Short Paper

Effect of GnRH analogue (Gonadorelin) on pregnancy rates in river buffaloes

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Summary

Field trials were carried out to assess the effect of gonadorelin (Fertagyl®, intervet, Holland) on pregnancy rates of river buffaloes. In this study 84 lactating cyclic buffaloes were randomly allotted to three treatment groups. (1) untreated control (n=40); (2) I.M. injection of 0.25 mg gonadorelin at the time of artificial insemination (n=20) and (3) I.M. injection of 0.25 mg of gonadorelin on days 11 to 13 post-insemination (n=24). Pregnancy was determined by rectal palpation of the uterus on days 42 to 55 after insemination. Pregnancy rates to first service (AI) in groups 1, 2 and 3 were 25%, 55% and 58%, respectively. In groups 2 and 3, a greater proportion of buffaloes that received GnRH became pregnant comparing to that of those untreated (P<0.01). The results demonstrated that a single dose of the gonadorelin significantly improved pregnancy rates in buffaloes when administered at the time of AI or during the mid luteal phase after AI.

Key words: GnRH agonist, Pregnancy rate, Buffaloes

Introduction

According to FAO (2000) there are about 166 million domesticated buffaloes (Bubalus bubalis) in the five world continents. Subspecies of B. bubalis are referred to as river buffalo and swamp buffalo. Despite river and swamp buffalo possessing a different number of chromosomes, (2n=50 and 48, respectively), they are able to interbreed and produce fertile hybrid progeny. Buffaloes play a prominent role in rural livestock production, particulary in Asia where over 95% of the world buffaloes are found. Reproductive efficiency is the primary factor affecting productivity which is hampered in the female buffalo by inherent late maturity, poor estrous expression, distinct seasonal reproductive pattern and prolonged calving intervals (Singh et al., 2000). Moreover, preimplantation embryonic loss is the major limiting factor for obtaining optimum reproductive performance and inadequate luteal function has been shown to be an important cause of embryo loss (Wilmut et al., 1986; Ashworth et al., 1989). In attempts to reduce embryonic mortality and improve reproductive performances in sheep and cattle, progesterone supplementation has been employed during early pregnancy (Thatcher et al., 1994). However, this approach has produced contrasting results. Another approach in reducing embryo loss during early pregnancy has been the administration of exogenous gonadotropin-releasing hormone (GnRH). The effect of synthetic GnRH on conception rate in dairy cows when injected at the time of artificial insemination (Lee et al., 1983; Rosenberg et al., 1991; Mee et al., 1993) and between 11-13 days after insemination (Macmillan and Thatcher, 1991; Rettmer et al., 1992 a; Sheldon and Dobson, 1993; Singh et al., 2003) is widely used. In mares one report shows that treatment with buserelin between days 8 and 12 after ovulation and service, increases the pregnancy rates (Newcombe et al., 2001). Administration of GnRH on day 12 post-mating has been shown to improve reproductive performance of ewes (Cam et
al., 2002). It is thought that GnRH treatment may increase the chances of embryo survival by improving luteal function and/or interfering with the luteolytic mechanism (Beck et al., 1994; Birnie et al., 1997; Cam et al., 2002). Therefore, it seemed reasonable to evaluate this strategy in buffaloes. The present clinical trials were conducted to elucidate the efficacy of single administration of a GnRH agonist (gonadorelin) at the time of AI or between 11 to 13 days after insemination on first service pregnancy rates in river buffaloes.

Materials and Methods

A total of 84 lactating river buffaloes (Bubalus bubalis), 4 to 12 year of age, weighing 430-650 kg were selected from a herd kept at the Buffalo Breeding Center in the North-West of Iran. Buffaloes had a history of normal calving and had no clinically detectable abnormalities in their genital tract. These buffaloes were housed in free stall confinement facility exposed to the natural environment, allowance for shade, wallowing in pool, sluicing or spraying water to cool the animals during the hot part of the day. The buffaloes were fed standard diet of chopped alfalfa, concentrate, corn silage and apple pomace silage. The experiment was carried out during the months of June to October (30°C maximum atmospheric temperature), the time when ovarian activity normally commences in buffaloes. Oestus detection was carried out by penile deviated buffalo bull (heterosexual behaviour or standing heat) and visual observation of oestrus signs such as: restlessness, bellowing, tumefaction of the vulva and clear vulval discharge 4 periods daily, for at least 30 min. Buffaloes were inseminated, using fresh semen from one sire by one technician. The animals were randomly allotted to one of three treatment groups. (1) Non- GnRH agonist treated as control group (n=40); (2) I.M. injection of 0.25 mg gonadorelin (Fertagyl®, Intervet, Holland) at the time of artificial insemination (n=20) and (3) a single I.M. injection of the same dose on days 11 to 13 after insemination (n=24). Pregnancy was determined via rectal palpation of the uterus 42-55 days post insemination. Data for pregnancy rates were compared using the (SPSS, version 10) Chi-square analysis and Fisher’s exact test.

Results

The effects of gonadorelin injection at the time of artificial insemination or 11 to 13 days after insemination are presented in Table 1. Pregnancy rates to first insemination for buffaloes in groups 1, 2 and 3 were 10/40 (25%), 11/20 (55%) and 14/24 (58%), respectively. In groups 2 and 3 a greater proportion (30% and 33%) of buffaloes that received gonadorelin became pregnant comparing to those of untreated animals (P<0.01).

Table 1: Effect of gonadorelin administration at the time of artificial insemination or on days 11-13 post-insemination on pregnancy rates in river buffaloes

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>Control buffaloes</th>
<th>Buffaloes treated at the time of AI</th>
<th>Buffaloes treated on days 11-13 post AI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number pregnant</td>
<td>10</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Number barren</td>
<td>30</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Total No. of buffaloes</td>
<td>40</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Percent pregnant</td>
<td>25</td>
<td>55</td>
<td>58</td>
</tr>
<tr>
<td>Significance of difference From control</td>
<td></td>
<td>P&lt;0.01</td>
<td>P&lt;0.01</td>
</tr>
</tbody>
</table>
Discussion

During the interval between fertilization and the process of implantation, some forms of embryonic signaling are necessary for maternal recognition of pregnancy to occur and cause the hormonal changes to elicit the uterine transformation necessary for implantation. Furthermore, it is during this period that most embryonic losses occur (Gandolfi et al., 1992). In ruminants this period is characterized by secretion of antiluteolytic factor, interferon tau (INF-t) by the conceptus (Geisert et al., 1992; Robert et al., 1996; Spencer and Bazer 1996). Evidence in cows suggests that embryonic viability and growth rate during the first few days of pregnancy are dependent on the concentration of circulating progesterone. A delay in the postovulatory rise in progesterone concentrations results in impaired embryonic development, whereas high progesterone concentrations are associated with well developed embryos that able to produce strong antiluteolytic signal. In fact there appears to be a cause–effect relationship among optimal progesterone production, embryo growth, INF-t production and maintenance of corpus luteum and hence pregnancy (Newcombe et al., 2001). Treatment with GnRH and its analogues cause acute secretion of LH and FSH such that concentrations in peripheral blood are increased for 3-5 hours. GnRH-induced alterations in the function of corpus luteum or follicles appear to be indirect through alterations in LH and FSH secretion (Rettmer et al., 1992 b; Thatcher et al., 1993).

Treatment of buffaloes with gonadorelin, a GnRH agonist at the time of artificial insemination improved pregnancy rates compared with the control group. There is no available similar information on the use of GnRH for buffaloes with which to compare these results. However, recent findings indicated that Dalmarelin injection (GnRH synthetic analogue) at the time of insemination improved the conception rates of repeat breeder Nilli-Ravi buffaloes during the low breeding season (Ghulam et al., 2002). Another one showed that gonadotropins with prostaglandin F2α can be safely used to induce and synchronize oestrus in anestrous buffaloes with good fertility (Thakur et al., 1992). The administration of GnRH around the time of artificial insemination at observed oestrus of normal and repeat breeder cows has been reported to increase pregnancy rates in some experiments (Lee et al., 1983; Ax, 1985; Rosenberg et al., 1991) while others have observed no improvement (Archbald et al, 1993; Drew and Peter, 1994). The rationale of this approach is presumably to induce ovulation, luteinisation at the appropriate time relative to insemination and its ability to increase progesterone secretion by the developing corpus luteum (Lee et al., 1985; Mee et al., 1993). This might prevent early embryonic loss and accounts for higher conception rates.

Treatment of buffaloes with gonadorelin once on days 11-13 after insemination significantly improved pregnancy rates. Some researchers have also reported increased pregnancy rates after administration of GnRH agonist on days 11 to 13 post-insemination in cattle (Macmillan and Thatcher, 1991; Rettmer et al., 1992 a; Sheldon and Dobson, 1993; Drew and Peter, 1994), whereas others reported no beneficial effect (Jubb et al., 1990; Jayakumar and Vahida, 2000). Furthermore, one report indicated that administration of buserelin in recipient cows on day 5 post embryo transfer increased pregnancy rate (Singh et al., 2003). In non-pregnant ruminants, during the normal oestrous cycle the synthesis and release of prostaglandin F2α (PGF2α) from the endometrium is stimulated by luteal oxytocin to cause regression of the corpus luteum. Oxytocin receptor concentrations increase during the luteal phase of the cycle, simulated by oestradiol-17β produced from waves of ovarian follicular growth. If pregnancy occurs, both secretion of luteal oxytocin and the development of endometrial oxytocin receptors are suppressed. Inhibition of oxytocin secretion and suppression of receptor development may serve to save corpus luteum for pregnancy. It seems that the mechanism involved in the effect of GnRH agonist on pregnancy rates is its ability to luteinize or induce ovulation of ovarian follicle at mid-cycle following the acute onset of LH release after GnRH injection. This may reduce oestradiol secretion from the ovarian follicles. Lack of oestradiol late in the oestrous cycle probably
prolongs the changes in uterine receptor concentrations of oxytocin as well as other events that are prerequisite for luteolysis (Thatcher et al., 1993; Beck et al., 1994; Drew and Peter, 1994; Harvey et al., 1994; Mann et al., 1995; Beck et al., 1996; Birnie et al., 1997; Arikan and Pamukcu, 2001). By delaying luteolysis treatment with a GnRH agonist, increases the chances for embryos to establish signals for maternal recognition of pregnancy before a new wave of estrogen secreting follicle develops and initiates luteolysis (Rettmer, 1992 b).

The present study proved potential opportunities for use of GnRH agonist in a range of pro-fertility applications in buffalo. Further trials using gonadorelin in buffaloes are indicated to determine the optimum dose, proper time of treatment and mechanism involved.

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