Effect of PGF2α, or CIDR on ovarian follicular development during estrous cycle in goats[1]

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ABSTRACT: Daily transrectal ultrasonographic examinations were conducted in 22 clinically healthy multiparous goats to determine the effect of PGF2α, CIDR methods of estrus synchronization on ovarian follicular development during the synchronized cycle. The number and diameter of all follicles ≥3mm were recorded in real-time. There were no significant differences (P>0.05) between groups in the total follicle number, and maximum size of ovulatory follicles. There were also no statistically significant differences (P>0.05) in the number of ≥3mm to ≥8mm follicles between PGF2α, CIDR synchronized and natural estrous cycle groups. The mean± SD maximum sizes of ovulatory follicles were 6.71 ± 0.39, 7.61 ± 1.43 and 7.33 ± 1.23, for PGF2α and CIDR synchronized and natural estrus cycles respectively. It was concluded that PGF2α or CIDR based methods of estrus synchronization do not significantly change the total number and size of follicles during the interovulatory period in goats.

Key words: Ovaries, follicle, ultrasonography, estrus synchronization, goats

INTRODUCTION

The development of biotechnology tools including estrus synchronization has contributed to advances in artificial insemination, multiple ovulation and embryo transfer techniques aimed at improving the productivity of goats through the manipulation of the time and number of ovulations. Ovarian follicular development has been shown to be affected by method of estrus synchronization used. The development and use of serial ultrasonography as a tool to monitor follicular development in goats has been described previously (Fernandez-Moro *et al*., 2008; Ginther & Kot, 1994; Gonzalez-Bulnes *et al*., 2004; Lassala *et al*., 2004; Simoes *et al*., 2006).

Vazquez *et al*. (2010) observed that synchronization of estrus and ovulation by administration of cloprostenol, 10-12 days apart caused differences in developmental dynamics and functionality of induced corpora lutea when compared with natural spontaneous estrus and ovulation. Leyva *et al*. (1998) suggested that estrus synchronization using progestagens sponge inserts modified the size of the largest follicles. Different progesterone concentrations have different effects on ovarian follicular development, higher concentrations associated with intravaginal progesterone inserts stimulate follicular turnover while lower concentrations extend follicular growth (Vinoles *et al*., 1999). Low concentrations of progesterone particularly towards the end of progestogen treatment may lead to inadequate suppression of LH resulting in abnormal follicular development such as large persistent follicles (Menchaca & Rubianes, 2004; Vinoles *et al*., 1999).

However, there is paucity of information on the effects of progesterone or PGF2α on the total follicular population during the interovulatory periods of non-seasonally polyestrous goats under tropical conditions. This study was therefore conducted to determine the mean total number and sizes

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of follicles in goats, synchronized with intra-vaginal progesterone insert (CIDR) or with injections of PGF2α (cloprostenol) during the interovulatory period.

MATERIALS AND METHODS

Twenty-two clinically healthy multiparous female Boer goat crosses of 3-4 years old were selected for this study from a population of 146 goats. The mean weight and body condition score for the experimental animals were 35±2.7 kg and 3-4 (scale: 1 to 5) respectively. The goats were raised intensively in raised sheds/barns with slatted floors at a commercial goat farm, (Lat: 3° 15N and Long: 101° 32' 60E), in Selangor, Malaysia. The does were fed rations daily, comprising palm leaves, commercial pellets, soya bean waste and palm leaf silage. Water and salt licks were provided *ad-libitum*.

The PGF2α synchronized group (n=11) were synchronized with a double injection of 125µg (0.5ml) of the PGF2α analogue, cloprostenol (Estrumate™, Schering-Plough) 11 days apart (Kusina *et al*., 2000; Vazquez *et al*., 2010). The progesterone synchronized group (n=11) were synchronized with Controlled Internal Drug Releasing Device (CIDR, EAZI-BREED™) each containing 0.3g of progesterone was inserted into the vagina and left in place for 17days in 11 does (Wildeus, 2000; Montlomelo *et al*., 2002). Natural (unsynchronized) group of 11does that were randomly selected from the PGF2α and CIDR groups already monitored and similarly studied 45 days after the end of ultrasonographic monitoring of the synchronized estrous cycles.

Daily ultrasonographic scanning of the ovaries to study ovarian follicular development commenced one day after removal of intravaginal CIDR insert in the first group or one day after the second PGF2α injection. Each goat was scanned once daily and the scanning periods were from 0800 to 1200 hours, using a real-time B-mode ultrasound scanner (Aloka, 500 SSD, Japan), with a transrectal 7.5MHz linear probe (UST-660-7.5 model). Ovaries were visualized and the number, size and position of follicles of ≥ 3mm in diameter were measured using the ultrasound scanner's in-built calipers. Images were frozen and sketches of all ovarian structures observed in each ovary were made as they were visualized in real time (Ginther & Kot, 1994; Simoes *et al*., 2005; Simoes *et al*., 2006).

Follicles were distinguishable as hypoechoic, roughly circumscribed image within the outline of the ovary. Some of the images were frozen and printed for subsequent comparison to the ovarian charts. Ovulation was considered as the collapse of a large preovulatory follicle (≥ 5mm in diameter), which had been monitored daily by ultrasonography, and the subsequent appearance of a corpus luteum on the same location (Ginther & Kot, 1994; Simoes *et al*., 2006; Menchaca *et al*., 2007; Vazquez *et al*., 2010). Data were subjected to Analysis of Variance (ANOVA) using SPSS statistical software (SPSS Inc. Version 17). Analyses were considered to be statistically significant at $P < 0.05$.

RESULTS AND DISCUSSION

Data from does that could not be scanned for two consecutive days were not included in the analysis (10 does). The ultrasound equipment was not used on the farm whenever it is not safe to do so during thunderstorms, which restricts the number of does that could be scanned for that day. There were no statistically significant differences ($P>0.05$) among natural estrous cycle, PGF2α and CIDR synchronized groups in the total number of 3mm to 8mm sized follicles (Table 1). This suggests that neither PGF2α nor CIDR were associated with significant increase in the number of different sized follicles though the number of 3 mm follicles in the PGF2α group (70 ± 38.30) appeared larger compared to the CIDR group (44.63 ± 12.77). The number of 8 mm follicles in the PGF2α group was smaller (1.43 ± 1.40) than the CIDR group (4.25 ± 3.11). This finding agrees with Lassala *et al*. (2004) who similarly found no statistical differences ($P>0.05$) in follicular development between prostaglandin synchronized and natural estrous cycles in Serrana goats. Vazquez *et al*. (2010) also suggested that the mean total number of follicles developing in each cycle did not differ significantly between groups of PGF2α synchronized and natural estrous cycle in Anglo Nubian goats. Both the Serrana and Anglo Nubian goats studied by Lassala *et al*. (2004) and Vazquez *et al*. (2010) respectively were seasonally polyoestrus goats, different from the non seasonally polyestrous does used in this study.

Time to ovulation from cessation of treatment was not significant (P>0.05) between PGF2α and CIDR synchronized groups in this study (Table 2). There were also no statistically significant differences (P>0.05) in the maximum diameter attained by the ovulatory follicles among the PGF2α, CIDR synchronized, and natural cycles. The time of ovulation were also similar to those reported by Simoes *et al*. (2008) in PGF2α synchronized Serrana goats during the breeding season. The mean diameters of the ovulatory follicles observed in this study were smaller than the 8.7 ± 0.3mm observed by (Ginther & Kot, 1994) in unsynchronized Anglo Nubian goats. On the other hand, the results were similar to 7.1 ± 1.0 mm, and 7.8 ± 0.4 mm maximum diameter of preovulatory follicle in PGF2α synchronized Serrana and Murciana-Granadina does respectively (Gonzalez-Bulnes *et al*., 2004; Simoes *et al*., 2006). Differences in breed, nutrition and body weight are known to affect follicular development, ovulation, and fertility (Wildeus, 2000).

The echotextural characteristics of the ovarian follicles and corpus luteum observed during the daily ultrasonographic scanning were similar to previous reports (Gonzalez-Bulnes *et al*., 2004; Lassala *et al*., 2004; Simoes *et al*., 2006; Fernandez-Moro *et al*., 2008; Simoes *et al*., 2008). Figure 1 shows the typical echotexture of a fluid filled tertiary follicle compared to the more echoic corpus luteum.

It could be suggested that the changes in the developmental dynamics of the follicles occurring as a result of the effects of PGF2α and CIDR on the hypothalamic-pituitary-ovarian response and consequent effects on the recruitment, selection and ovulation of follicles as previously reported by Wildeus (2000) and Vazquez *et al.* (2010) was limited to the preovulatory period. This would also suggest that the total postovulatory follicle number and size following synchronization were not influenced by a previous treatment and does could be re-synchronized immediately after synchronized ovulations with either PGF2α or CIDR without carry- over effects from the previous treatment.

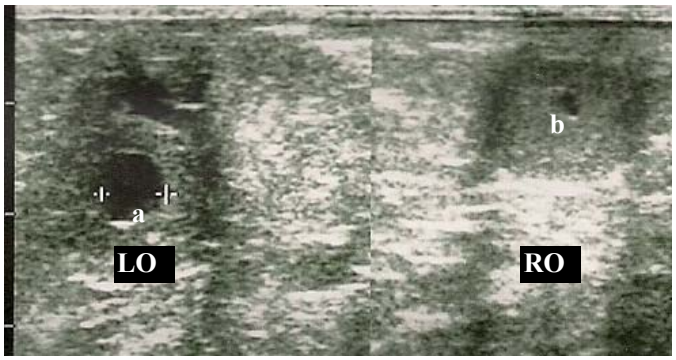

Figure 1. Echograph showing a growing follicle (**a**) on the left ovary (**LO**) and a mature corpus luteum with antrum (**b**) on the right ovary (**RO)** of a Boer doe. Note the hypoechoic echotexture of the follicle and the more echogenic echotexture of the corpus luteum, which is clearly distinguishable from the surrounding tissue stroma.

Table 1. Mean ± SD total follicle number during PGF2α, CIDR synchronized and natural estrous cycles in Boer does

	Method of estrus synchronization		
Description	PGF2α (n=7)	CIDR (n=8)	Natural (n=11)
3 mm	70 ± 38.30	44.63 ± 12.77	28.55 ± 7.92
4 mm	35.14 ± 25.00	24.63 ±7.61	22.18 ± 8.54
5 mm	16.86 ± 9.26	15.63 ± 7.01	24.00 ± 9.23
6 mm	11.43 ± 6.85	8.75 ± 1.98	15.55 ± 7.65
7 mm	4.71 ± 3.59	4.38 ± 3.50	6.82 ± 5.15
8 mm	1.43 ± 1.40	4.25 ± 3.11	2.00 ± 2.57

Table 2. Means ± SD time to ovulation, interovulatory interval, mean size of ovulatory follicle, and mean daily and total follicle number during PGF2α, CIDR synchronized and natural estrous cycle in Boer does

Description	Method of estrus synchronization		
	PGF2α (n=7)	CIDR (n=8)	Natural (n=8)
Time to ovulation (days)	3.86 ± 0.69	3.63 ± 1.06	-
Interovulatory interval (days)	18.71 ± 1.25	18.75 ± 2.96	-
Diameter of ovulatory follicle (mm)	6.71 ± 0.39	7.61 ± 1.43	7.33 ± 1.23

CONCLUSIONS

It was concluded that estrus synchronization using cloprostenol or CIDR does not significantly alter the mean number and sizes of ovarian follicles during the synchronized estrous cycle in non-seasonally polyestrous goats raised under tropical conditions.

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