The efficacy of the recycled CIDR on estrus synchronization in postpartum anestrus in buffalo cows

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Abstract

The present study aims to evaluate the efficiency of the reused controlled-internal drug-releasing devices (CIDR) compared with the hormonal method to induce estrus in the postpartum anestrus of Iraqi buffalo’s cow. Thirty-two buffalo cows aged at least three years suffering from postpartum anestrus were randomly selected and divided into four groups (eight animals each). Ultrasound was used to assess the ovarian status. Animals with any reproductive defects were excluded. In the first group (G1), a new CIDR device was used for nine days, while in G2 animals, the device of the first group was reused for nine days; while, in the G3 group, the devices were further reused either for nine days (subgroup A) or 18 days (subgroup B, received PGF2α, at day 17; GnRH, at day 19). In the fourth group (G4), the animals received an injection of PGF2α (IM, 25 mg) followed by a dose of GnRH (IM, 500 mg) after 72h, without CIDR insertion. Blood samples were collected from the jugular vein pre and post CIDR insertion. Blood samples were utilized for the progesterone level assessment. For estrus and conception rates, animals were bred by fertile buffalo bulls, and pregnancy was detected at day 45 post-mating. Results showed that there was no variation in the rates of estrus induction and conception between the uses of the new CIDR device (G1) and the reused devices (G2 and G3 subgroup A); however, in the subgroup B and G4, only 50% of the treated animals demonstrated estrus. The duration, hormone, estrus, and pregnancy rate results revealed highly significant variations between groups. After the device withdrawal, the progesterone level in G2, G3, and G4 revealed a significant decline relative to G1. In addition, the duration was positively correlated to the progesterone level, estrus, and pregnancy rate. The progesterone level during the first and second services revealed a slight negative correlation with pregnancy. In conclusion, reusing the same CIDR device up to three times for estrus synchronization is highly effective inducing estrus with high conception in postpartum anestrus Iraqi buffalo cows. Additionally, it is possible to reuse the CIDR device in 9 days without administration of GnRH in the lactating buffalo cows.

Introduction

Reproductive efficacy is a vital key point in commercial herds. To improve the productive productivity of a buffalo herd, buffalo cows should demonstrate estrus within 80-90 days after calving; thus, a calf is produced, and a new lactation period is started every 13-13.5 months (1). Buffalo’s reproduction and production are highly affected by postpartum reproductive disorders. The decreased reproductive efficiency in Iraqi buffaloes is especially due to postpartum anestrus, prolonged calving interval, and poor estrus detection (2). Early postpartum disorders manifested by increased days to first estrus, calving interval, open days, and service per conception are extended in diseased animals.
more than in healthy animals (3). A survey on reproductive disorders showed that postpartum anestrous is the greatest cause of infertility in Iraqi buffalo cows, with an incidence of 12-18% (4). True anestrus due to inactive ovaries is an essential cause of infertility in buffalo cows, which leads to economic losses in buffalo herds by declining milk and new calf production (1). The efficacy of the estrus synchronisation in buffaloes by CIDR device protocol accompanied with GnRH and prostaglandin F2α mainly depends upon progesterone concentration in the device (5). The CIDR device protocol significantly the induction of estrus and conception rates in postpartum anestrous Iraqi buffalo cows (6). Estrus synchronisation using CIDR devices plus GnRH protocol revealed high conception rates in buffalo cows (7). Because of the increased expenses of estrus synchronisation programs, there is an increased demand to find other methods to decrease the cost along with the increased reproductive performance (8). The CIDR device programs are recommended for only a single use because of the risk of venereal disease transition. However, it has been used to evaluate the oviducts and uterus to exclude any defect. A new CIDR device (progesterone 1.9g) was used in the first group (G1) for nine days, while in (G2) the devices of the first group were reused for other buffalo cows for the same period. Animals in the G3 group were subdivided into two groups (4 buffalo cows in each subgroup): subgroup-A received double reused devices for nine days while subgroup-B received PGF2α (IM, 25 mg) 24h before the day of CIDR withdrawal (18 day) and 24h later animals were injected with GnRH (IM, 500 mg). In the fourth group (G4), buffalo cows (n=8) received an injection of PGF2α (IM, 25 mg) followed by a dose of GnRH (IM, 500 mg) after three days of PGF2α injection without the insertion of CIDR. Pre- and post-insertion of the CIDR devices (day 0 of insertion and the ninth day after withdrawal, respectively), blood samples were collected from the jugular vein to determine the blood progesterone level (15,16). Buffalo cows were inseminated naturally with fertile buffalo bulls. Pregnancy diagnosis was applied on day 45 post-mating to estimate the conception rate (17,18).

Results

Results of the estrus synchronisation by the reused CIDR device in postpartum anestrous buffalo cows are presented in table 1. The analyzed data (estrus and pregnancy rate) between the studied groups exhibited highly significant variation (P<0.001) in estrus and pregnancy rate after a natural mating in the G1, G2, and G3A groups 100%, each. At the same time, estrus and pregnancy rates declined in G3B and G4 (50% each).

Regarding the 1st and second services, the analyzed pregnancy rate data between the studied groups exhibited highly significant variation (P<0.001). The chi-square test demonstrated significant variations between groups in estrus duration, hormonal level, estrus, and pregnancy rates (P value 0.000, 0.000, 0.015, and 0.000, respectively) with χ² values 64.00, 32.00, 12.308, and 21.333, respectively, among the studied groups. Meanwhile, compared to the G1 and G2, the pregnancy rate from the first insemination declined in both the G3 and G4 groups (Figure 1).
Table 1: Results of CIDR application

<table>
<thead>
<tr>
<th>Groups</th>
<th>No. Animals</th>
<th>Duration of insert CIDR days</th>
<th>PGF$_2\alpha$</th>
<th>GnRH</th>
<th>Estrus rate</th>
<th>Pregnancy rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>8</td>
<td>9</td>
<td>+ve</td>
<td>-ve</td>
<td>100%**</td>
<td>100**</td>
</tr>
<tr>
<td>G2</td>
<td>8</td>
<td>9</td>
<td>+ve</td>
<td>-ve</td>
<td>100%**</td>
<td>100**</td>
</tr>
<tr>
<td>G3-A</td>
<td>4</td>
<td>9</td>
<td>+ve</td>
<td>-ve</td>
<td>100%**</td>
<td>100**</td>
</tr>
<tr>
<td>G3-B</td>
<td>4</td>
<td>18</td>
<td>+ve</td>
<td>+ve</td>
<td>50%</td>
<td>50</td>
</tr>
<tr>
<td>G4</td>
<td>8</td>
<td>-</td>
<td>+ve</td>
<td>+ve</td>
<td>50%</td>
<td>50</td>
</tr>
</tbody>
</table>

** high significant at the $P \leq 0.001$ level.

Figure 1: The pregnancy rates among groups according to the required insemination.

Before CIDR insertion, the results showed that the progesterone level significantly declined in the G2, G3, and G4 relative to the G1 group ($P$ value 0.00). Similarly, after the device withdrawal, the G2, G3, and G4 revealed a significant decline in the progesterone level relative to its level in G1 ($P$ value 0.024) (Figure 2).

Figure 2: Variation in progesterone levels among experimental groups.

The Pearson correlation test showed that the duration was positively correlated to the hormonal level ($r$ value 0.942), estrus ($r$ value 0.584), and the pregnancy rate ($r$ value 0.590, $P$ value 0.000). The hormonal level was also positively correlated ($P$ value 0.000) to estrus and pregnancy ($r$ value 0.620 and 0.745, respectively). In addition, the estrus was positively correlated to pregnancy rate ($P$ value 0.000 with $r$ value 0.832), as in table 2. The progesterone level during the first and second inseminations revealed a slight negative correlation with pregnancy ($P$ value 0.038 with $r$ value -0.368), as in table 3.

Table 2: Pearson Correlation Sig. (2-tailed) between the studied parameters in the treatment groups

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Duration</th>
<th>Hormone</th>
<th>Estrus</th>
<th>Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>1</td>
<td>0.942**</td>
<td>0.000</td>
<td>-</td>
</tr>
<tr>
<td>Hormone</td>
<td></td>
<td>0.584**</td>
<td>0.620**</td>
<td>0.745**</td>
</tr>
<tr>
<td>Estrus</td>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.832**</td>
</tr>
<tr>
<td>Pregnancy</td>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

Table 3: Pearson Correlation Sig. (2-tailed) of progesterone level with pregnancy rate

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Progesterone</th>
<th>Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progesterone</td>
<td>1</td>
<td>-0.368*</td>
</tr>
<tr>
<td>Pregnancy</td>
<td></td>
<td>0.038</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).

Discussion

The current study revealed that Iraqi buffalo cows suffering from postpartum anestrus and treated with a new or previously used CIDR device expressed similar reproductive performance, including estrus and pregnancy. A corpus luteum on the ovary causes negative effects on follicular development, and removing the exogenous progesterone hormone source (CIDR) promotes ovarian activity (19). On the other hand, in the postpartum period, the administration of PGF$_2\alpha$ causes a sharp decline in progesterone levels, resulting in degeneration of the active luteal tissue; thereby, it blocks the negative feedback of progesterone on the pituitary hormones. In addition, following the withdrawal of
CIDR devices, the rapid drop in the circulating progesterone level would promote the release of GnRH from the hypothalamus. Consequently, the pituitary FSH and LH are released, followed by the resumption of ovarian cyclicity (20). Therefore, releasing GnRH after CIDR device removal can effectively stimulate the pituitary gonadotropins with consequent estrus induction in buffalo cows’ postpartum anestrus (21).

A previous study on dairy buffalo cows revealed a positive impact of the exogenous progesterone embedded in the CIDR device on estrus induction and follicular development (22). The unused CIDR device contains progesterone in a concentration of 1.92g, while the residual progesterone concentration after the single use may reach 1.31±0.01 g, and the estimated progesterone release is 0.61g; in the same way, the received second and third used CIDR devices contain residual progesterone of 1.38 and 1.05 ng/mL, respectively (23,24).

In the present study, the ovaries of the presynchronized animals demonstrated insufficient follicular growth and absence of mature follicles with the presence of mature corpora lutea; however, after being synchronized with a new or reused CIDR devices, estrus was detected within 2-3 days (25). In addition, the estrus and pregnancy rates were 100% in the treated groups (G1-G3A). Therefore, high significance of a CIDR device appears to be the presence of a corpus luteum at the end of the estrus synchronization program without the need to complete the program by administration of GnRH hormone at day 11, when the presence of dominant follicle development in the final stage of the program (12). Similar observations of ovarian responses and pregnancy rates were recorded in buffalo cows treated with new or reused CIDR devices (25,26). These results suggested that treating buffalo cows with a new or used CIDR device during the postpartum period provides adequate regulation of follicular growth and improves the final follicular growth by reducing the progesterone level. Moreover, injection of PGF2α before the CIDR removal in estrus synchronization programs improves fertility and pregnancy rates (12,27,28).

This study found that CIDR can be reused effectively up to three times (9 days each) to induce estrus and increase pregnancy rates. So that the progesterone released from both the new or reused CIDR is adequate to induce estrus, this might be attributed to the reduced level of progesterone released from reused CIDR devices, which can induce estrus following the removal of the reused CIDR (13). In this study, after the CIDR removal, the onset of estrus was earlier in buffalo cows treated with the reused CIDR (1-3 times) than in animals with a new CIDR. It has been suggested that the low progesterone released from the reused CIDR might efficiently control ovarian follicular growth, where a similar effect on the induction of estrus and pregnancy rates of the postpartum anestrus buffalo cows was revealed (25,29).

There was a significant variation in the progesterone level between the day of CIDR insertion and the withdrawal possibly due to the administration of PGF2α on the eighth day. The response of postpartum anestrus buffaloes to the new or reused CIDR protocols might predict a high response to estrus and pregnancy (30-32). Furthermore, buffalo cows that responded to CIDR protocols during the postpartum period had progesterone hormone levels ≥ 2.0 ng/mL at the time of CIDR insertion (33,34). After the PGF2α injection, the decreased progesterone level (less than 2.0 ng/mL) might be considered a positive responsive sign for the treatment (35,36). However, with low progesterone, the growing follicles might undergo persistent follicle and during the LH surge, the follicle growth will be promoted toward ovulation (13,37).

Using PGF2α-GnRH protocol for estrus synchronization in buffalo cows can promote luteolysis, decrease the progesterone level, and induce estrus (38). However, another study in buffalo cows noted that using GnRH-PGF2α protocol for estrus synchronization revealed higher estrous observation than other treatments (39). In the present study, administration of PGF2α in buffalo cows with the presence of corpus luteum caused a decline of corpus luteum diameter, progesterone levels, and a rise in the follicle diameter, suggesting the initiation of a new estrous within 56-72hr. However, in the G4, only 50% of buffalo cows failed to ovulate after administering PGF2α, possibly due to the declined serum progesterone level in the first 24-48 hr. This decline did not reach >1.0 ng/mL after administration, where this result agrees with a previous study (7,40).

Conclusions

The present study verified that the reused CIDR, up to three times, can effectively increase the reproductive performance in the postpartum anestrus buffalo cows by inducing estrus and increasing the pregnancy rates. Notably, following this protocol can halve the expenses of postpartum anestrus in buffalos.

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Conflict of interest

The author has no financial or personal ties to groups or individuals who might have improperly influenced the paper’s content.

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فعالية إعادة استخدام اللولب المهلي لتوحيد الشبق في إناث الجاموس التي تعاني من انعدام الشبق بعد الولادة

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الخلاصة

تهدف الدراسة الحالية إلى تقييم فعالية إعادة استخدام اللولب المهلي، ومقارنة مع الطرق الهرمونية في إحداث الشبق وبائية إناث الجاموس العراقي التي تعاني من انعدام الشبق بعد الولادة. تعلو على الدراسة أن الัย ضع أسلة من إناث الجاموس بعد الولادة خاضعت لإجراء اللولب المهلي لفترة قصيرة. فلقد عبرت حالة البامية والرحم باستخدام جهاز الأوموج فوق الصوئية استنتاج أن جميع أنثى المجموعة الأولى تم إدخال اللولب المهلي الجديد لمدة 9 أيام وقبل استخدام نفس اللولب المهلي المستخدم بالمجموعة الأولى لمدة 9 أيام، أما المجموعة الثالثة فإن استخدام اللولب المهلي المستخدم لمرتين وفستهذه المجموعة تحت المجموعة 1 لمدة 9 أيام وجمع المجموعة الثانية بعد 18 يوم حيث تم حقن البروستوكلاندين يوم 17 وحقن هرمون المحرر للقند يوم 19 أما المجموعة الرابعة فهي مجموعة استخدام البرنامج الهرموني حيث تم حقن البروستوكلاندين بجرعة 500 ملغ. وحمض البسلة بعد 22 ساعة هرمون المحرر للقند بجرعة 500 ملغ. بالرغم لاستخدام اللولب المهلي، ثم تم حقن عينة الدم من الوريد الودبي من أصل تقدم مستوي هرمون البروستوكلاندين ونسبة لمحاد الشبق في إناث الجاموس ينصح بسلاسة للمجموعة الأولى والذي تم إدخال اللولب المهلي. تسجيل حدوث الشبق والحمل بعد إدخال اللولب المهلي، وحين اللولب المهلي ونسبة الحمل في المجموعة الرابعة تصل نسبة إحداث الشبق ونسبة الحمل فيها إلى 90٪، كما سجل وجدنا نسبة عيني على في مستوى هرمون البروستوكلاندين من انخفاض بعد سحب اللولب المهلي في المجموعات أو من دون اللولب المهلي، بالإضافة إلى وجود علاقة إيجابية بين فترة بقاء اللولب ومدى هرمون البروستوكلاندين وفي مدة الشبق ونسبة الحمل. فيما لوحظ وجود علاقة إيجابية بين حصول الحمل من العمل الأول والثاني كمقارنة مع معدل حصول الحمل. لاستنتج أن تواريخ الشبق بقاعدة استخدام اللولب المهلي وأصل ثلث من يكون ب💼 إذ أخذت تلك المجموعة في متابعة في إحداث الشبق وللمعمر من اللولب المهلي لمدة 9 أيام ودون الحجة الهرمون المحفز للقند في اليوم 11 من برنامج توحيد الشبق في إناث الجاموس المرضعة.

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