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Factors Limiting the Pregnancy Rates in Artificially Inseminated Cows in Bangladesh

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ABSTRACT

The study was designed to determine the effects of breed, age, parity, feeding practice, Body Condition Score (BCS), timing of insemination, postpartum insemination interval and milk yield on first service pregnancy rates in cows (n = 308). The demographic factors were recorded by interviewing the farmers. All cows were examined for pregnancy diagnosis by rectal palpation of genital tract at 60-80 days post Artificial Insemination (AI). The pregnancy rate of different groups was compared and analyzed by Z test using SPSS software version 17. The overall pregnancy rate in cows was 52.6%. Though the age and parity of cows and milk yield did not affect significantly on pregnancy rate, the pregnancy rate was the highest in cows of 3-5 years of age (56.1%), in cows of parity 1-2 (57.4%) and in moderate yielding (2-5 liters milk/day) cows (62.1%). Balanced feeding and timing of insemination had a profound impact on the pregnancy rate of cows. The pregnancy rate in cows fed with combination of green grass, straw and concentrate was significantly ($p < 0.05$) higher (63.5%) than cows fed only straw (38.5%). The pregnancy rate in cows with BCS 3-4 was significantly ($p < 0.05$) higher (58.0%) than that of BCS 1.5-2 cows (35.0%). The pregnancy rate in cows inseminated at 6-12 h after the start of standing estrus was significantly ($p < 0.05$) higher (58.8%) than those inseminated 13-24 h after start of standing estrus (40.4%). Cows with good BCS and AI at 6-12 h after the start of standing estrus are the best choice of selection for getting the best result in the first service pregnancy rate in cows.

Key words: Pregnancy rate, AI, BCS, parity, milk yield

INTRODUCTION

Dairy is an important sector for rural development and poverty alleviation in Bangladesh but reproductive potentiality of native cattle is very low. Herd profitability is majorly determined by dairy cows reproductive performance (LeBlanc, 2007). Four main factors affect reproductive efficiency in dairy herds: days postpartum at first AI, estrous detection rate, pregnancy per AI (P/AI) and pregnancy loss (Risco and Retamal, 2011). Fertility or conception or pregnancy of dairy cows has a great importance to meet today's expectation of dairy man to get one calf per cow per year. This places an increased emphasis on the need to understand factors that affect fertility/pregnancy, encompassing both herd level management factors and individual cow factors (Hudson, 2011). To improve the reproductive efficiency of cattle, Artificial Insemination (AI) using semen from numerous improved zebu and temperate cattle has been introduced for years (Ahmed and Islam, 1987). Despite introduction of AI for long time, still the reproductive efficiency

of cattle in Bangladesh is below the satisfactory level. Thus, dairy producers have challenging complaint about a poor reproductive performance in animals using AI (Lemma and Kebede, 2011). The major constraints of reduced efficiency of dairy cattle in Bangladesh are low Conception Rates (CR), a large number of services per conception, prolonged calving to first service interval, poor heat detection (Alam and Ghosh, 1988; Shamsuddin *et al.*, 2001). However, pregnancy rates of cows with AI may be affected by many factors.

Major reproductive performance factors encompass both herd-level management factors (such as methods of husbandry, feeding, estrus detection, semen handling and transition cow management) and cow-level factors (such as age, BCS, post parturient problem, disease events, milk yield and genetics) (Lucy, 2001; Hudson *et al.*, 2012; Lopez-Gatius, 2013; Muller *et al.*, 2014). Tesfaye *et al.* (2015) stated that BCS and age of the cow, management system and AI service performance affect the reproductive performance of the smallholder dairy farms. Pena *et al.* (2004) reported that intervals parturition to first AI shorter than 51 days, dystocia, autumn calving and cows with parity equal or more than 5 and Paul *et al.* (2015) reported age, parity, body weight, feeding and milking practice are risk factors for low pregnancy rate/first AI (PR/FAI). The productivity of cows is affected by poor genetics (Rahman *et al.*, 1995), week herd health veterinary services and marketing access (Shamsuddin *et al.*, 2007). Reynolds *et al.* (1979) reported differences in pregnancy rates due to differences in breeds of cows. Fonseca *et al.* (1983) found declined conception rate with increasing age of animals. Khan *et al.* (2015) reported higher conception rate in cows at second and third parity than that of cows at zero parity (nulliparous). Barcellos *et al.* (1996) reported a higher conception rate in multiparous cows than that in primiparous cows. Moreover, Poor feeding practices, lack of reproductive health management and diseases have been demonstrated elsewhere as the causes of poor fertility in Bangladesh (Sarder *et al.*, 1997).

These reports emphasize the importance of different factors influencing the post-AI conception rates in cattle. Factors limiting the pregnancy rates in artificially inseminated cows are poorly documented in respect of Bangladesh despite having a lot of importance for success of dairy farms of our country. Therefore, it is necessary to determine the causative factors those may limit the pregnancy rates in artificially inseminated cows. So, this study was designed to determine the effects of breed, age, parity, feeding practice, BCS, interval between oestrus and AI, interval between calving and AI and milk yield on first service pregnancy rates of artificially inseminated cows for the profitable dairying in Bangladesh.

MATERIALS AND METHODS

A total of 308 cows brought to Veterinary Hospital for artificial insemination during the period from April, 2011 to March, 2012 were randomly included in this experiment. The semen was collected from Central Cattle Breeding Station (CCBS), Savar, Dhaka, Bangladesh. The Body Condition Score (BCS) of inseminated cows was determined by eye estimation according to the methods described by Nicholson and Butterworth (1989) and age of inseminated cows was determined by observation of teeth eruption and by interviewing the farmers. The data of an overview of the owners for different variables (breed, feeding practice, parity, interval between calving and AI, milk yield etc.) of cows were shown in Table 1.

The farmers detected the oestrus of inseminated cows on the basis of clinical manifestation of oestrus signs. The cows were inseminated between 6-24 h of onset of heat; data (history) obtained from the owners. All inseminated cows were checked for presence or absence of oestrus signs at

Table 1: Description of demographic variables of artificially inseminated cows (n = 308)

Breed	Age		Parity		BCS		Interval between calving and AI		Milk yield		
Category	No. of cows	Category (Years)	No. of cows	Category	No. of cows	Category	No. of cows	Category (Months)	No. of cows	Category (liters)	No. of cows
Local	173	2-3	51	0	100	1.5-2.0	40	2-3	56	1-2	117
Local×Friesian	94	3-5	171	1-2	183	2.5	94	3-8	150	>2-5	141
Friesian×Sahiwal	19	5-8	86	3-5	25	3.0-4.0	174	8-16	102	5-12	50
Local×Sahiwal	22										

BCS: Body condition score

20-22 days post-AI. Only first service pregnancy was included in this study. Therefore, the cows which did not show any oestrus were examined for pregnancy per rectal palpation at 60-90 days post-AI.

Feeding practice of cows: Most cows were fed with paddy straw and green grass. Approximately 5-10 kg roughages were given to each animal daily. Some cows were grazed everyday for 1-2 h in the open field and road sides. Some cattle feeds were also supplemented with 500-750 g concentrates daily. The concentrates were mainly rice polish, wheat bran, oilcake and common salt. All cows had free access to drinking water.

Study approaches: Three hundred and eight cows were used in the present study. All cows were repeatedly allocated in eight working groups. In study 1, the effect of breed of cows on pregnancy rates was determined. The pregnancy rates were compared among cows of different breeds such as Local, Local×Friesian, Friesian×Sahiwal and Local×Sahiwal. In study 2, the effect of age of cows on pregnancy rates was determined. The pregnancy rates were compared among cows received insemination at different ages such as 2-3 years, >3-5 years and >5-8 years. In study 3, the effect of parity of cows on pregnancy rates was determined. The pregnancy rates were compared among cows received insemination at parity 0, parity 1-2 and parity 3-5. In study 4, the effect of feeding practices of cows on pregnancy rates was determined. The pregnancy rates were compared among cows received insemination under 4 different feeding practices such as green grass plus straw, green grass plus straw with concentrate, straw plus concentrate and only straw. In study 5, the effect of BCS of cows on pregnancy rates was determined. The pregnancy rates were compared among cows received insemination at BCS 1.5-2, 2.5 and 3-4. In study 6, the effect of time interval between oestrus and artificial insemination of cows on pregnancy rates was determined. The pregnancy rates were compared among cows inseminated at 6-12 h interval and 13-24 h of oestrus. In study 7, the effect of time interval between calving and artificial insemination of cows on pregnancy rates was determined. The pregnancy rates were compared among cows received insemination at 2-3 months, >3 to <8 months and 8 months to 16 months interval between calving and insemination. In study 8, the effect of milk yield in cows on pregnancy rates was determined. The pregnancy rates were compared among cows received insemination with different milk yields such as 1-2 L, >2-5 L, >5-12 L.

Statistical analysis: The data generated from this study were entered in Microsoft Excel Worksheet and descriptive statistics were performed. The pregnancy rates in different experiments were expressed as percentage (%). The data were analyzed by Z test using SPSS software version 17. The variation in pregnancy rates was considered significant when the P value was less than 0.05.

RESULTS

The overall first service pregnancy rate of cows was 52.6% (162 out of 308 cows became pregnant) in the present study.

Study 1: Effects of breed on pregnancy rates in cows are presented in Table 2. The pregnancy rate in different breed of cows ranged from 50.3-59.1%. However, the difference in pregnancy rates among breeds of cows was not significant ($p>0.05$).

Study 2: Effects of age on pregnancy rates in cows are presented in Table 3. The pregnancy rate in cows of 3-5 years of age was the highest (56.1%) and the pregnancy rate in cows of 2-3 years of age was the lowest (47.1%). However, the variation in pregnancy rates among different age groups of cows was not significant ($p>0.05$).

Study 3: Effects of parity on pregnancy rates in cows are presented in Table 4. The pregnancy rate in cows of parity 1-2 was the highest (57.4%) and the pregnancy rate in cows of parity 0 was the lowest (45.0%). However, the variation in pregnancy rates among different parity of cows was not significant ($p>0.05$).

Table 2: Effects of breed on pregnancy rates in cows

Breed	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
Local	173	87	50.3
Local×Friesian	94	51	54.3
Friesian×Sahiwal	19	11	57.9
Local×Sahiwal	22	13	59.1

Pregnancy rates within same column did not differ significantly from each other ($p>0.05$)

Table 3: Effects of age on pregnancy rates in cows

Age (years)	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
2-3	51	24	47.1
3-5	171	96	56.1
5-8	86	42	48.8

Pregnancy rates within same column did not differ significantly from each other ($p>0.05$)

Table 4: Effects of parity on pregnancy rates in cows

Parity	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
0	100	45	45.0
1-2	183	105	57.4
3-5	25	12	48.0

Pregnancy rates within same column did not differ significantly from each other ($p>0.05$)

Table 5: Effects of feeding practice on pregnancy rates in cows

Feeding practice	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
Green grass+straw	59	31	52.5 ^{ab}
Green grass+straw+conc. feed	96	61	63.5 ^b
Straw	65	25	38.5 ^a
Straw+conc. feed	88	45	51.1 ^{ab}

Pregnancy rates with superscript within same column differed significantly from each other ($p<0.05$)

Table 6: Effects of BCS on pregnancy rates in cows

BCS	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
1.5-2.0	40	14	35.0 ^a
2.5	94	47	50.0 ^{ab}
3.0-4.0	174	101	58.0 ^b

Pregnancy rates with superscript within same column differed significantly from each other ($p<0.05$), BCS: Body condition score

Table 7: Effects of time interval between oestrus and AI on pregnancy rates in cows

Interval between oestrus and AI (h)	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
6-12	204	120	58.8 ^b
13-24	104	42	40.4 ^a

Pregnancy rates with superscript within same column differed significantly from each other (p<0.05)

Table 8: Effects of time interval between calving and AI on pregnancy rates in cows

Interval between calving to AI (months)	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
2-3	56	28	50.0
3-8	150	85	56.7
8-16	102	61	59.8

Pregnancy rates within same column did not differ significantly from each other (p>0.05)

Table 9: Effects of milk yield on pregnancy rates in cows

Milk yield (litres)	No. of inseminated cows	No. of pregnant cows	Pregnancy rate (%)
1-2	117	58	49.6
>2-5	141	88	62.4
5-12	50	27	54.0

Pregnancy rates within same column did not differ significantly from each other (p>0.05)

Study 4: Effects of feeding practice on pregnancy rates in cows are presented in Table 5. The pregnancy rate in cows fed with combination of green grass, straw and concentrate (conc.) feed was the highest (63.5%) and the pregnancy rate in cows fed with only straw was the lowest (38.5%). The variation in pregnancy rates of cows among different feeding practices was significant (p<0.05).

Study 5: Effects of BCS on pregnancy rates in cows are presented in Table 6. The pregnancy rate in cows of BCS 3-4 was the highest (58.04%) and the pregnancy rate in cows of BCS 1.5-2 was the lowest (35.00%). The variation in pregnancy rates among cows of different BCS was significant (p<0.05).

Study 6: Effects of time interval between oestrus and AI on pregnancy rates in cows are presented in Table 7. The pregnancy rate in cows received insemination at 6-12 h was significantly higher (58.8%) than that of 13-24 h counterparts (40.4%, p<0.05).

Study 7: Effects of time interval between calving and AI on pregnancy rates in cows are presented in Table 8. The pregnancy rate in cows with calving to AI interval of 8-16 months was the highest (59.4%) and the pregnancy rate in cows with calving to AI interval of 2-3 months was the lowest (50.0%). However, the variation in pregnancy rates of cows among calving to AI intervals was not significant (p>0.05).

Study 8: Effects of milk yield on pregnancy rates in cows are presented in Table 9. The pregnancy rate in cows yielding >2-5 L milk was the highest (62.1%) and the pregnancy rate in cows yielding 1-2 L milk was the lowest (49.4%). However, the variation in pregnancy rates among cows of different milk yields was not significant (p>0.05).

DISCUSSION

Effective fertility management of cows is a key component of profitable dairy farming. The goal on commercial dairy farms is to get one calf per year, the clue of success of dairy farming. To get the success, high pregnancy rate with minimum Calving Conception Interval (CCI) (usually 85-95 days) is essential. Artificial insemination is one of the most important agricultural

technologies developed during the past century and most dairy farms use AI to remain competitive in the current economic climate of the dairy industry. In Bangladesh, Artificial Insemination (AI) using semen from numerous improved zebu and temperate cattle has been introduced for years (Ahmed and Islam, 1987). Despite introduction of AI for long time, still the reproductive efficiency of cattle is below the satisfactory level. The present study was carried out to determine the effects of breed, age, parity, feeding practices, BCS, interval between oestrus and AI, interval between calving and AI and milk yield on first service pregnancy rate of cows in the selected area of Bangladesh.

The overall first service pregnancy rate in cows received AI using frozen semen was 52.6%. This is in agreement with the previous study done by Shamsuddin *et al.* (2001), Khan *et al.* (2015), Paul (2010) and Mollah (2011) who found 54.9, 59.3, 57.3 and 55.1% pregnancy rates, respectively in cows of Bangladesh. Moreover, similar first service pregnancy rate of cows (49.8%) has been reported in Spain (Pena *et al.*, 2004), as however, contrasting to the present study, Balachandran (1975) reported 65.6% pregnancy rate in cows using chilled semen and Basuro *et al.* (1997) reported 62.1% pregnancy rate in cows using frozen semen. Moreover, 43% post-AI first service pregnancy has been documented by Freer (1981). The variation in pregnancy rates among studies might be due to variations in semen (chilled vs. frozen) and breed of cows (local zebu vs. crossbred vs. temperate breed) used.

The present study demonstrates that the pregnancy rate of cows is not influenced by the breed of cows. Contrasting to the present study, Shamsuddin *et al.* (1997) reported that Sahiwal (SL) and their crosses with non descriptive zebu cows achieved lower fertility than Friesian and their crosses with local zebu cattle. Moreover, Sarder *et al.* (1997) observed that the overall fertility was better in local nondescript cows than that in Friesian crossbred animals. Further, Reynolds *et al.* (1979) reported variation in pregnancy rates among breeds. It is likely that genetics may influence the pregnancy rate in cows. However, the reason for obtaining no variation in pregnancy rate among breeds in the present study may be due to using small numbers of cows.

The pregnancy rate of cows was not influenced by the age of animals in the present study as indicated that no significant variation in pregnancy rate among different age group of cows. Contrasting to the present finding, there is a report that fertility is the highest in cows between 4 and 9 years of age and declines after 10 years of age (Schilling and England, 1968). Moreover, Fonseca *et al.* (1983) found that conception rate declined with increasing age of animals. It is likely that young cows suffer more from negative energy balance than middle aged grown cows and old cows. Further, the older cows might have more chance to get subclinical uterine infection resulting in lower pregnancy rate. However, in the present study, the minimum age of the cows was 2 years and maximum age of cows was 8 years which may be regarded as young to middle age for cows.

The present study found the parity as non-significant influencing factor in the pregnancy rate of cows. Contrasting to the present finding, Khan *et al.* (2015) reported higher conception rate in cows at second and third parity than that of cows at zero parity (nulliparous). Moreover, Barcellos *et al.* (1996) reported a higher conception rate in multiparous cows than that in primiparous cows. There is also report that conception rates in cows at their first three parities are higher than that of their later parities (Zu and Zun, 1997). Further, Hla *et al.* (2001) reported an increased conception rate with advancing parity from parity 2 up to 6 and then declined at parities 7 and 8. In the present study, the maximum recorded parity of cows was 5 and most of the cows were belonged to 1-2 parities (183 out of 308) which may be considered as the parity of grown

cows. Although no significant variation in pregnancy rate of cows was obtained among different parity groups, obtaining lower pregnancy rate (45%) in 0 parity (nulliparous) cows supports the earlier finding reported by Khan *et al.* (2015).

The present study demonstrates the significant influence of feeding practices on pregnancy rate. A significantly higher pregnancy rate (63.5%) was found in cows fed with a combination of green grass, straw and concentrate feed than that of cows fed with only straw (38.5%). The present finding indicates the importance of daily supplementation of some concentrates in feed of dairy cows. It is likely that cows fed with a combination of green grass, straw and concentrate feed is more balanced diet than that of cows fed with only straw. It is found in a number of studies that nutrition manipulation can result in changes in gonadotrophin (GnRH) secretion. The cows deficient in adequate quantity of balanced feed had reduced pituitary responsiveness to a GnRH challenge (Nolan *et al.*, 1988). Thus providing a feed with combination of green grass, straw and concentrate in the present study might have contributed to proper functioning of reproductive hormones resulting in good rate of pregnancy.

The present study reveals the effect of BCS on pregnancy of cows. A significantly higher pregnancy rate (58.0%) was found in cows with BCS 3-4 than that in cows with BCS 1.5-2 (35.0%). Similarly, higher pregnancy rate in cows with good BCS than that in cows with poor BCS has been documented by Shamsuddin *et al.* (2001) in Bangladesh. The stored fat or diminished muscle mass of an animal reflects the nutritional plane to which it was exposed. Condition scoring provides a quick, cheap and easy method of comparing cattle herds or individual animals under different management system. Large number of animals can be scored at a time without the need to handle them or use weigh scale. Condition scoring is a subjective assessment, but with practice a high level of repeatability and reproducibility can be obtained both between workers and between observations. It is likely that cows with good BCS are more responsive to hormonal stimulation than poor BCS counterpart resulting in good pregnancy rate in the present study.

The success of an AI programme depends on deposition of semen at right place of genital tract at right time. The present study showed that the first service pregnancy rate in cows is influenced by the time interval between oestrus and insemination as evidenced by significantly higher pregnancy rate (58.8%) in cows received insemination at 6-12 h interval than that of 13-24 h counterparts (40.4%). Similarly, Gonzalez (1981) reported the highest conception rate when insemination was done at 12-18 h after the onset of oestrus. He also suggested that maximum conception rate was achieved when the cows showing oestrus in the morning were inseminated in the afternoon and the cows showing oestrus in the afternoon inseminated in the following morning. The importance of time of insemination for the conception rate in cattle has also been demonstrated by Foote (1979).

In the present study, the pregnancy rate was not significantly influenced by the interval from calving to AI. Similarly, Kale *et al.* (1988) reported pregnancy rate was not influenced by the calving to AI interval. In contrast, Carlos (2004) reported short time interval between calving to AI decreased pregnancy rates in cows. Moreover, Tibbo *et al.* (1994) reported that a long time interval between calving to AI increased pregnancy rates in cows. This may be explained by the fact that most cows with long calving to AI interval were dry and had minimum or no suckling resulting in higher pregnancy rate. Negative effect of suckling on conception rate has been documented by Shamsuddin *et al.* (2001) who obtained higher first service conception rate in cows with once or twice suckled by the calves daily than that of cows suckled several times. Moreover, the pregnancy rate was higher in suckling restricted cows than that in continuously suckled counterpart

(Tegegne *et al.*, 1992). The reason of negative effect of suckling on conception rate may be explained by the fact that suckling inhibits the tonic GnRH and LH secretion in animals (Jainudeen and Hafez, 2000).

The present study indicated that milk yield has no effects on pregnancy rate in cows. Similarly, Sarder (2001) found no variation in pregnancy rates between high and low yielding indigenous cows. In contrast, conception rates are higher in cattle with higher milk production than that with lower milk production (Shamsuddin *et al.*, 2001). The positive effect of high milk yield on conception rate may be explained by the fact that the high yielding cows received more attention of owners, balanced diet and reared under good management programme (Shamsuddin *et al.*, 2001).

CONCLUSIONS

Pregnancy rates of cows with AI may be affected by both herd-level management factors (methods of husbandry, feeding, estrus detection, semen handling and transition cow management) and cow-level factors (age, BCS, post parturient problem, disease events, milk yield and genetics). However, the first service pregnancy rate is not significantly influenced by the breed, age, parity and milk yield of cows. Feeding practice with combination of green grass, straw and concentrate feed improves the pregnancy rate in cows. Good BCS significantly enhances the pregnancy rate in cows. AI should be performed between 6-12 h after onset of oestrus for obtaining good first service pregnancy in cows. The time interval between calving and AI does not influence the pregnancy rate in cows.

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