Effect of lecirelin acetate, hCG or progesterone administration on day 7 post-insemination on conception rate and progesterone concentration in cross-bred cattle

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Abstract

The present study was designed to evaluate the effect of administration of lecirelin acetate, hCG and progesterone after AI on ovarian picture, serum progesterone concentrations and first service conception rate in cross-bred cattle. A total of 160 lactating cross bred (Friesian x Sahiwal) cattle were divided into 4 groups after AI. The groups were treated as follows: control (injected i.m with normal saline 2ml, n=40), d 7-LA (injected i.m with lecirelin acetate100 µg, n=40), d 7-hCG (injected with hCG 3300 IU, n=40) and d 7-P₄ (injected i.m with Progesterone 0.5 mg daily for 4 days, n=40) group. The hormonal treatments were given to animals on day 7 after AI. The ultrasonography and blood sampling was done before treatment and then 7 days later. All animals were examined for pregnancy through ultrasonography at 40 ± 1 day after AI. The diameter of SCL on 7 days after treatment was higher (P < 0.01) in group d 7-LA and d 7-hCG group cows as compared to control cows. In contrast, the diameter of SCL in d 7- P₄ treated cows did not differ from control cows. Formation of ACL was observed only in 50 % & 80 % cows in d 7-LA and d 7-hCG group respectively. No ACL was observed in control and d 7- P₄ cattle on day 7 after treatment. The P₄ concentrations were significantly higher (P < 0.01) in d 7-hCG treated cattle as compared to control at 7 days after treatment. As compared to 10 percent First Service Conception Rate (FSCR) in controls, an increase (P < 0.05) of 50 percent and 40 percent was observed in each treatment group (d 7-hCG & d 7-LA), non-significant (P > 0.05) difference in FSCR was observed between control and d 7-P₄ group. It was concluded that the use of hCG or LA, 7 days after AI is a beneficial tool to improve conception rate in cross-bred cattle whereas use of parental P₄ post-breeding has no effect on SCL diameter and conception rate.

Keywords: Lacerilin acetate, hCG, Progesterone, Accessory corpus luteum, Conception rate

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تأثر اعطاء اسيات الليسيريلين محفز القند المشيمي البشري أو البروجستيرون في اليوم السابع بعد التلقيح على معدل الاخصاب وتركيز البروجستيرون في الابقار المضربة

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الخلاصة

صممت الدراسة الحالية لتقدير تأثير إعطاء اسيات لليسيريلين، محفز القند المشيمي البشري وهورمون البروجستيرون بعد التلقيح الاصطناعي على صورة المبيض، وتركيز البروجستيرون في المصل، وعدد مرات التلقيح في الأبقار المضربة. تم تقسيم 160 بقرة
Introduction

Efficient reproduction is important for the sustainable improvement of animal productivity and is a critical factor influencing the economic viability of livestock farmers. In developing countries, lower fertility is an important factor affecting the livestock production (1).

Conception failure is related with less than normal concentrations of progesterone (P4) as early as day 6 after insemination (2). Embryo development is associated with concentrations of progesterone and the ability of the conceptus to secrete the anti luteolytic hormone, interferon-tau (3). Exogenous P4 has been shown to stimulate embryo development (4). A number of treatments could be used to increase peripheral P4 concentrations after artificial insemination (AI), that improve the function of corpus luteum (CL), or supplement progestin.

A variety of hormonal regimens have been used to improve conception rates in cattle. Modern approaches have been focused on gonadotropin releasing hormone (GnRH) and human chorionic gonadotropin (hCG) hormones. But, their effects on conception rates are variable. Some authors reported increased conception rate in lactating dairy cattle (5-6), whereas, others have reported no effect (7-8).

Use of GnRH or its agonists (leciurelin acetate) to enhance conception rates is based on an understanding of GnRH-induced biological effects on the reproductive-endocrine system. This consequence has been brought through GnRH-stimulated LH surge and stimulating corpus luteum for P4 production (9). The use of GnRH (10-11) or hCG (12-13) after AI increases P4 secretion due to the luteotropie effect (13-14) and/or induction of an accessory corpus luteum (11-15) thus, increasing P4 concentration and, possibly, also conception. The use of P4 releasing intravaginal devices (PRID) and controlled internal drug release (CIDR) between day 6 and 12 improves conception rate has been well documented in literature (16-17). The parental use of P4 after 7 days of AI has not been studied. The present study was, therefore, designed to determine the effect of leciurelin acetate, hCG and P4 administration post-breeding in crossbred cattle.

Materials and methods

The research was conducted on 160 lactating cross breed (Friesian x Sahiwal) cows in Pakistan at a cattle farm located between Latitude 30.1984°N and Longitude 71.4687°E. The animals were in 3rd lactation and body weight of animals ranged from 312±1.70 to 318±1.94 kg and milk production ranged from 7.1±0.29 to 7.6±0.17 liters per day. Each animal was fed cotton seed cake (1.6 kg), wheat bran (1.59 kg), wheat straw (4.55 kg) and green fodder (9.09 kg) daily. All cows included in the study were in their first AI postpartum and interval from calving to treatment was above 90 days and cows were free from brucellosis, tuberculosis and mastitis. Each cow was identified by tattoo in the ear. The animals had free access to drinking water. Semen of single bull of Sahiwal breed was used for AI. All the inseminations were done by single technician. Following AI, the animals were randomly divided into four groups viz., control (normal saline 2ml, n=40), d 7-LA (leciurelin acetate100 µg, Dalmeralin; Fatro, Itlay, n=40), d 7-hCG (hCG 3300 IU, Choriomon; Lugano, Switzerland, n=40) and d 7-P4 (Progesterone 0.5 mg daily for 4 days, Pregtene; Sellmore Pharmaceuticals, Pakistan, n=40) group. The hormonal treatments were given i.m to animals on day 7 after AI.
Ovaries of all experimental animals were scanned through trans-rectal probe (7.5 – MHz, Honda, Japan). The ultrasonography was done before treatment and then 7 days later. Blood sampling from all experimental cows was done before hormonal treatment and 7 days after treatment. Blood was collected from jugular vein with sterilized disposable syringe with 18G needle. The blood samples were brought to the lab in cooled box. Serum was separated by centrifugation at 3000 rpm for 15 minutes. The serum samples were stored at -20°C till analysis (18).

Serum progesterone concentrations were determined in all experimental cows at the time of treatment and 7 days later (Table- 2). In all experimental groups, the serum P₄ concentrations were increased (P<0.01) 7 days after treatment as compared with the day of treatment (Fig. 1). The P₄ concentrations were significantly higher (P<0.01) in d 7-hCG and d7-LA cattle as compared to control at 7 days after treatment. As compared to 10 percent FSCR in controls, an increase (P<0.05) of 50 percent and 40 percent was observed in each treatment group (d 7-hCG & d 7-LA). Non-significant (P>0.05) difference in FSCR was observed between control and d 7-P₄ group.

Table 1: Ovarian response in cross-bred cattle treated with LA, hCG and progesterone on day 7 after AI: (SCL and ACL diameter: mm)

<table>
<thead>
<tr>
<th>Day</th>
<th>Control</th>
<th>d 7-P₄</th>
<th>d 7-LA</th>
<th>d 7-hCG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCL</td>
<td>ACL</td>
<td>SCL</td>
<td>ACL</td>
</tr>
<tr>
<td>Day 7</td>
<td>12.6 ± 0.4</td>
<td>-</td>
<td>12.8 ± 0.5</td>
<td>-</td>
</tr>
<tr>
<td>Day 14</td>
<td>12.8 ± 0.5</td>
<td>-</td>
<td>12.9 ± 0.5</td>
<td>13.8 ± 0.4°*</td>
</tr>
</tbody>
</table>

*There was significant difference (P < 0.01)

Fig. 1: Difference in serum progesterone concentrations before treatment and 7 days later in experimental cross-bred cattle.

Table 2: Serum progesterone concentrations and first service conception rate in cross-bred cattle treated with LA, hCG and progesterone on day 7 after AI

<table>
<thead>
<tr>
<th>Progesterone Concentration (ng/ml)</th>
<th>Control</th>
<th>d 7-P₄</th>
<th>d 7-LA</th>
<th>d 7-hCG</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₄ at the time of treatment</td>
<td>1.5 ± 0.2</td>
<td>1.4 ± 0.4</td>
<td>1.6 ± 0.3</td>
<td>1.5 ± 0.3</td>
</tr>
<tr>
<td>P₄ 7 days after treatment</td>
<td>3.4 ± 0.3</td>
<td>3.6 ± 0.3</td>
<td>4.7 ± 0.3°</td>
<td>5.1 ± 0.2°</td>
</tr>
<tr>
<td>First Service Conception Rate (%)</td>
<td>10</td>
<td>10</td>
<td>40°*</td>
<td>50°*</td>
</tr>
</tbody>
</table>

*There was significant difference (P < 0.01)
Discussion

In the present study, cross-bred cattle were treated with LA, hCG or P4, 7 days after AI to induce ACL and increase circulating progesterone concentrations. About 50 % & 80 % cows develop ACL in response to LA and hCG. Development of ACL during this phase of estrous cycle is in agreement with other studies for GnRH (20) and hCG (13-21). The increase in size of SCL in response to hCG is attributed to the fact that hCG functions like LH. hCG binds with LH receptors at target site and affects on small luteal cells to secrete P4. Size of large luteal cells increased when hCG was given on day 3-5 of ovine estrous cycle (22). Since about 80 % P4 is synthesized from large luteal cells (22), therefore, in our study increase in diameter of SCL was due to increase in size of large luteal cells. Higher P4 in hCG treated cattle in our study is due to the effect of hCG on SCL as well as ACL.

Formation of ACL in response to LA is reported in another study also (21). In our study, P4 concentrations were higher in LA treated cattle than control and are in agreement with Howard et al. (23). The results of LA and hCG are comparable for development of ACL in our study, LA and hCG were equally effective in inducing CL when given on day 6 of estrous cycle in heifers (11). In our study, we replaced the use of CIDR in previous studies with daily P4 administration for 4 days. Administration of P4 (i.m) for 4 days did not increased the SCL diameter as well as serum P4 concentrations as compared with control group.

It has been reported that administration of hCG/ GnRH in early luteal phase between 4-6 day of estrous cycle induced ovulation of the first wave dominant follicle and formation of accessory CL. Higher FSCR was observed in hCG and LA cattle. These findings are in agreement with Santos et al. (13) who evaluated the effects of hCG administered on day 5 after AI on CL number, P4 concentrations, conception rate and pregnancy loss in high-producing dairy cows. The findings of present study also corroborate with Stevenson et al. (21). Daily P4 administration did not affected FSCR in present study. The P4 concentration during luteal phase after AI is associated with good quality embryo development (24). During the process of maternal recognition of pregnancy, high quality embryo will suppress luteolytic process through IFN-τ (25-26). In our study, beneficial effect of hCG and LA was observed through improvement of SCL diameter, development of ACL and thus higher circulating P4 concentrations. It was concluded that use of hCG or LA, 7 days after AI is a beneficial tool to improve conception rate in cross-bred cattle. The use of parental P4 post-breeding has no effect on SCL diameter and conception rate.

References


