



Effects of hormonal administration and locality influence on superovulatory responses in goats

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Received: 25 January 2013; Accepted: 14 May 2013

Key words: Caprine, Embryo recover rate, Flushing cycle, PMSG, FSH-V

In goats embryo transfer faces mainly 2 limiting factors—variability of response to superovulatory treatments and premature regression of corpora lutea (CL) (Kharche *et al.* 2008, Barman *et al.* 2012). Goats can be synchronised with exogenous hormones in association with pregnant mare's serum gonadotrophin (PMSG), human chorionic gonadotrophin (hCG), porcine follicular stimulating hormone (FSH) or injections of cycling does with luteolytic agents. However, problems are found associated with PMSG-induced superovulation (Amoah and Gelaye 1990). PMSG has the advantage of a lower cost and single-dose protocol, but the variability of response obtained restricts its use (Pintado *et al.* 1997).

PMSG has the advantage of a lower cost and single-dose protocol, but the variability of response obtained restricts its use. In addition, the goat is seasonal polyoestrus animal in which the oestrous cycle and intensity of oestrus depend on the breed and geographical locality such as temperate and tropical regions. This study was conducted to investigate the influence of hormonal administration and 2 different latitudinal regions on superovulatory responses.

Two different latitudinal regions were Kuala Lumpur (3°N101°E) (Malaysia) and Kunming (25°N102°E) (China). Average temperature, relative humidity, height above sea level and climate for Kuala Lumpur and Kunming were 27.8 vs. 15.6°C, 82 vs. 74%, 100 vs. 1895m and tropical vs. sub-tropical monsoon, respectively. In experiment 1, does 47 and 17; does (for Kuala Lumpur) were inserted with 1 CIDR for 14 (PMSG treatment) or 17 (FSH-V treatment) days to synchronise the oestrous cycle, respectively. In experiment 2, does (58 for Kunming) were inserted with one CIDR for 17 (FSH-V treatment) days to synchronise the oestrous cycle

and compared with FSH-V treatment in experiment 1. At both sites of does were 1.5 to 5 years old, and body weight ranged between 18 to 40 kg (Kuala Lumpur) and 35 to 50 kg (Kunming).

In experiment 1, for the 14 days CIDR administration, the following hormonal injections on does were made: Estrumate (125 µg) on day 13, PMSG (1200 IU) on day 14, and hCG (500 IU) on days 16 and 17. In experiments 1 and 2, for the 17 days CIDR administration, the following hormonal injections on does were made: FSH-V (160 mg) from days 14 to 17, each day twice consecutively (20 mg, 0900 and 2100 h). After CIDR withdrawal, oestrus detection was carried out using a buck for 3 sessions daily.

The superovulatory response was assessed after a laparotomy on 7 days after CIDR withdrawal. During the procedure, both ovaries were exteriorised, and the number of CL was recorded. Uterine horns were flushed with 40 ml of Dulbecco phosphate-buffered saline supplemented with gentamicin sulphate salt (30 µg/ml) and heparin (52 IU/100 ml) through a 2-way Foley catheter. All data were analysed using SPSS software (ver. 17, SPSS Inc., USA).

In experiment 1, for the 14 days CIDR and PMSG treatment goat, the success rate in oestrus after synchronisation and superovulation treatment was 85.11%. A total of 311 CL were observed from 38 does. After flushing, 106 unfertilised oocytes plus embryos were obtained from 38 does, the rate of embryo recovered was 34.08%. For the 17 days CIDR and FSH-V treatment goat, the success rate in oestrus after treatment was 94.12%. A total of 184 CL were observed from 16 does. After flushing, 81 unfertilised oocytes plus embryos were obtained from 16 does, the rate of embryo recovered was 43.55%. The FSH-V treatment does showed more fertilised oocytes (86.42%) compared with PMSG (23.58%), and the number of fertilised oocytes per ovulated doe (4.38) compared with PMSG treatment (0.63) ($P \leq 0.05$) (Table 1).

In experiment 2, comparing between Kuala Lumpur and Kunming, the respective success rates for does in oestrus

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Table 1. Comparison of PMSG and FSH-V effects on synchronisation, superovulation and embryo production by does (experiment 1)

Goats	Group 1 (PMSG, Malaysia)	Group 2 (FSH-V, Malaysia)
No. of does	47	17
Does in oestrus (%)	85.11% (40/47)	94.12% (16/17)
Does ovulated (%)	95% (38/40)	100% (16/16)
No. of CL	311	184
Rate of unfertilised oocytes plus embryos recovered (%)	34.08% (106/311)	43.55% (81/186)
No. of CL/doe in oestrus	7.76±1.18 ^a	11.50±1.38 ^a
No. of CL/ovulated doe	8.18±1.21 ^a	11.50±1.38 ^a
Oocytes fertilised (%)	23.58% (25/106)	86.42% (70/81)
Unfertilised oocytes plus embryos recovered/ovulated doe	2.79±0.66 ^a	5.06±0.90 ^a
No. of embryos/ovulated doe	0.66±0.25 ^a	4.38±0.85 ^b

^{ab}Means with different superscripts in a column were significantly different ($P \leq 0.05$).

after treatment were 94.12 vs. 87.93%. The ovarian response in Kunming gave a higher value ($P \leq 0.05$) than in Kuala Lumpur. A total of 70 and 365 embryos were obtained from Kuala Lumpur and Kunming donor does, in which the respective fertilisation rates were relatively similar between 2 localities (86.42 vs. 85.88%); however, the number of fertilised oocytes per ovulated doe for Kuala Lumpur does (4.38) was significantly ($P \leq 0.05$) lower compared to Kunming does (8.13) (Table 2).

Study showed that 74 to 100% responses to oestrus synchronisation in Boer goat for CIDR treatment (Lehloenya and Greyling 2009), and these differences may be attributed to the type and dose of progestagen used. Lower oestrus responses in goats was also observed following the oestrus synchronisation of young does or when CIDR was utilised without the supplementation of PMSG (Oliveira *et al.* 2001). In this study, the oestrus responses rates were from 85 to 94%. The 17-days CIDR treatment given does showed a higher oestrus response than 14-day treatment does. The reason for the difference in oestrus responses after 14 and 17 days of CIDR implant is not clear at the moment. For the different localities (Kuala Lumpur vs. Kunming) the oestrus response was not different.

This study showed higher embryo superovulatory responses from FSH-V (4.38) compared with PMSG treated does (0.66). A total of 16.55 CL were observed from per doe by FSH treatment and 11.70 CL per doe by PMSG (Mahmood *et al.* 1991). Rosnina *et al.* (1992) who treated the goat by FSH and PMSG obtained 6.8 and 3.0 embryos per doe, respectively. Although, most researchers found that the FSH treatment was better than PMSG, yet the PMSG is still widely

Table 2. Superovulatory responses of goats at two latitudinal regions (Experiment 2)

Parameter	Group 1 Does (FSH-V, Malaysia)	Group 2 Does (FSH-V, China)
No. of does	17	58
Does in oestrus (%)	94.12% (16/17)	87.93% (51/58)
Ovulated does (%)	100% (16/16)	80.39% (41/51)
Fertilised oocytes (%)	86.42% (70/81)	85.88% (365/425)
Unfertilised oocytes plus embryos recovered/ovulated doe	5.06±0.90 ^a	9.47±0.64 ^b
No. of embryos/ovulated doe	4.38±0.85 ^a	8.13±0.69 ^b

^{ab}Means with different superscripts in a row were different ($P \leq 0.05$).

used on goat superovulation, might be due to the lower cost and easily available (Kumar *et al.* 2010). The long half-life of PMSG in the doe body system may lead to the production of a large number of ovarian follicles which fail to ovulate. Compared with the PMSG, the half-life of FSH in goats is only 5 h (Demoustier *et al.* 1988). This proves that it contains an appropriate admixture of approximately 40% luteinising hormone, not only provides better superovulatory responses but also superior embryo viability.

Comparison on superovulation responses with different localities, the number of unfertilised oocytes plus embryos and number of embryos obtained per doe in Kunming were higher ($P \leq 0.05$) than that of in Kuala Lumpur. In south China, the duration of day was significantly different in the 4 seasons. For this experiment, a difference between Kuala Lumpur and Kunming in longitude (3°N vs 25°N) and altitude (100 m vs 1895 m) may influence the ambient temperature and atmospheric oxygen and thus may cause the difference in reproductive physiology of the goats between the 2 localities. For the 2 localities, in Kuala Lumpur, the temperature is almost constant throughout the year while in Kunming the temperature varies according to season.

SUMMARY

Using 2 different hormones (PMSG and FSH-V) and 2 different localities (Kuala Lumpur and Kunming) for goats, CIDR was inserted for 14 or 17 days and PMSG or FSH-V were injected before CIDR withdrawal. After day-7 of CIDR withdrawal, uterine horn was flushed; 295 embryos were obtained from 122 does. In Kuala Lumpur, the does synchronised with 17 days of CIDR administration showed a higher ovulation rate (94 vs 85%) compared with 14 days of CIDR treatment, respectively. The ovulation and unfertilised oocytes plus embryo recovery rates were higher in the FSH-V (100 and 44%) than those of PMSG treated does (95 and 34%), respectively. The FSH-V treatment gave better results than PMSG in both fertilisation rate (43.55 vs

34.08%, respectively) and number of embryos obtained (4.38 vs 0.66, respectively); the ovarian response and embryo transfer performance after FSH-V treatment was better in Kunming than in Kuala Lumpur. Superovulation using specific hormones protocol and localities on individual does are important considerations for multiple ovulation and embryo transfer programme in goats.

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