IJAS Iranian Journal of Applied Animal Science

# Effect of Flushed Feeding and Age on Estrus Synchronization and Conception Rate of Holstein × Local Crossbred Cows After Using Analogue GnRH and Prostaglandin $F_2\alpha$ Hormone

Research Article

M. Sydur Rahman[1], M. Kabirul Islam Khan[2*] and T. Bilkis[2]

[1] Remount Veterinary and Farm Core Depo, Savar, Dhaka, Bangladesh
[2] Department of Genetics and Animal Breeding, Chittagong Veterinary and Animal Science University, Khulshi, Chittagong 4225, Bangladesh

Received on: 22 Oct 2013
Revised on: 11 Dec 2013
Accepted on: 30 Dec 2013
Online Published on: Sep 2014

*Correspondence E-mail: ki.khan-dgab@cvasu.ac.bd

Online version is available on: www.ijas.ir

## ABSTRACT

The study was conducted to know the effect of flushed feeding on estrus synchronization and conception rate of Holstein × Local crossbred cow's after using the GnRH (fertagyl) and $PGF_2\alpha$ hormone. As a representative sample 20 Holstein × Local crossbred cows were chosen from Chittagong Cantonment Military Dairy Farm in Bangladesh and the experimental work was carried out for 60 days. Ten cows were flushed with high energy feed (10.5 mega Joule metabolisable energy/kg feed dry matter) and considered as treated group and 10 cows was allowed for normal feeding. Both the control and treated group cows were injected intramuscularly by the GnRH and $PGF_2\alpha$ hormone. After injection of these hormones, 100% cows from both groups showed estrus. Fixed time artificial insemination (AI) was done and the cows were diagnosed in pregnancy after 60 days of AI. It was observed that 20% cows were conceived after AI from control group, but treated group cows showed more conception / pregnancy rate (40%). After using the hormones, age of the cow did not influences for estrus synchronization, but for conception rate it was observed that younger cows showed more than older one.

KEY WORDS artificial insemination, conception rate, crossbred, estrus synchronization, hormones.

## INTRODUCTION

The present cattle population of Bangladesh is 24.17 million (DLS, 2009). More than 80 percent of this cattle population is indigenous and rests of them are purebreds and crossbreds of different exotic breeds (Friesian, Jersey and Shahiwal) cattle, which is contributing a major share of livestock sub-sector and playing multi-functional roles (supply of milk, meat, skin, manure, carting etc.) in the subsistence production system of Bangladesh. Although the cattle population is large, however the present livestock industry can support less than 20% of national requirements of milk, meat and their value added products. Low genetic potential along with low nutrition and other management limitations is the key factor for the low productivity of these cattle. Generally, the Deshi cattle produce only 1.5 liter milk per day (Hossain *et al*. 2002) and the temperate and tropical crossbred produces 3 to 5 liter milk per day per cow (Khan *et al*. 2005). Moreover, the demand of livestock products is increasing with the population growth and socio-economic changes. However, the productivity of livestock is not increasing for meeting the requirements of the country (Huque *et al*. 2011). In this circumstance, development of specialized cattle breeds for milk and meat production is an emergent issue in Bangladesh. For programmed breeding, it is essential to bring all the animals

reproductive cycle (estrus) at a same time. The available option for inducing heat is estrus synchronization (Diaz *et al*. 2005). Estrus synchronization is the manipulation of the reproductive process so that females can be bred with normal fertility during a short, predefined interval (Troxel and Whitworth, 2007). It reduces or some cases eliminate labor for detecting heat and allow the breeder / producers for scheduled breeding. Uniform calf cropping can be possible utilizing synchrony of estrus. It is enabling more cows to be artificially inseminated using genetically superior bulls. The length of the breeding season can be reduced by successfully utilizing of estrus synchronization. For synchronization of estrus, there are some protocols involving the use of gonadotropin releasing hormone (GnRH) and Prostaglandin $PGF_2$ are used in dairy cattle. After using these hormones Whisnant *et al*. (1999) observed the conception and pregnancy rates averaged 34.9 and 34.9%; and 37.7 and 19.8%, respectively. Synchronization treatments with the combination different hormones (GnRH, Prostaglandin $PGF_2$) for manipulation of follicular development and estrus are more effective than a single one (Pursley *et al*. 1995).

Although the information on estrus synchronization and followed by artificial insemination are abundant in literature (e.g. Pursley *et al*. 1995; DeJarnette *et al*. 2004; Troxel and Whitworth, 2007) for developed countries, but in some developing countries, including Bangladesh the use of hormones for estrus synchronization are very limited. Therefore, the present study was undertaken with the objectives (i) to know the effect of flushed feeding on estrus synchronization and conception rate of Holstein × Local crossbred cow's after using the GnRH and $PGF_2\alpha$ hormone; (ii) to study the effect of age on conception rate of flushed Holstein × Local crossbred cows after using the hormones.

## MATERIALS AND METHODS

The research program was conducted at Military Dairy Farm of Chittagong Cantonment in Bangladesh and the duration of the experiment was 60 days.

### Animal and experimental design

In this experiment, the effect of short term (two weeks) flushed feeding on estrus synchronization and conception rates of crossbred cows (50% L × 50% F) after using the GnRH (fertagyl) and Prostaglandin $F_2\alpha$ (Dinoprost) hormone. A representative sample of 20 Holstein × Local crossbred (50 to 62.5% exotic blood levels) cows of 2 and 3 lactations were chosen based on their production performance, physical appearance, pedigree record, body condition score, health condition (no diseased, no ovarian cysts present) and good reported fertility.

The age, body weight of cows for hormonal treatment, and days after calving to hormone administration of selected cows were presented in Table 1.

**Table 1** Age and live weight of the experimental cows

| Cow no | Age in month | Days of hormonal treatment after calving | Body weight (kg) at day of hormonal treatment |
|---|---|---|---|
| Control group | | | |
| 1 | 63 | 135 | 314 |
| 2 | 58 | 133 | 262 |
| 3 | 58 | 130 | 222 |
| 4 | 73 | 127 | 314 |
| 5 | 61 | 126 | 251 |
| 6 | 62 | 124 | 255 |
| 7 | 61 | 101 | 256 |
| 8 | 59 | 109 | 262 |
| 9 | 57 | 108 | 275 |
| 10 | 58 | 117 | 253 |
| Treatment group | | | |
| 11 | 52 | 168 | 235 |
| 12 | 58 | 163 | 240 |
| 13 | 60 | 163 | 262 |
| 14 | 61 | 113 | 257 |
| 15 | 55 | 105 | 259 |
| 16 | 56 | 116 | 280 |
| 17 | 59 | 107 | 296 |
| 18 | 60 | 124 | 278 |
| 19 | 61 | 113 | 256 |
| 20 | 55 | 106 | 265 |

The age of the selected cows was between 50-72 months. The 20 selected cows were divided into two groups: control and treatment groups, each group having ten cows. Control group provided only hormonal treatment with normal ration (Table 2) of the farm and treatment group provided nutritional flushing (extra 01 kg concentrate and *ad libitum* fodder, having 10.5 MJ metabolisable energy per kg feed dry matter) for two weeks before hormonal treatment. After hormonal treatment the cows of the treatment group were provided normal ration as given in the control group. Green grasses were provided *ad libitum* throughout the period including flushing period.

All cows were treated with anti-helmintics before the start of this experiment to control the parasitic infestation. The experimental cows were maintained install feeding system.

### Effect of flushed feeding on estrus synchronization and conception rate

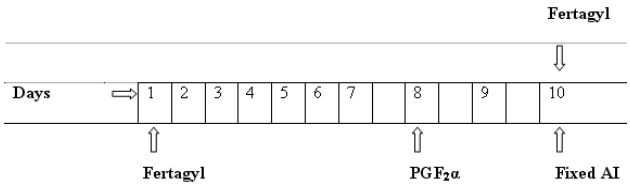
Each cow was intramuscularly injected with gonadotopin releasing hormone (GnRH) analogue (Fertagy l) manufactured by Intervet, according to the instructions provided by the manufacturer in a dose of 250 µg on day 1 and 10 mg Prostaglandin $F_2\alpha$ (Dinoprost) on day 8 followed by 250 µg GnRH analogue after 48 hours on day 10 was administrated.

At the end of day 10 the cow exhibits sexual desire by valleys frequently and accepting the males to mount on her; furthermore the vaginal and cervical mucus was visible and hanging from the vulva or wrapped around the tail.

**Table 2** Ration for the experimental cows

| Ingredients | Ingredients (%) | Groups | |
|---|---|---|---|
| | | Control | Treated (Flushed) |
| Rice bran | 15 | 3.5 kg concentrate, 25 kg green grass, 1 kg molasses per cow per day | 4.5 kg concentrate, *ad libitum* green grass and 1 kg molasses per cow per day |
| Wheat bran | 40 | | |
| Maize crush | 20 | | |
| Khesari crush | 10 | | |
| Soybean meal | 12 | | |
| Oyster meal | 02 | | |
| Salt | 01 | | |

In the early morning of day 11 (during 12-18 hour of heat) the first AI was done with frozen thawed semen collected from Central Cattle Breeding Station (CCBS), Savar, Dhaka then after 12 hour 2nd AI was done. The cow was observed for return of heat and pregnancy (conception) was diagnosed after 60 days of AI through rectal palpation. The hormonal schedule is shown as:




### Effect of age on estrus synchronization and conception rate

The estrus and conception rate of flushing Holstein × Local crossbred cows were recorded according to the age of the cows to know the age effect on estrus synchronization and conception rate.

### Statistical analysis

Results were expressed as the percentage and data was analyzed using the SPSS software (Version 11.5; SPSS Inc., Chicago, IL, USA). Least significant different (lsd) test was done for comparison the significant means difference at 5% level of significance (Steel *et al*. 1997).

## RESULTS AND DISCUSSION

### Effect of flushed feeding on estrus synchronization and conception rate

The effect of hormones (GnRH and $PGF_2\alpha$) on flushed feeding crossbred (Holstein × Local) cows for exhibition of estrus are presented in Table 3. Table 3 indicated that both groups (control and treated) cows exhibited 100% heat after administration of hormones (250 µg GnRH+10 mg Prostaglandin $F_{2\alpha}$+250 µg GnRH).

The cows were provided nutritional flushing for two weeks and body weight of cows was increased 25 to 35 kg per animal in the flushed group during the experimental period. Çoyan *et al*. (2003) obtained similar results (100% cows showed heat) with the current study.

**Table 3** Effect of hormones (GnRH and progtandin $PGF_2\alpha$) on flushed feeding cows for exhibits estrus

| Cows | Number | Heat exhibition |
|---|---|---|
| Control | 10 | 10 |
| Treatment | 10 | 10 |
| Sign of heat shown (%) | 100 | 100 |

However, Diaz *et al*. (2005) observed the estrus synchronization of Brown Swiss and Holstein cows after administering prostaglandin $F_2\alpha$ ($PGF_2\alpha$), they observed 61.10% Brown Swiss and 50.8% Holstein exhibited estrus; this finding was lower than the present study. Moreover, the estrus of Holstein was reported 65% by DeJarnette *et al*. (2004) and DeJarnette and Marshall (2003) found 63.3% after administration of combined hormones and these findings were also lower than the current study. This higher percentage of estrus in the current study might be due to the effect combined hormone use (GnRH+prostaglandin $F_2\alpha$), double dose of GnRH and also the effect of management, body conditions of the cow. The success of synchronization programs depends on overall herd management, including nutrition, health, breeding and reproductive programs and the level of hormone administration (Macmillian, 2010; Cavalieri *et al*. 2004; Dailey *et al*. 1983). The effect of flushing on conception rate following estrus synchronization is shown in Table 4.

**Table 4** Effect of flushing on conception rate following estrus synchronization with GnRH and Prostaglandin $F_2\alpha$

| Cows group | No of cows | Conception (%) | |
|---|---|---|---|
| | | At first heat followed by fixed AI (%) | At second heat naturally observed after 21 days of first heat |
| Control | 10 | 2 (20) | 2 (20) |
| Treatment | 10 | 4 (40) | 4 (40) |
| Level of significance | | * | * |

* ($P<0.05$).
AI: artificial insemination.

Table 4 indicated that administration of hormones (250 µg GnRH+10 mg prostaglandin $F_2\alpha$+250 µg fertagyl) following flush feeding (15 days) increases the conception rate of cows. The obtained result on conception rate in the current study after hormonal treatment was 40% for Holstein × Local genotypes for flushed group, which was similar with the result of DeJarnette and Marshall (2003), who observed 41% concept rate for Holstein cows in their experiment. However, Diaz *et al*. (2005) and Pursley *et al*. (1997) obtained 51.6% and 46.3% conception rate for Holstein

cows followed by prostaglandin $F_2\alpha$ injection. On the other hand Hiers *et al*. (2003) observed 63% cows in estrus of *Bos indicus* × *Bos taurus* using gonadotropin-releasing hormone plus prostaglandin $F_{2\alpha}$ in combination with melengestrol acetate. The lower conception rate of the current study might be due to the late insemination, inaccuracies of estrus detection, poor semen quality, badly performed insemination procedure and also the effect of genotype × environment interaction. Troxel and Whitworth, (2007) and Troxel (2008) reported the highest conception rate to AI has been noted 4 to 12 hours after on the onset of standing heat. Furthermore, Mgongo *et al*. (2009) reported that administration of $PGF_2\alpha$ prior to AI improved conception/pregnancy rate.

**Effect of age on estrus synchronization and conception rate**

All the cows showed heat after hormonal (250 µg GnRH+10 mg Prostaglandin $F_{2\alpha}$+250 µg GnRH) treatment irrespective of age, therefore it can be noted that the age of the cows hasn't affected on estrus synchronization, hence only the effect of age on pregnancy (conception rate) was presented in the current study. The effect of age on conception rate of flushed crossbred (Holstein×Local) cows are presented in Table 5.

**Table 5** Effect of age on conception rate of hormonal (250 µg GnRH+10 mg prostaglandin $F_2\alpha$+250 µg GnRH) treated flushed fed Holstein×Local crossbred cows

| Traits | Control group age (year) | | | Treated group age (year) | |
|---|---|---|---|---|---|
| | 5 Years | 5.5 Years | 6.0 Years | 4.5 Years | 5.0 Years |
| Conception rate (%) | 25 | 20 | 16 | 45 | 35 |
| Average (%) | | 20 | | 40 | |

From table 5, it was observed that for both the treated and control groups the conception rate was higher in younger cows than older one. However, Ferdousi and Khan (2013) observed that older cows i.e. 9 years old Holstein × Local cows showed a higher conception rate than the younger cows. This difference might be due to the effect of flushed feed and age in the current study. Coach (2010) found that the nutrition has the positive effect on conception rate. (Troxel and Whitworth, 2007) reported that the duration of postpartum anestrus averages 20 days longer for first-calf heifers than mature cows.

## CONCLUSION

It can be concluded that the cows exhibit estrus 100% after administrating the combination of GnRH and prostaglandin $F_2\alpha$ hormone. The conception rate after 1st time artificial insemination and 2nd time artificial insemination for the flushed feed group was higher than the control group. Age does no influence for inducing heat, but the conception rate was affected.

Estrous synchronization can be a useful tool in the reproductive management of a cow herd. However, if proper levels of nutrition, body condition and health are not maintained, the program is likely to be fall. Estrus synchronization and AI is essential to develop the cattle population as well as to increase productivity of milk and meat. In the current study there were some limitations: small sample size, short experimental period, funds and availability of hormones. However, a further intensive study with more sample size is recommended before use the method for estrus synchronization in a large dairy herd.

## ACKNOWLEDGEMENT

The authors are pleased to acknowledge the authority of the Military Dairy Farm, Chittagong, Bangladesh for giving permission to purse this study and their cooperation. Moreover, they are grateful to the authority and staffs of Chittagong Veterinary and Animal Science University (CVASU) for the providing a good academic environment at CVASU. Grateful to everybody who help directly or indirectly, for conducting this research.

## REFERENCES

Cavalieri J., Hepaworth G. and Fitzpatrick L.A. (2004). Synchronization of estrus with estradiol benzoate after using a two-dose prostaglandin treatment to synchronize luteolysis in dairy heifers. *Australian Vet. J*. **82,** 120-125.

Coach L. (2010). Factors influencing conception rate. Available at: www.wvu.du/vagexten/forglvst/Dairy/dirmilo.pdf.

Çoyan K., Ataman K.B., Erdem H., Kaya A. and Kasikci G. (2003). Synchronization of estrus in cows using double $PGF_2$ alpha, GnRH-$PGF_2\alpha$ and hCG-$PGF_2\alpha$ combination. *Rev. Med. Vet*. **154,** 91-96.

Dailey R.A., James R.E., Inskeep E.K. and Washburn S.P. (1983). Synchronization of estrus in dairy heifers with prostaglandin $F_2$alphs with or without estradiol benjoate. *J. Dairy Sci*. **66,** 881-886.

DeJarnette J.M., House R.B., Ayars W.H., Wallace R.A. and Marshall C.E. (2004). Synchronization of estrus in postpartum beef cows and virgin heifers using combinations of melengestrol acetate, GnRH, and $PGF_2\alpha$. *J. Anim. Sci*. **82,** 867-877.

DeJarnette J.M. and Marshall C.E. (2003). Effects of pre-synchronization using combinations PGF2 and (or GnRH on pregnancy rates of Ovsynch and Cosynch-treated lactating Holstein cows. *Anim. Reprod. Sci*. **77,** 51-60.

DLS. (2009). Department of Livestock Services. Statistics of the department of livestock services, Bnagladesh, Annual Report.

Diaz C.A.G., Emsen E.N., Tuzemen Yanar M., Kutluca M. and Koycegiz F. (2005). Reproductive performance and synchronization of estrus in Brown Swiss and Holstein cows and heifers using $PGF_2\alpha$. *J. Anim. Vet. Adv*. **4,** 551-553.

Ferdousi J. and Khan M.K.I. (2013). Study on the conception rate of different dairy cows under farming conditions in Chittagong area. *Bangladesh J. Vet. Anim. Sci*. **2,** 37-41.

Hiers E.A., Barthle C.R., Dahms M.K.V., Portillo G.E., Bridges G.A., Rae D.O., Thatcher W.W. and Yelich J.V. (2003). Synchronization of *Bos indicus* × *Bos taurus* cows for timed artificial insemination using gonadotropin-releasing hormone plus prostaglandin $F_2\alpha$ in combination with melengestrol acetate. *J. Anim. Sci*. **81,** 830-835.

Hossain K.B.S., Takayanagi T., Miyake T., Bhuiyan A.K.F.H. and Sasaki Y. (2002). Statistical genetic studies of cattle breeding for dairy productivityin Bangladesh: II. Estimation of reciprocaland heterosis effects and optimum crossbreeding system between the local and exoticbreeds for milk performance. *Asian-australasin J. Anim. Sci*. **15,** 777-782.

Huque K.S., Deb K. and Jalil M.A. (2011). High yielding dairy breed development in Bangladesh limitations and opportunities. Pp. 14-25 in Proc. Int. Worksho. High Yield. Dairy Breed Dev. Dhaka, Bangladesh.

Khan M.K.I., Blair H.T., Lopez-Villalobos N. and Jhonsion P.L. (2005). Productive, reproductive and economic performance of dairy cattle in Bangladesh. *Proc. Advanc. Anim. Breed. Gen*. **16,** 124-127.

Macmillian K L. (2010). Recent advances in the synchronization of estrus and ovulation in dairy cows. *J. Reprod. Dev*. **56,** 42-47.

Mgongo F.O.K., Mujuni P. and Kitambi A. (2009). Pregnancy rates of crossbred dairy cattle synchronized using GnRH and one injection of $PGF_2\alpha$ versus two injections of $PGF_2\alpha$ prior to insemination. Livest. Res. Rural. Dev. http://www.lrrd.org/lrrd21/8/mgon21136.htm.

Pursley J.R., Wiltbank M.C., Stevenson J.S., Ottobre J.S., Garverick H.A. and Anderson L.L. (1997). Pregnancy rates per artificial insemination for cows and heifers inseminated at a synchronized ovulation or synchronized estrus. *J. Dairy Sci*. **80,** 295-300.

Pursley J.R., Mee M.O. and Wiltbank M.C. (1995). Synchronization of ovulation in dairy cows using PGF2α and GnRH. *Theriogenology*. **44,** 915-923.

Steel R.G.D., Torrie J.H. and Dickey D.A. (1997). Principles and Procedure of Statistics-A: Biometrical Approach. McGraw-Hill Co., Inc., NY and London.

Troxel T.R. (2008). Purebred cattle series synchronization of estrus in cattle. University of Arkansas Cooperative Extension Service. FSA3120. http://www.albcia.com/documents/EstrusSynch-FSA-3120.pdf.

Troxel T.R. and Whitworth W. (2007). Synchronization of estrus in cattle. University of Arkansas Cooperative Extension Service. MP383. http://www.uaex.edu/Other_Areas/publications/PDF/mp383.pdf.

Whisnant C.S., Washburn S.P. and Farin P.W. (1999). Current concepts in synchronization of estrus and ovulation of dairy cows. *Proc. Am. Soc. Anim. Sci*. **20,** 1-8.