Effect of high doses of equine chorionic gonadotrophin (eCG) treatments on follicular developments, ovulation and pregnancy rate in boer goats

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The aim of this study was to determine the effects of the superovulatory technique using equine chorionic gonadotrophin (eCG) on follicle response, ovulation and pregnancy rate in Boer goats. Twenty nine (29) does were divided into three groups, G1 (n = 11), G2 (n = 8) and G3 (control, n = 10). All groups had their estrus synchronized by the use of controlled internal drug release (CIDR) containing 0.3 g progesterone for 18 days. Twenty-four hours prior to CIDR removal, all animals were intramuscularly injected with different eCG doses: does in G1, G2 and G3 received 600, 800 and 1000 IU eCG, respectively. Follicular activity was determined once a day for four consecutive days by ultrasonographic monitoring starting at eCG treatment (day 17) in all groups. The number of corpora lutea were assessed on day seven after estrus to calculate ovulation rate, whereas the pregnancy diagnosis was detected on 30 days post mating. Follicles response resulted in significant differences (P < 0.05) only under small size follicles but not significant difference (P > 0.05) on number of follicles under medium and large size follicles among treatments. Ovulation rate recorded a significant difference (P < 0.05) among treatments after seven days post estrus with the highest rate at 2.3 ± 0.3, 1.6 ± 0.2 and 1.4 ± 0.1 for G2, G3 and G1, respectively. Meanwhile, pregnancy rate that showed the highest recorded was 50, 45.5 and 12.5% for G3, G1 and G2, respectively. The results concluded that there was no significant difference on follicle number recorded among treatments except for small size follicle numbers on days 19 and 20. Meanwhile, we concluded that 800 IU eCG was the best treatment resulting in the highest ovulation rate. Different doses of eCG however did not influence the pregnancy rate in superovulated does.

Key words: Equine chorionic gonadotrophin, follicular, ovulation, pregnancy, estrus synchronization, goat.

INTRODUCTION

The optimization of reproductive performance is one of the main facts that assure high productivity on goat farms. This requires that the management practices take into account the physiology and behavior of the animals since environmental, managerial and sanitary aspects interfere with fertility and can impair it. Indeed, reproduction could be considered a “luxury” function and the female appears able to feel whether the conditions are too severe and risky for a successful reproductive cycle (Fringgens, 2003). Multiple ovulation and embryo transfer (MOET) is widely used to increase genetically superior offspring produced from selected females (Greyling, 2002). Ovarian superstimulation in domestic animals may thus be used to increase the number of developmentally competent
oocytes for in vivo or vitro embryo production (Malhi et al., 2008). This variation may be due to both extrinsic equine chorionic gonadotrophin (eCG) treatment and follicle stimulating hormone (FSH) preparation, mode of administration or the dosage regimens) and/or intrinsic (ovarian status, genetic variation) factors (Cognie et al., 2003; Gonzales-Bulnes et al., 2004; Shipley et al., 2007).

Superovulatory procedures using eCG commonly used high dose of eCG after synchronizing their estrus cycles with controlled internal drug release (CIDR). This procedure agreed with a previous research (Holtz, 2005) which they reported that, in goats, superovulatory treatment (ovarian status, genetic variation) factors (Cognie et al., 2003; Gonzales-Bulnes et al., 2004; Shipley et al., 2007).

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Materials and Methods

The experiment was conducted in a total of 29 healthy pluriparous Boer does, aged from three to five years and body weight between 45 and 65 kg maintained indoors at the experimental farm of Kampung Kuala Pah Breeding Goat Center, owned by Department of Veterinary and Services (DVS), Malaysia. The animals were randomly divided into three groups. Group 1 consisted of 11 does, group 2 with eight does and group 3 (control) with 10 does. Animals were housed in an animal shed (6.1 x 6.1 m) built approximately 3 m above the ground level. The goat house was located at the hill top surrounded by open paddock. All does were kept indoors and fed twice daily. In the morning, animals were fed with Bracharia humidicola (Rendle) and Panicum maximum (Guinea). In the evening, commercial concentrates (Biopalma®) (Crude protein ≤ 14.9%, crude fiber ≤ 26.1%, crude fat ≤ 5.1%, calcium ≤ 0.72%, phosphorus ≤ 0.36 % and metabolisable energy ≤ 9.06 MJ/kg) were given to the animals at 450 g/doe/day. Mineral blocks and water were provided ad libitum to the animals.

Results

The follicle response of Boer does following estrus synchronisation is shown in Table 1. The patterns of follicular...
growth within different size categories indicate the duration of exogenous gonadotrophin stimulus. The shift from the numerical superiority of the smaller follicle category to the superiority of the next higher one at the attainment of the next phase of the estrus period (pre-estrus to estrus, or estrus to post estrus) represents the end of recruitment, and therefore the end of the exogenous gonadotrophin action. Regarding the experiment, after an hour superovulatory treatment given, the highest mean number of follicles found was 4.0 ± 0.5, under small size category in right side ovary of G1. However, mean number of follicles for small, medium and large size category at left and right side ovary was not significant (P > 0.05) among group treatments on day 17.

Twenty four hours after superovulatory treatment, the highest mean number of follicles recorded was from medium size categories at 4.3 ± 1.0 from G3 on right side ovary, followed by G1 (2.2 ± 0.4) and G2 (2.0 ± 0.3), on left and right ovary, respectively. Only G1 resulted in an increasing number of follicle on large size categories in both side ovary compared to others group. On day 18, no significant difference (P > 0.05) was found on number of follicles between group treatments at left and right side ovary.

On day 19, 48 h after CIDR removal, the highest mean number of follicles recorded on day 19 was in G3 (3.5 ± 1.5) followed by G1 (3.1 ± 0.3) under small size categories at 4.3 ± 1.0 from G3 on right side ovary, followed by G1 (2.2 ± 0.4) and G2 (2.0 ± 0.3), on left and right ovary, respectively. Only G1 resulted in an increasing number of follicle on large size categories in both side ovary compared to others group. On day 18, no significant difference (P > 0.05) was found on number of follicles between group treatments at left and right side ovary.

On day 20, 48 h after CIDR removal, a highly significant difference (P < 0.05) in number of follicles was recorded with G3 at 2.5 ± 0.2 follicles, followed by G2 (2.0 ± 1.5) and G1 (1.4 ± 0.2) under small size categories. The highest number of follicles recorded from G1 and G2 on day 20 was 1.5 ± 0.3 and 2.1 ± 0.4, respectively both under large size follicles. Table 2 shows the ovulation rate of does administered with CIDR + eCG. In this study, 11 (100%) out of 11 does in G1, eight (100%) out of eight does in G2 and 10 (100%) out of 10 does in G3 ovulated during estrus. The highest mean numbers of CL at the left side ovary was from G2, which is 1.3 ± 0.1. However, the mean numbers of CL on the left ovary was not significantly different (P > 0.05) compared with G1 (1.1 ± 0.1) and G3 (1.0). Meanwhile, the highest mean numbers of CL found on the right ovary was from G2 at 1.3 ± 0.2, followed by G3 and G1 at 1.3 ± 0.1 and 1.0, respectively. This result shows that the ovulation rate from right ovary was not significantly different (P > 0.05) among group treatments. The highest numbers of CL recorded in the right side ovary was two from G2 and G3; meanwhile the lowest CL recorded was 1 from G1.

Table 3 shows the result of does that conceived by natural mating. Out of 21 estrus does, 11 (52.4%) does were pregnant. The highest pregnancy rate in this study was from G3 at 71.4% followed by G1 (55.5%) and G2 (20%). Only G2 and G1 resulted more than 50% pregnancy rate. In contrast, G1 and G2 recorded the highest non pregnant rate, with four does in each group,
Table 2. Ovulation rate after following 18 days CIDR treatment with eCG injection on day 17.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of females synchronized</td>
<td>11 (100%)</td>
<td>8 (100%)</td>
<td>10 (100%)</td>
<td>29 (100%)</td>
</tr>
<tr>
<td>Number of does ovulated</td>
<td>11 (100%)</td>
<td>8 (100%)</td>
<td>10 (100%)</td>
<td>29 (100%)</td>
</tr>
<tr>
<td>Mean number of CL on left ovary (range)</td>
<td>1.1 ± 0.1 (1-2)</td>
<td>1.3 ± 0.1 (1-2)</td>
<td>1.0 ± 0.0</td>
<td>29 (100%)</td>
</tr>
<tr>
<td>Mean number of CL on right ovary (range)</td>
<td>1.0 ± 0.0</td>
<td>1.3 ± 0.2 (1-2)</td>
<td>1.3 ± 0.1 (1-2)</td>
<td>29 (100%)</td>
</tr>
<tr>
<td>Mean number of CL per doe (range)</td>
<td>1.4 ± 0.1a (1-2)</td>
<td>2.3 ± 0.3b (1-4)</td>
<td>1.6 ± 0.2ab (1-3)</td>
<td>29 (100%)</td>
</tr>
</tbody>
</table>

*Values with different superscript in the same row differ significantly at P<0.05. Mean ± S.E.M.

Table 3. Pregnancy rate following 18 days CIDR treatment with eCG injection on day 17.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>G1 (n=11)</th>
<th>G2 (n=8)</th>
<th>G3 (n=10)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of does in estrus</td>
<td>9</td>
<td>5</td>
<td>7</td>
<td>21 (52.4%)</td>
</tr>
<tr>
<td>Number of does that did not display oestrus</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Number of does pregnant</td>
<td>5 (55.5%)</td>
<td>1 (20%)</td>
<td>5 (71.4%)</td>
<td>11 (52.4%)</td>
</tr>
<tr>
<td>Number of does aborted</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Gestation period (days)</td>
<td>144.4 ± 7.5</td>
<td>145.0</td>
<td>145.3 ± 6.5</td>
<td>29 (100%)</td>
</tr>
</tbody>
</table>

Mean ± S.E.M.

DISCUSSION

On the first day of eCG treatment, the highest mean number of follicles was from G1 at 4.0 ± 0.5 in small size category. This finding was in line with previous study (Francisco Carlos de Sousa et al., 2011) which found 7.1 ± 0.9 follicles in 3 to 4 mm size at the ovarian stimulation day. Another study (Riesenbreg et al., 2001) also concurred to our study which reported 8 h after eCG treatment given, mean number of follicles that range 0.3 and 0.4 cm was 2.7. The highest mean number of follicles found on day two after eCG treatments in the current study was 4.3 ± 1.0 from G3 under medium size category. Our finding is higher than previous study (Kermami et al., 2012) which recorded 1.6 ± 0.4 follicles (≥ 4 mm) at the same time after receiving 850 IU eCG. However, the same findings are more similar with the present study after comparing the highest mean number of follicles (4 ≤ 5 mm) found in G2 (800 IU) at 1.2 ± 0.2 at the same period.

The present study shows the highest mean number of5 follicles found on day three after eCG treatment was 3.5 ± 1.5 from G3 in small size category. This is comparable with previous findings by Kermami et al. (2012) which recorded 3.5 ± 0.6 mean number of follicles at the same size category. Four days after eCG treatments, our study recorded the highest mean number of follicles at 2.5 ± 0.2 from small size category from G3. This finding agrees with previous study by Ali (2007) who found the highest follicles on day four after eCG treatment was 2.5 follicles. These findings are also close to the previous study by Salehi et al. (2010) who showed that the administration of eCG and FSH caused growth and development of the small follicles present in the ovaries. Subsequently, the large follicles during estrus will ovulate and transform to mature CL’s.

The ovulation rate in our study showed that all (100%) does ovulated with at least 1 CL observed by transrectal ultrasonography on day 7 after mating. The present finding is higher than previous study (Gonzalez de Bulnes et al., 1999a) which only recorded 89.3% ovulation rate. These treatments have met our goal to induce multiple ovulation by giving the minimum of 600 IU eCG dosage. Some of the does from G1 (2 does), G2 (3 does) and G3 (3 does) failed to display oestrus within 48 h after CIDR removal. This might be due to either inadequate oestradiol secretion, or oestrus was displayed silently without any overt signs of oestrus (Romano and Wheaton, 1998; Cardwell et al., 1998). Besides that, the absence of oestrus and ovulation may be due to insufficient gonado-trophic hormone released by the pituitary, leading to poor response by the ovary to the exogenous eCG.

Previous studies had reported that the lower pregnancy rate was recorded after a long-term (12 days) progesteragen treatment and related to a slower follicular turnover, promoting the ovulation of persistent dominant follicles. In
agreement with that, our findings showed that only 52.4% out of 21 estrus does became pregnant after undergoing 18 days CIDR treatment with eCG treatment on day 17. Our findings were also supported by previous findings of Barrett et al. (2004) who reported that the administration of 500 IU eCG, 12 days after progestagen treatment, had limited effects on the dynamics of ovarian follicular wave development. The short-term progestagen treatment (six days) on the other hand resulted in a higher pregnancy rate, probably due to the ovulation of newly recruited growing follicles (Vinoles et al., 2001).

Conflict of Interests

The author(s) have not declared any conflict of interests.

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REFERENCES


