poor reproductive performances of cows and the productive veterinary health care services improved the general health and production status of the dairy cows in *char* areas.**

Key words: Indigenous cow, Production, Reproductive performance, Char areas, Bangladesh

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Introduction

About 80% of the poor and 36% of ultra-poor people of Bangladesh live in the island of river, called '*Char*' (Low lying flood and erosion-prone areas in or adjacent to major rivers) [2]. Most of them are ultra-poor. The donor organization come forward to stand beside the *Char* dwellers and donated cattle as a living asset. Although the *Char* dwellers rear livestock as a major means of livelihood [3; 4] is not without constraints. The productivity of cattle is low because of poor genetics [5; 7] nutrition [8] herd health management, lack of veterinary service and the poor marketing system [9; 12]

Profitability of dairying is to the larger extent determined by reproductive performance [13]. The main index to estimate reproductive performance is the calving interval (the period in days between two subsequent calving). Calving interval is an important index of cow reproductive performance and calving interval of 365 days is desirable for efficient production [14]. For smallholder dairy cattle in others areas of Bangladesh, the calving interval are reported as 487 to 494 days [15] and much longer days are also observed [16]. These intervals are considerably longer than the standard recommendation of 430 days under tropical conditions and they reflect evidence of poor reproductive performance in such farms [17; 18].

Milk productions increasingly become recognized as a catalyst for livelihood and social development [19]. Increased milk production per cow is the most practical way to decrease production cost. The success rate at village level community based dairy development has proved successful in certain plain land areas of Bangladesh (e.g. Grameen Motsho Foundation, Milk-Vita, and Field Fertility Clinic of BAU: [8; 20; 21]. It provides regular returns to farmers, especially to destitute women, enhances

household nutrition and food security and create off-farm employment-as many as 10-20 litres of milk processed and marketed[22].

The ultra poor people living in the *Char* areas of northern Bangladesh keep a significant number of unproductive cows, and are unable to ensure food security. It is imperative to improve productivity in order to increase food production and alleviate poverty.

No comprehensive reports on productive potentials of indigenous cows under various management conditions in *Char* areas of Bangladesh [23; 29].

Therefore, the present study was carried out so that information's on the real problem and magnitude can be identified, quantified and availed to policy makers and other key stake holders i.e. researchers etc so that interventions can be made available for controlling the problems for small scale milk producers having at least one cow in *Char* areas.

Materials and methods

Study area

The study was conducted from October 2009 to March 2010 at the *Char* area of river Jamuna at Sirajgonj district of Bangladesh covering five villages of Bordhul, Bonkhuri, Bilmohisha, Gach Chapri and Khidra Chapri of Belkuchi Upazila (Sub district).

Animals and study procedures

Fifty seven dairy households for the study were randomly selected from five *Char* villages on the basis of having at least one breedable cow. These households contributed 125 breedable female stocks of various physiological statuses that were eligible for the study. The farms were visited at least three times (cross-sectional study) during the study period. All the information collected (excepting calving dates) related to animal events occurring in, or relevant to 2009. The data on 125 cows were collected using pre tested questionnaire from 57 cattle households by direct interviewing of the owner. Information about dairy husbandry training of owner, numbers of cows, herd health [breed, age, body weight, Body Condition Score (BCS)], feeding and grazing system, milk yield, reproductive performance, awareness and monitoring of oestrus signs, source and distance to breeding bull (in kilometers), calving dates, any histories of abortion, dystocia and retention of fetal membrane of animals were obtained.

Veterinary Interventions

Selected animals were dewormed with a combination of Triclabendazole INN 900 mg and Levamisole 600 mg (Renadex®, Renata Animal Health Limited, Dhaka) @ 19.5 mg/kg body weight orally. In another group, only the pregnant cows were treated to deworm with Nitronil (Dovinix® , MERIAL-17,rue Bourgelat 69002 Lyon-France) subcutaneously @ 1 ml/25 kg body weight in every three months with the supplementation of vitamin-mineral premixes [Vitamins AD_3E 10,000,000, 1,000,000 iu & 10g, respectively and Trace Minerals Co-0.20g, Cu-1g, Fe-6g, I-1g, Mn- 1.20g, Se-0.01g & Zn-2g (Renavit DB®) & Combination of Zn, Mn, Cu, Co & Amino Acid (Availa® 4); Renata Animal Health Limited, Dhaka] @ 1 gm/kg of feed and @ 4 gm/120 kg body weight orally, respectively.

The nutritional status of each animal was assessed through body condition scoring (BCS) using a scale of 1 (thin) to 5 (fat). Body weights were taken by using measuring tape (RONDO®, Hauptner-Instrumente GmbH, CH 8304 Wallisellen SWITZERLAND). The data were recorded at regular intervals during the study period.

Definition of reproduction parameters

Birth rate (BR): was defined as the proportion of total number of births in 2009 to total number of cows alive or cow days in 2009[30].

Calving interval (CI): was defined as the average interval between the two most- recent consecutive calving for each cow in each herd.

Long calving interval (LCI): was considered to occur if the CI was beyond the standard recommended of 430 days under tropical condition [17; 18].

Abortion (A): was defined as the expulsion of one or more calves < 271 days after natural mating or artificial insemination [31].

Foetal membranes (FM): were considered retained (RFM) if they remained unexpelled for at least 12 hours after calving or abortion.

Dystocia (D): was considered to occur if parturition was assisted either by the farmer or by a veterinarian.

Statistical analysis

Animal and farm level explanatory variables were statistically analyzed for descriptive statistics (i.e. means, frequencies) using Statistical Package for Social Sciences (SPSS) computer program. The outcome (dependent) responses investigated were LCI and evidence of RFM as binary variables. The variables subjected to compare were used t-test and Modified Duncan Multiple Range Test (DMRT) was used for test of significance of means with unequal subclass number [32].

Results and discussion

Cattle, composition and management

All selected households were visited and farmer interviewed during the period of October 2009 to March 2010. The dairy cattle in the study area were indigenous cow, open field grazing throughout the year. Of the 125 cows examined, 29(23.2%), 25(20.0%) and 71(56.8%) were dry, pregnant and lactating cows respectively, at the day of examination. The proportions of cow in each category of each variable investigated are detailed in Table 1.

The average number of breedable females (cows) per farm was 2 (range, 1 to 3). The average age and mean body weight (kg) of the investigated cows were 5 years and 148 ± 8.4, with range varying from 3-8 yrs and range of 100 to 310kg, respectively.

Body condition score (BCS)

The overall mean (±SE) body score was 2.8± 0.04. No single cow was recorded to have a score of 0 and >4.0. Majority of the cows (72.8%) had a body score ranging from 2.0 to 3.5. Since the score was performed at a particular point time, the current estimate may not be adequate to compare with other works and draw conclusions from.

The distance between cow bull sources

The distance to breeding bull for natural service tended to affect the efficiency of mating. The *Char* dwellers also keep the breeding bull as valuable living assets and the bull are available within 1 km for natural service of the cows. The distance range between cow area of domicile and the bull source can influence reproduction in several ways: delayed mating or late mating of cows, discourage or retard the morale of trekker. Long distance trekking may impose stress on cows, resulting in low conception rates. The observed ratio of cow to bull in the study area was noted to be 31: 1. This ratio was considered to be lower considering the terrain areas.

Heat sign awareness

Knowledge on heat signs is important element for improved reproduction efficiency. Of the interviewed farms, fifty two (92%) of the participants could recognize at least one of the cardinal signs of heat namely bellowing. Over 50 % could recognize other signs like discharge white mucous, mounting other cows and restless shown in Figure 1.

Farm dynamics, fertility and birth trends

Information gathered from study farms includes detailed tracing of all cows that stayed at some stage in the study households during the study period. 7 animals left the study areas due to various reasons including, 5 (71 %) sold for paying back credit, and 2 (29%) left for other reasons including gifts as dowry. During the same period, 3 animals entered the study area as a result of purchases for breeding (3; 100%). Three cows were reported to have stolen. No animal was reported to have died. At the end of the study, data were available for 125 breedable females above study period.

Pattern of births

Between January 2009 to December 31, 65 calves were born. Of the born alive calves, 35(53.8%) were males and 30 (46.2%) females. Births were reported to occur in all months of the year. However, a substantial proportion of calves were born in June, September and October. The few numbers of births in May is difficult to explain. The temporal patterns of birth are shown in Figure 2. The estimated overall birth rate was 53.7 per 100 cow's years. The estimated birth rates for each age category are shown in Table 2. Cows above 4 years old had significantly higher birth rates ($P< 0.01$). The overall estimated birth rate was lower than that reported in some studies [33] and comparable to that reported in small-scale farms in Bangladesh [20]. Again this observation suggests problem of long calving interval in smallholder dairy farming are broadly similar.

Calving interval (CL)

The mean (mean ± SE) estimated CI of the cows that had calved more than once was 492 ± 15 days. The estimated mean calving interval was longer than that previously reported for indigenous and crossbred cows in Bangladesh [34;36] however, consistent with the figure recorded in smallholder dairy farm in other part of the country [15; 37] but longer than recommended interval of 430 days in dairy cattle [17; 18]. Such a long calving interval implies that farmer's income suffers because cows spend a greater portion of their lactation at low production levels. The calf crop is also reduced. The mean interval between calving and the initiation of ovarian activity was 111 ± 6.7 days. This interval is comparable to the value of 108 ± 36.32 days reported by [34] for the Indigenous cattle breed in Bangladesh and slightly higher than the finding of 95.89 days reported by [38] for crossbred dairy cattle raised at farm conditions in Bangladesh. These figures reflect a postpartum anoestrous or silent oestrus or poor heat detection problem in the animals. This might have contributed to the long calving interval obtained in this study. Sixty to ninety days postpartum is recommended for mating exotic dairy cows [13; 14]. The observed long calving interval predicts reduced reproductive efficiency, which may also be due to diseases, poor nutrition and poor management.

Prevalence of abortion and peripartum problems

Of the 87 cows that were reported to have calved more than once in their lifetime 6(6.9%) and 5(5.7%) were associated with abortion and dystocia,

respectively. Evidence of retention of fetal membrane was reported from 8 (9.2%) cows only. This finding is consistent with the finding of 10.3% reported by Islam et al (2013) and slightly lower than the 13.4% fetal membrane retention estimated in smallholders dairy cows of Rajshahi region in Bangladesh [39].

The recorded prevalence of 9.2% cases of retention of fetal membrane is within the limit of 5% to 12% in normal population of calving dairy cows reported by [33] and [40]. Causes such as nutrition, diseases such as brucellosis and factors associated with cross breeding may be responsible for the observed cases.

The observed incidence of abortion was higher than the level of 5% considered normal [41]. The detected abortion of 6.9% reflect significant economic loss in terms of calf crop, drop in milk production, costs of treatment and prolonged calving interval and also danger to public health. The actual cause(s) of abortion in the present study were not ascertained. However, occurrence of infectious diseases and some locally un-measurable factors might contribute to abortion.

Milk yield

The mean daily milk production of indigenous cow at before nutritional supplement were 1.5 ± 0.1 litres and after deworming and nutritional supplementation over a moth milk yield were increased to 2.3 ± 0.02 litres (Table 3): the differences were significant ($p<0.001$). The finding were consistent with the value of 2.1±0.41litres reported by [35] in other part of Bangladesh. This result was slightly lower than the findings of [36] where, daily milk production of indigenous and crossbred cow was 2.6 and 4.9 litres, respectively. Results also partially agree with those of [42]; [37] and [26].

The milk yield was significantly ($p<0.001$) affected by feeding intervention which is similar to the findings with the [42] who observed that feeding significantly ($p<0.01$) increased the milk yield in indigenous cow and also reported by [43] in crossbred cows in Bangladesh. Milk yield is highly heritable, as cows produce more milk either by using ingested food or by mobilizing body fat [44]. Management and nutrition are important for milk production and fertility [45; 46].

Body weight

The initial mean body weight was 121.1 ± 21.0 kg/cow which improved to 165.0 ± 14.0 kg/cow after productive veterinary interventions (Table 3). The mean daily body weight gain of indigenous cow was 80g/day. The weight gain was significantly ($p<0.001$) affected by feeding intervention which was consistent with the body weight gain 76.8 ± 2.5gm/day of indigenous cow in Bangldesh reported by Alam et al., [47] and Khan et al., [48]. Ghosh et al. (1993) found that UMMB plus green grass supplementation improved body condition. Body weight change is a major determinant of postpartum reproduction [50; 51]. The increase of body weight probably would have been due to better assimilation of deworming and vitamin minerals supplementation and better conversion to body tissue.

Conclusions

The present study estimate the long calving interval is the indicator of poor reproductive performance of indigenous cows on *Char* areas. It may be concluded that factors contributing to this situation seem to be mal-factorial; accessibility to breeding bull, poor heat detection, poor nutrition, late resumption of ovarian activity and risk of abortion and peripartum disorders (dystocia, retention of fetal membrane). Delivery of productive veterinary health care services significantly ($p<0.001$) improved cows' health and increased milk production. Further detailed investigation is necessary to identify and quantify the specific reproductive disorders attributing to such poor performance.

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Table 1: The proportions of cows in each category of each variable investigated during the study (n=125).

Variables	Categories	Number of animals,%
Animal level variables		
Age	3 to 4 yrs	45(36)
	>4 to 6 yrs	65(52)
	> 6 yrs	15(12)
Condition score	0 to 2	23(18.4)
	>2 to 3.5	91(72.8)
	>3.5 to 5	11(8.8)
Bull location	< 1 km	117(93.6)
	>1 km	8(6.4)
Parity	1 to 2	72(57.6)
	>2 to 4	31(24.8)
	> 4	22(17.6)
Physiological state	Dry cows	29(23.2)
	Pregnant	25 (20.0)
	Lactating	71(56.8)
Body weight (in kg)	100 to 150	37(29.6)
	>150 to 200	62(49.6)
	>200	26(20.8)
LCI (n =87)	>430 days	56(64.3)
	<430 days	31(35.6)
RFM (n =87)	Yes	8(9.2)
	No	79(90.8)
Farm level variables		
Attended a training course	Yes	7(5.6)
	No	118(94.4)
Gender: owner	Male	58(46.4)
	Female	67(53.6)
Feeding minerals	Yes	12(9.6)
	No	113(90.4)

Table 2: The birth rates by age category for cattle on smallholder dairy household in *char* area of Bangladesh

Age category	Number of births	Cow time in years	Birth rate per 100 cow-years
3 to 4 yrs	9	22	40
> 4 to 6 yrs	39	69	56.6
>6 yrs	17	30	56.7
Overall	65	121	53.7

Table 3: Average milk production and body weight in cows

Variables	Before intervention (Mean ± S.D)	After intervention (Mean ± S.D)	Difference	t-Value
Milk yield(lit.) per cow	1.5 ± 0.1	2.3 ± 0.02	0.8	6.07**
Body wt. gain (kg) per cow	121.1 ± 21.0	165.0 ± 14.0	43.9	20.44**

S.D= Standard deviation; ** = Significant at (P<0.001)

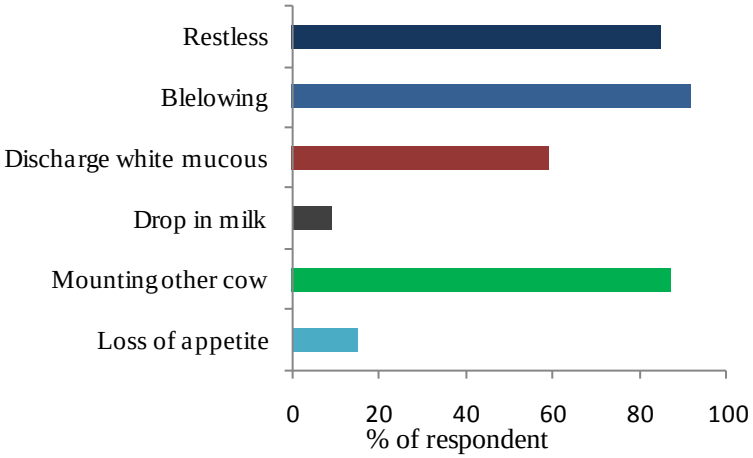

Fig.1: Percentage of respondent of heat detection in cow following different heat signs in char areas of Bangladesh.

Fig.2: Temporal pattern of birth in cow throughout the year

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