

Abortion Induction and Post-Abortion Oestrous Cycle Pattern Following Administration of Prostaglandin F₂ Alpha in Sokoto Red Goats

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Abstract: The aim of this study was to evaluate the features of induced abortion and post-abortion oestrous cycles pattern following treatment with prostaglandin F_{2α} (PGF_{2α}) in Sokoto Red (SR) goats. Twelve apparently healthy goats made up of 6 pregnant and 6 non-pregnant (cycling) does were used for the study. Each doe was given a single intramuscular injection of 7.5 mg PGF_{2α}. All the 6 pregnant does treated with PGF_{2α} aborted within 72.0±12.4 h post-treatment. Of the 6 does that aborted, 5 (83.3%) showed oestrus subsequently while 4 (66.7%) out of the 6 non-pregnant does were induced to oestrus. Time interval to induced oestrus was 129.6±36.1 and 50.0±11.5 h for the aborted and non-pregnant does, respectively. Mean duration of oestrus for the aborted and non-pregnant does was 46.9±9.6 and 38.7±4.3 h, respectively. The first and second post-abortion oestrous cycle lengths were 6.5±0.5 and 12.5±8.5 days, respectively. While the first and second post-treatment cycle lengths in the non-pregnant does was 22.5±1.2 and 21.3±0.3 days, respectively. It is concluded that a single dose of 7.5 mg PGF_{2α} is sufficient to induce abortion and oestrus simultaneously in SR goats. However, the post-abortion cycles are short.

Key words: Goat, prostaglandin F_{2α}, abortion, post-abortion oestrous cycles, Nigeria

INTRODUCTION

The process of normal parturition in domestic animals (Jenkin and Young, 2004) and humans (Lalithkumar *et al.*, 2007) is achieved, partly through PGF_{2α}-induced uterine contraction and cervical dilatation. Induced abortion is used to eliminate unwanted or unplanned pregnancy in dogs (Shille, 1984) and humans (Lalithkumar *et al.*, 2007). It is also used to synchronize post-abortion oestrus (Meeker *et al.*, 1985) and parturition (Bazer and First, 1983) for production purposes. Thus, PGF_{2α}-induced parturition has been successfully carried out in goats (Day and Southwell, 1979; Maule Walker, 1983), sheep (Bosc *et al.*, 1977), cows (Johnson and Jackson, 1982), horses (Daels *et al.*, 1996) and pigs (Day and Southwell, 1979). Prostaglandin F_{2α} induces luteolysis resulting in decreased levels of circulating progesterone thus making the gravid uterus more sensitive to the contractile effect of endogenous PGF_{2α} and oxytocin at parturition (Bretzlaff and Ott, 1983; Jenkin and Young, 2004). The SR goats constitute about 60% of the Nigerian goat population (RIM, 1992). They are year round breeders

with oestrous cycle length and oestrus duration ranging from 19-21 days and 21-26 h, respectively (Molokwu and Igono, 1982; Pathiraja *et al.*, 1991). Despite, the importance of the SR goat to the rural economy of Nigeria, information on induced abortion and post-abortion oestrous cycles pattern is lacking in this goat breed. Such information may be useful in the design of a comprehensive rebreeding programme for the SR goat.

MATERIALS AND METHODS

Experimental location: The study was carried out at the National Animal Production Research Institute (NAPRI), Shika, Ahmadu Bello University, Zaria. Shika is located between latitudes 11° and 12°N and between longitudes 7° and 8°E at an altitude of 640 m and in the Northern Guinea Savanna zone. The average annual rainfall in Shika is approximately 1100 mm and mainly during the months of April to October. The maximum ambient temperature range in Shika is 27-35°C depending on season (Taiwo *et al.*, 2005).

Experimental animals and management: Twelve apparently healthy goats made up of 6 pregnant and 6 non-pregnant (cycling) does aged between 2-3 years with body condition score ranging from 2.5-3.0 were used for the study. They were housed in a semi-open concrete floor pen. *Digitaria smutsi* hay was provided *ad libitum* as basal diet while supplementary concentrate ration of approximately 15% crude protein was provided at 300 g/head/day. Water and mineral salt lick were also provided *ad libitum*.

Abortion induction: Abortion was induced by a single injection of 7.5 mg PGF_{2α} (Dinoprost promethamine; Lutalyse®) given intramuscularly to each goat at the thigh muscle. Abortion in the pregnant does was confirmed by the presence of blood-tinged vaginal discharge lasting for 48 h or more and (or) the presence of expelled fetuses.

Oestrus detection: Heat detection was carried out twice daily between the morning hours of 8.00-9.00 am and evening hours of 4.00-5.00 pm, respectively. Standing to be mounted was the single criterion used to confirm oestrus. Oestrus observation was carried out for 25 days post-treatment.

Reproductive parameters: The following reproductive parameters were determined number of animals that were induced to abort; number of animals that were induced to oestrus; time interval (h) from PGF_{2α} injection to abortion; time interval (h) from PGF_{2α} injection to induced oestrus; duration of oestrus (h); first two cycle lengths (days) following abortion or induced oestrus in non-pregnant does.

Data analysis: The data collected were expressed in percentage and as mean (±SEM). The data were subjected to Student's t-test and Tukey's post hoc test. The statistical package used was GraphPad Prism Version 4.0 in 2003 for windows from GraphPad® Software, San Diego, California, USA (www.graphpad.com). Values of p<0.05 were considered significant.

RESULTS

All the 6 pregnant does treated with PGF_{2α} aborted and 5 (83.3%) of them exhibited oestrus subsequently (Table 1). Of the 6 non-pregnant does treated with PGF_{2α}, 4 (66.7%) were induced to oestrus. Mean (±SEM) time interval from treatment to abortion was 72.0±12.4 h (Table 2). Time intervals to induced oestrus were 129.6±36.1 and 50.0±11.5 h in the aborted and

Table 1: Abortion and oestrus response rates in pregnant and non-pregnant goats treated with prostaglandin F_{2α}

Goats	n	Aborted	Oestrus (+)	Oestrus (-)
Pregnant	6	6 (100)	5 (83.3)	1 (16.7)
Non-pregnant	6	Nil	4 (66.7)	2 (33.3)
Total	12	6	9 (75.0)	3 (25.0)

() = Percentage; Oestrus (+) = Animals that were induced to oestrus; Oestrus (-) = Animals that did not exhibit oestrus

Table 2: Mean (±SEM) time interval to induced abortion, oestrus duration and oestrous cycle lengths in pregnant and non-pregnant goats treated with prostaglandin F_{2α}

Parameters	Pregnant (n = 6)	Non-pregnant (n = 6)
Time interval to abortion (h)	72.0±12.4 (5)	Nil
Time interval to induced oestrus (h)	129.6±36.1 (5)	50.0±11.5 (4)
Duration of oestrus (h)	46.9±9.6 [7]	38.7±4.3 [6]
First cycle length (days)	6.5±0.5 (2)	22.5±1.2 (4)
Second cycle length (days)	12.5±8.5 (2)	21.3±0.3 (4)

() = No. of animals; [] = No. of oestrus phases

non-pregnant does, respectively. Mean oestrus duration in aborted and non-pregnant goats were 46.9±9.6 and 38.7±4.3 h, respectively. First and second post-treatment oestrous cycle lengths in aborted does were 6.5±0.5 and 12.5±8.5 days, respectively. While first and second post-treatment cycle lengths in the non-pregnant does were 22.5±1.2 and 21.3±0.3 days, respectively.

DISCUSSION

The fact that all the pregnant does aborted within 72 h of a single injection of 7.5 mg PGF_{2α} confirms the efficacy of a single dose of PGF_{2α} for induction of abortion in goats. This finding agrees with earlier reports of PGF_{2α}-induced termination of pregnancy in goats (Day and Southwell, 1979; Maule Walker, 1983), cattle (Johnson and Jackson, 1982), horses (Daels *et al.*, 1996) and pigs (Meeker *et al.*, 1985). This means that unlike in dogs (Hubler *et al.*, 1993), a single injection of PGF_{2α} is sufficient to induce abortion in goats. This could be because in goats, the corpus luteum is the main source of progesterone (Thorburn *et al.*, 1977). Thus, the luteolytic effect of PGF_{2α} causes circulating progesterone to decline resulting in abortion or induced parturition (Bretzlaff *et al.*, 1983). However, the average time interval to PGF_{2α}-induced abortion (72 h) recorded in this study was longer than earlier reported in goats (30-36 h) (Purohit *et al.*, 2012), horses (48 h) (Daels *et al.*, 1995) and women (17.6 h) (Mackenzie and Embrey, 1976). This difference may be due to the dose or potency of PGF_{2α} analogue used (Day and Southwell, 1979).

In the present study, both aborted and non-pregnant does were induced to oestrus within 50-129 h after treatment with PGF_{2α}. This suggests that a single injection of PGF_{2α} could be used to induce abortion and synchronize oestrus simultaneously in goats. Similarly,

oestrus synchronization occurring immediately after PGF_{2α}-induced abortion has been reported in pigs (Meeker *et al.*, 1985). The relatively longer time interval to induced oestrus in aborted (129 h) as compared to the non-pregnant goats (50 h) suggests that the process of the PGF_{2α}-induced abortion had to be completed before behavioural oestrus is initiated. In other words, PGF_{2α}-induced luteolysis and subsequent decline in circulating levels of progesterone resulted in abortion (Bretzlaff and Ott, 1983). Thereafter, stimulation of the hypothalamo-pituitary-ovarian feedback mechanism was initiated resulting in oestrus (Chemineau *et al.*, 1982).

The relatively longer oestrus duration recorded in the present study in aborted as compared to the non-pregnant goats (46.9 vs. 38.7 h) may be suggestive of better post-abortion follicular activity and thus higher oestradiol levels in the aborted than non-pregnant goats. Administration of PGF_{2α} causes changes in oestradiol: progesterone ratio resulting in sustained increase in endogenous oestradiol and PGF_{2α} secretion (Weems *et al.*, 1999). This sustained increase in circulating oestradiol may be responsible for the longer duration of behavioural oestrus observed in this study in aborted as compared to non-pregnant goats.

The short cycling observed in this study in the aborted as compared to the non-pregnant does suggest that the process of luteolysis in aborting goats may be unstable. This is because short cycling is attributed to premature luteal regression (Camp *et al.*, 1983; Taponen *et al.*, 2002) or hypoplasia of incompletely formed corpus luteum (Okada *et al.*, 2000). Short cycling following oestrus synchronization in goats had been linked to low kidding rate and high embryonic mortality (Chao *et al.*, 2008). Therefore, in order to achieve optimum fertility it may be necessary to delay rebreeding in goats induced to abort with PGF_{2α} until the second or third post-abortion oestrus.

CONCLUSION

The findings of this study indicate that a single dose of 7.5 mg PGF_{2α} is sufficient to induce abortion and oestrus simultaneously in SR goats. However, the post-abortion cycles are short.

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