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ORIGINAL ARTICLE

Conception rates of cows inseminated with frozen semen of Rural Development Academy, Bogura, Bangladesh

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Abstract

Background: The first service conception rate (FSCR) is an important parameter for any artificial insemination (AI) programme. The present study was conducted to determine the FSCR and its influencing factors in cows inseminated with frozen semen produced by Rural Development Academy, Bogura.

Methods: Data were collected from 372 cows at 39 villages under Sherpur Upazilla of Bogura district on breed, age, body condition score (BCS), parity, milk yield, suckling, AI season and the interval between oestrus to AI using a questionnaire.

Results: The overall FSCR of cows was 66.4% and the service per conception was 1.53. The FSCR was higher (74.1%) in local cows compared to the Holstein-Friesian (HF) cross counterpart (64.2%). The FSCR was higher (70.4%) in 24-47 months old cows compared to 84-98 months old counterpart (61.5%). The highest FSCR (81.6%) was observed in cows with 3.0 to 3.5 BCS and the lowest (25.7%) was observed in cows with 2.5 BCS. The highest FSCR (68.3%) was observed in the 0 (zero) parity (heifers) group of cows and the lowest (62.5%) was observed in the 4-7 parity counterpart. The highest FSCR (72.4%) was observed in cows yielded daily >15-22 L milk and the lowest (62.1%) was observed in cows yielded ≤5 L milk. The highest FSCR (72.7%) was observed in suckling restricted cows and the lowest (60.9%) was observed in cows that had several times suckling daily. The highest FSCR (72.1%) was observed in cows received inseminations in Rainy (July-October) season and the lowest (58.4%) was observed in cows received inseminations in Winter (November-February). The highest FSCR (67.1%) was observed in cows received inseminations between 12-18 hrs of detection of oestrus and the lowest (59.1%) was observed in cows received insemination between 8-11 hrs of detection of oestrus. However, the difference in FSCR in cows with different BCS groups was significant ($p<0.01$).

Conclusion: The current FSCR in cows can be considered to be satisfactory. The BCS of cows significantly influences the FSCR in cows.

Keywords: Artificial insemination, bull, dairy cows, pregnancy rates, influencing factors

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Introduction

The half of Bangladeshi people are engaged in agricultural and livestock farming (Hossain *et al*., 2022). Livestock plays an important role by contributing about 1.85% of gross domestic product (GDP) and 16.52% of agricultural GDP in Bangladesh (Anon, 2023). Additionally, the livestock subsector provides employment to 20% of the population directly and 50% of the population indirectly in Bangladesh (Anon 2023). Among 442.85 million livestock species, cattle are the major dairy animal in Bangladesh (Anon 2023). For this reason, dairying is as an essential sector for employment generation, poverty alleviation and livelihood improvement in rural areas.

The productivity of local cattle is low due of poor genetics (Alam *et al*., 2001), poor nutrition (Ghosh *et al*., 1993) and weak herd health veterinary services. For up-gradation of local cows, artificial insemination (AI) using semen of exotic breeds has been in practice since sixties. For fulfilment of the incremental demand of milk and for sustainable dairy farming, achieving desired post-AI fertility of dairy cows is prerequisite. Among others, fertility of dairy cows is evaluated by determination of conception rate in a farm or population. For profitable dairy farming, optimum conception rate is desired in every farming system.

The post-AI conception rate in any AI programme may be influenced by numerous parameters such as semen donor, body condition score (BCS) of cows, time interval between oestrus and AI, parity, breed, milk production and age of cows (Alam and Ghosh, 1988; Shamsuddin *et al*., 2001). The season of insemination can also be the crucial component to attain maximal conception rate in cows (Miah et al., 2004). Moreover, it is likely that the conception rate and other fertility indices after AI may be affected by health condition of bull, semen collection, processing, storage, transportation, proper heat detection, AI at right time and sound uterine environment. Further, Paul *et al*. (2011) stated that the efficiency and skill of Al technicians play an important role in conception rate of cows.

The Rural Development Academy (RDA) is a specialized rural development institution established in 1974 at Sherpur Upazila of Bogura district, Bangladesh for training and action research. As part of extension service and research, the Cattle Research and Development Centre (CRDC) of RDA has been producing frozen semen followed by AI in cows of its beneficiary farmers since its establishment. However, the efficacy of frozen semen produced by CRDC has not yet been evaluated under field conditions. Therefore, it is rationale to evaluate the efficacy of frozen semen produced by CRDC with respect to conception rates. This will help policy makers of RDA and beneficiary farmers for taking measures for improving milk production in rural areas of Bangladesh. Considering the above facts, this study was designed to determine the first service conception rates (FSCR) and its associated influencing factors in cows inseminated with frozen semen of RDA, Bogura.

Materials and Methods

The experiment was undertaken on cows and heifers from different parts of Sherpur Upazila that were artificially inseminated (AI) with semen produced by the CRDC of RDA, Bogura.

Study area

This study was conducted from April to August, 2023 in 39 villages under Sherpur Upazilla of Bogura district.

Data collection

A questionnaire was used for collection of information related to farms, cows, inseminations, semen and technicians. The information was collected by interviewing the farmers or by examining the record register, if any. Data were collected from 372 cows (258 lactating cows, 9 dry cows and 105 heifers) on breed, age, BCS, parity, milk yield, suckling, AI season, semen donor, interval between oestrous to AI and conception.

Management of cows

Most cows were tie stalled. Some cows had zero grazing with occasional semi-zero grazing or grazing under tethering conditions. Most cows were fed on straw and, cut and carry grasses. Some cows were also feed on cultivated fodder. Common concentrate supplements were rich polish, wheat bran and oil cake but their supply to animals were limited, sporadic and restricted

largely to lactating cows. All cows had free access to drinking water.

Artificial insemination and pregnancy diagnosis

Artificial insemination (AI) was performed by five randomly selected technicians following rectovaginal method using frozen semen produced by CRDC, RDA. The AI technicians were trained by RDA and all technicians had at least 5 years experiences in insemination. Pregnancy was diagnosed by per rectal palpation of genital tract at 60-90 days post-AI by AI technicians and results were informed to the farmers. The results on conception or pregnancy were collected by interviewing the farmers or by examination of inseminated cows by the investigator if the pregnancy result was not known yet.

Breed of cows

Three breeds of inseminated cows were selected to determine the influence of breed of cows on FSCR. The breeds were Local (Nondescript indigenous), Holstein-Friesian (HF) cross and Sahiwal cross. The breed of cows was identified on the basis of phenotype of animals.

Age of animals

The age of cows was determined by observation of teeth eruption, interviewing the farmers or by examination of register, if any. To determine the influence of age on FSCR, the age of cows was divided into four groups such as 15-23, 24-47, 48-83 and 84-98 Months.

BCS of animals

The BCS of the cows/heifers was determined by eye estimation. The BCS was measured by 1-5 scale as per method described by Nicholson and Butterworth (1986). To determine the influence of BCS on FSCR, the BCS of inseminated cows were divided into three groups such as 2.5, 3.0-3.5 and 4.0-4.5 BCS groups.

Parity of cows

The number of births given by the cows was regarded as parity. The parity of cows was determined by interviewing the farmers and by examining farm register, if any. To determine the influence of parity on FSCR, cows were categorized as 0, 1, 2 to 3 and 4 to 7 parity cows where 0 indicated the heifer.

Milking and suckling of animals

The quantity of milk yield per cow on day of insemination was estimated by interviewing the farmers or by examining the milk register, if any. Most cows were milked by hand milking keeping calves at feet of mother. To determine the influence of milk yield on FSCR, the milk yield was categorized into ≤5, >5 to 10, >10 to 15 and >15 to 22 L daily. To determine the influence of suckling, the cows were categorized as several, twice and restricted groups. Restricted suckling was considered when no suckling during milking was practiced if calf was sold or died.

Season of AI

To determine the influence of season of AI on FSCR, the inseminated cows were classified into three categories such as Summer (March-June), Rainy (July-October) and Winter season (November-February) cows on the basis of period when the cows received inseminations.

Interval between oestrus to AI

The interval between oestrus and AI was determine by calculating the time interval between time when farmers detected cows in oestrus and the time when the inseminators performed AI. To determine the influence of interval between oestrus to AI on FSCR in cows, the interval was grouped as 8-11, 12-18 and 19-24 Hrs intervals.

Calculation of FSCR in cows

The FSCR was estimated from the proportion of cows became pregnant within last 18 months among cows received insemination for the first time after calving or heifers received insemination for the first time in her life. The FSCR was expressed as %.

Calculation of service per conception

The service per conception was estimated by calculation of number of services required for each conception or pregnancy within last 18 months period of starting investigation.

Statistical analysis

The data generated from this study were entered in Microsoft Excel Worksheet and FSCR was calculated. The FSCR in cows was expressed as percentage. The data were further analyzed by Chi Square Test using SPSS software version 25. The variation in conception rate was considered significant when the p value was

less than 0.05.

Results and Discussion

The overall first service conception rate (FSCR) of cows was 66.4%. Similar to the present findings, Mouffok *et al.* (2019) reported 64.0% FSCR in dairy cows in Algeria. On the other hand, Shamsuddin *et al.* (2001) and Paul *et al.* (2011) found lower FSCR (46.2% and 42.7%, respectively) than present findings in Bangladesh. Moreover, lower overall FSCR (34.5%) than present findings have been reported by earlier study conducted in Algeria (Mekonnen *et al*., 2010). The variation in conception rates among studies, among others, might be due to variations in management of cows, semen donor, skill of AI technicians and agro-ecological conditions of study areas.

The service per conception (SPC) is regarded as an important indicator of fertility. It is likely that low SPC saves time and Al cost, and therefore, low SPC is desirable to any dairy farmers in the world. In the present study, the SPC was 1.53. This result is in agreement with the previous study where Saleem *et al.* (2012) reported 1.53 SPC in Achai cows in the Hindu Kush of Northern Pakistan. Contrasting to the present study, El-Amin *et al.* (1986) reported average 2.6 SPC of dairy cows in Sudan. Mollah *et al*. (2015) also reported 2.9 SPC elsewhere in Bangladesh. The variation in required number of services for each conception among studies might be due to variations in management of cows and agro-climatic conditions in different areas.

Influence of breeds on FSCR

The influence of breeds on FSCR of cows is presented in Table 1. The FSCR was the highest (74.1%) in local cows and the lowest (64.2%) was found in Holstein-Friesian (HF) cross cows. However, the difference in FSCR did not vary significantly among different breeds of cows ($p>0.05$). This result is in agreement with Shamsuddin *et al*. (2001) who did not report any significant difference in FSCR in different breeds of small holding cows at Mymensingh district of Bangladesh. In contrast, Paul *et al.* (2011) demonstrated significant difference in FSCR among different breed of cows at Sirajganj district of Bangladesh. The reason for variations in conception rates among studies might be due to variations in management of cows, skill of AI technicians, quality of semen and agro-ecological conditions of study areas. Additionally, long term adoption of local cows and tolerant to high temperature and humidity condition might lead to obtaining better FSCR than other exotic breeds of Bangladesh.

Table 1: Influence of breeds on FSCR

Breeds	No. of cows inseminated	No. of cows conceived	Conception rate (%)
Local	54	40	74.1
HF Cross	271	174	64.2
SL Cross	47	33	70.2

The FSCR in cows with respect to breeds did not differ significantly from each other ($p>0.05$).

Table 2: Influence of age on FSCR

Age group (Months)	Cows inseminated	Cows conceived	Conception rate (%)
15-23	75	50	66.7
24-47	115	81	70.4
48-83	104	68	65.4
84-98	78	48	61.5

The FSCR in cows with respect to age did not differ significantly from each other ($p>0.05$).

Influence of age on FSCR

The influence of age on FSCR of cows is presented in Table 2. The highest FSCR (70.4%) was observed in 24-47 months old cows and the lowest (61.5%) was observed in 84-98 months old counterpart. The present study demonstrated that the FSCR did not vary significantly among different age group of cows ($p>0.05$). This result is in agreement with Howlader *et al.* (2019) who did not report any difference in FSCR in different ages of small holding cows in selected areas at Sirajganj district of Bangladesh. Shikder (2011) also stated that there was no difference in FSCR with respect to different age groups of dairy cows in Satkhira district. Similarly, Paul *et al.* (2011) and Haque *et al.* (2015) did not find any significant difference in FSCR of different age group of cows

elsewhere in Bangladesh. In contrast, Miah *et al.* (2015) reported influence of age on FSCR in dairy cattle of northern part of Bangladesh. There is a decline in fertility with advancing age and a decrease in ovulation rate due to lack of gonadotropin release from the pituitary. A deterioration in the quality of eggs ovulated with subsequent fertilization resulting in embryonic or fetal loss or uterine failure due to hormonal imbalance or deficiency may occur in advanced age (Al-Amin *et al.*, 2018).

Influence of BCS on FSCR

The BCS on FSCR of cows is presented in Table 3. The highest FSCR (81.6%) was observed in cows with 3.0 to 3.5 BCS and the lowest (25.7%) was observed in cows with 2.5 BCS. The difference in FSCR in cows was significant ($p<0.01$) among cows with different BCS groups. Similarly, Shamsuddin *et al.* (2001) and Haque *et al.* (2015) found a significant influence of BCS on conception rates in dairy cows of Bangladesh. On the contrary, Islam *et al.* (2019) did not find any influence of BCS on conception rates in cows elsewhere in Bangladesh. It is likely that providing adequate quantity of balanced diet to animals will help to gain good BCS resulting in satisfactory FSCR in cows. A cow with good BCS will stimulate proper secretion of hormones resulting in good conception rate. In addition, good nutritional status with better management may help maintaining general health condition of cows resulting in stimulation of endocrine system through the activation of the hypothalamo-pituitary-ovarian axis followed by improved reproductive performance in cows.

Table 3: Influence of BCS on FSCR

BCS	Cows inseminated	Cows conceived	Conception rate (%)
2.5	101	26	25.7[a]
3.0-3.5	267	218	81.6[b]
4.0-4.5	4	3	75.0[ab]

[a,b] Values with superscripts within same column differed significantly from each other ($p<0.01$).

Influence of parity on FSCR

The influence of parity on FSCR of cows is presented in Table 4. The highest FSCR (68.3%) was observed in 0 parity (heifers) group of cows and the lowest (62.5%) was observed in 4-7 parity group of cows. In the present findings, FSCR did not vary significantly among cows with different parity groups ($p>0.05$). This result is in agreement with Khatun *et al.* (2014) who did not report any significant influence in conception rate with respect to parity in small holding cows at Kurigram district, Bangladesh. Haque *et al.* (2015) also reported that there was not any significant difference in conception rates in cows with different parity in Bangladesh. In contrast to present findings, Howlader *et al.* (2019) reported that there were significant differences in FSCR with respect to parity of cows in selected areas of Sirajganj district of Bangladesh. Nordin *et al.* (2004) and Potdar *et al.* (2016) also found that there was significant variation in FSCR in cows with different parity in Malaysia and India, respectively. The differences in conception rates with respect to parities among studies might be due to differences in breed of cows used, feeding system and agro-climatic condition where the investigations were conducted.

Table 4: Influence of parity on FSCR

Parity	Cows inseminated	Cows conceived	Conception rate (%)
0 (Heifers)	105	73	69.5
1	82	56	68.3
2-3	129	83	64.3
4-7	56	35	62.5

The FSCR in cows with respect to parity did not differ significantly from each other ($p>0.05$).

Influence of milk yield on FSCR

The influence of milk yield on FSCR of cows is presented in Table 5. The highest FSCR (72.4%) was observed in cows yielded daily >15-22 L milk and the lowest (62.1%) was observed in cows yielded daily ≤5 L milk. In the present study, FSCR did not vary significantly among cows with different milk yielding groups ($p>0.05$). This result is in agreement with Haque *et al.* (2015) who did not report any significant difference in FSCR in different milk yielding cows in Bangladesh. Similarly, Shamsuddin *et al.* (2001) did not report any significant difference in FSCR in different milk yielding cow groups in Mymensingh district of Bangladesh. In contrast, Islam *et al.* (2019) found significant difference among cows with different

milk yielding groups in Bangladesh. Grimard *et al.* (2006) also stated that there was significant difference among different milk producing groups of dairy cows in France. It is likely that the reduced fertility is associated with negative energy balance resulting from the failure of cows to keep pace with the energy demand for high milk production, especially during the early lactation stage. However, obtaining numerically higher FSCR in cows yielding more milk in the present study might be explained by the fact that the high yielding cows received more attention, received balanced diet and were reared under good management conditions.

Table 5: Influence of milk yield on FSCR

Milk yield (l)	Cows inseminated	Cows conceived	Conception rate (%)
≤5	132	82	62.1
> 5-10	54	35	64.8
> 10-15	43	30	69.8
> 15-22	29	21	72.4

The FSCR in cows with respect to milk yield did not differ significantly from each other (p>0.05).

Influence of suckling on FSCR

The influence of suckling on FSCR of cows is presented in Table 6. The highest FSCR (72.7%) was observed in suckling restricted cows and the lowest (60.9%) was observed in cows those had several times suckling daily. The FSCR did not vary significantly among cows with different suckling groups in the present investigation (p>0.05). This result is in agreement with Shamsuddin *et al.* (2001) who did not find any significant difference in conception rates in cows with different suckling groups in Bangladesh. In contrary, Bastidas *et al.* (1984) found significant difference in conception rate among cows with different suckling groups in Venezuela. The suckling stimulus has been shown to delay return to oestrus and subsequent conception in the postpartum cows. 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 followed by reduced conception rate in animals.

Table 6: Influence of suckling on FSCR

Suckling (daily)	Cows inseminated	Cows conceived	Conception rate (%)
Several	92	56	60.9
Twice	155	104	67.1
Restricted	11	8	72.7

The FSCR in cows with respect to suckling did not differ significantly from each other (p>0.05).

Influence of season on FSCR

The influence of season on FSCR of cows is presented in Table 7. The highest FSCR (72.1%) was observed in cows received inseminations in Rainy (July-October) season and the lowest (58.4%) was observed in cows received inseminations in Winter (November-February) season. However, the difference in FSCR did not vary significantly among cows received insemination in different seasons (p>0.05). This is in agreement with earlier studies where no significant difference in FSCR was demonstrated in cows received insemination in different seasons in India (Potdar *et al.*, 2016) and Bangladesh (Miah *et al.*, 2015). On the contrary, significant influence of seasons on conception rates was recorded by earlier investigators in Bangladesh (Miah *et al*., 2004; Paul *et al*., 2011; Khatun *et al*., 2014). Stress associated with high temperatures in combination with high humidity is known to decrease FSCR in cows (Sprott *et al*., 2001). The difference in conception rate among seasons may be caused by differences in concentrate supplement, environmental temperature, availability of green grass, pasture land and photo period.

Table 7: Influence of season on FSCR

Season	Cows inseminated	Cows conceived	Conception rate (%)
Summer	149	105	70.5
Rainy	86	62	72.1
Winter	137	80	58.4

The FSCR in cows with respect to seasons did not differ significantly from each other (p>0.05).

Influence of interval between oestrus to AI on FSCR

The influence of interval between oestrus to AI on FSCR of cows is presented in Table 8. The highest FSCR (67.1%) was observed in cows received

insemination between 12-18 hrs of detection of oestrus and the lowest (59.1%) was observed in cows received insemination between 8-11 hrs of detection of oestrus. In the present investigation, the difference in FSCR did not vary significantly among cows received inseminations at different intervals between oestrous detection to AI ($p>0.05$). This result is in agreement with Haque *et al*. (2015) who found that there was not any significant difference among cows received inseminations at different intervals of oestrous detection to AI in Bangladesh. Nordin *et al*. (2004) also reported that time interval between oestrus to AI had no influence on FSCR of cows in Malaysia. On the other hand, Howlader *et al.* (2019) and Paul *et al*. (2011) found significant differences in conception rates among cows received inseminations at different intervals of oestrus detection to AI in Bangladesh. The time of insemination is crucial for optimum fertility in cows. Nevertheless, the reason for variations in FSCR among studies might be due to variations in management of cows, skill of AI technicians, quality of semen and agro-ecological conditions of study areas.

Table 8: Influence of interval between oestrus to AI on FSCR

Interval between oestrus to AI (Hrs)	Cows inseminated	Cows conceived	Conception rate (%)
8-11	22	13	59.1
12-18	310	208	67.1
19-24	40	26	65.0

The FSCR in cows with respect to influence of interval between oestrus to AI did not differ significantly from each other ($p>0.05$).

Conclusions

In conclusions, the overall first service conception rate (FSCR) of cows inseminated with frozen semen of Rural Development Academy, Bogura, Bangladesh is 66.4% and the service per conception (SPC) is 1.53 which is satisfactory. The FSCR is influenced by BCS of cows and farmers may be advised to maintain 3.0-3.5 BCS for obtaining satisfactory FSCR in cows.

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Competing Interest

The authors declare no conflict of interest.

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