COMPARATIVE EVALUATION OF OESTRUS RESPONSE, PREGNANCY RATE AND OESTRADIOL 17β B PROFILE OF RED SOKOTO, SAHELIAN AND WEST AFRICAN DWARF GOATS FOLLOWING SYNCHRONISATION WITH PROSTAGLANDIN $F_{2\alpha}$

ABSTRACT

Reproductive inefficiency is one of the most important and cost limiting factor to profitable small ruminant production in the tropics. The aim of this studywas to evaluate the influence of breed on oestrus response,reproductiveand oestradiol17 β profiles in Red Sokoto (RS), Sahelian (SH) and West African Dwarf (WAD) goats following synchronisation with prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$). Thirty (N = 30) apparently healthy; RS (n = 10), SH (n = 10) and WAD (n=10) goats, aged between 1.5 – 2.0 years, and body condition score of 3.0 – 4.0 were used for the study. Each doe was synchronised with 1 mL (0.26 mg) cloprostenol sodium (Synchromate®) given as a single intra-muscular injection on Day 0. Prior to synchronisation, a5mL blood sample was collected from each doe on Day 0, (pre- synchronisation sample) and subsequently on Day 1, Day 2 and Day 3 post-synchronisation for determination of serum reproductive and oestradiol17β profiles.The findings of the study were as follows: Oestrus response rates (%): RS; 100.0; SH; 100.0;WAD; 0.0; pregnancy rate (%): RS; 70.0; SH; 20.0%; WAD; 0.0%.The Sahelians that kidded (SHK) had significantly higher ($P < 0.05$) serum progesterone concentration than Sahelian that did not kid (SHN); Red Sokoto goats that kidded (RSK) had significantly higher ($P< 0.05$) serum concentrations of oestradiol-17β than Red Sokoto that did not kid (RSN); oestradiol-17β was higher in RSK than SHN ($P< 0.05$). It is, therefore, concluded that: Red Sokoto goats responded better to $PGF_{2\alpha}$-based oestrus synchronisation than Sahelian and WAD. Oestradiol-17β activitywas comparatively higher in RS than in SH and WAD between Day 1 and Day 3 post-synchronisation with $PGF_{2\alpha}$. WAD goats were completely non-responsive to oestrus synchronisation with $PGF_{2\alpha}$. It is therefore recommended that WAD goat will require more time (approximately 6 months) to adapt to the Northern Guinea Zone for their hypothalamo-pituitary- Ovarian axis to be activated sufficiently to cycle, ovulate and develop a functional corpus luteum that will respond to $PGF_{2\alpha}$.

Key words: Goat breeds,Oestrus Response, Oestrus synchronisation, Prostaglandin$F_{2\alpha}$.

Introduction

Goats are the most prolific of all domesticated ruminants under tropical and subtropical conditions and are able to breed throughout the year (Mamabolo and Webb, 2005). They provide meat, milk and skin, and other by-products such as manure to maintain soil fertility (Boyazoglu *et al*, 2005). Goats are hardy animals and are ubiquitous in Nigeria. They are year–round breeders with age and weight at first oestrus being4-6 months and 10-18 kg, respectively (Mamabolo and Webb, 2005). The Nigerian goat population is the largest in Africa and the 4th largest in the world after India, China and Pakistan (Blench, 1999: FAO, 1999). The three recognized breeds of goats in Nigeria are: Red Sokoto goat which is probably themostwide spread and well- known type in Nigeria (Osinowo, 1992; Kawu, 2000) and consist of about 60% of Nigerian goat population (Molokwu and Igono, 1978; Wilson, 1991; RIM, 1992). Exogenous hormones are used to modify the physiological chain of events involved in the sexual cycle, while the non-hormonal methods of oestrus synchronisation involve the use of light control or exposure to a male. In the doe, the window of opportunity is generally greater during the luteal phase, which is of longer duration and more responsive to manipulation (Wildeus, 2000). It is essential that any oestrus synchronisation techniqueshould not only establish synchrony, but also ensure reasonable levels of fertility in the synchronised cycle (Rahman *et al.*, 2008).The advantages of oestrussynchronisation in goats include, amongst others, better oestrus detection, increased application of AI, MOET, shortening of kidding intervals, concentration of kid crop, improved management of pregnant does, induction of puberty in doelings and the more efficient use of labour and animal facilities (Rahman *et al*., 2008; Abecia *et al*., 2012). An easy-to-apply method of oestrus synchronisation in goats is by the use of prostaglandins to cause luteolysis so as to induce the subsequent follicular phase of the oestrous cycle. In small ruminants, prostaglandin$F_{2\alpha}$ is the primary luteolytic agent (McCracken *et al.*, 1970).Dinoprostthromethamine marketed as Lutalyse® and Carboprost® are frequently used natural prostaglandins, while cloprostenol sodium, marketed as Fenprostenol®, Estrumate® and EstroPLAN®, is a synthetic prostaglandin(Bello, 2011; Omontese *et al*., 2012~~;~~). Factors reported to affect oestrus response and subsequent fertility following administration of prostaglandin or its analogues include the dose level of the prostaglandin (Kawu, 2000; Tauheed, 2010), the interval between administration of the prostaglandin (Kawu, 2000), the responsiveness of the corpus luteum to the prostaglandin/ stage of the oestrus cycle (Kawu, 2000; Lassal *et al*., 2004), season (Kawu, 2000).With the discovery of prostaglandin $F_{2\alpha}$as a luteolysin in farm animals as a synchronisation agent, it has been implemented to shorten the cycle and synchronize females for breeding. Both single (Greyling and Van Niekerk, 1990) and double prostaglandin $F_{2\alpha}$ injections, given at 10–11 day intervals in does have been successful (Khanum *et al*., 2006). The limitation of this regimen is however that it is only effective in cycling does.

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MATERIAL AND METHODS

Experimental location

The study was carried out at the Small Ruminant Research Programme, National Animal Production Research Institute (NAPRI), Shika, Ahmadu Bello University, Zaria, Nigeria. Shika is located between latitudes 11 and 12° N and between longitudes 7 and 8° E at an altitude of 640 m 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 ℃ depending on season (Taiwo *et al.*, 2005)

Experimental animals

Thirty apparently healthy and nonpregnant RS (n=10), SH (n=10) and WAD (n=10) were selected from the main flock were used for the study. The ages of the does ranges between 1.5 – 2.0 years, parity, 1-2; and body condition score (BCS), of 3.0 - 4.0. (Spahr, 2005). The does were identified by means of plastic ear tags. They were fed *Digitariasmuttsi* hay as basal diet and 15% crude protein concentrate ration. Water was provided ad libitum. Ethical clearance for the experiment was obtained from the Ahmadu Bello University Committee on Animal Use and Care (ABUCAUC). No.ABUCAUC/2021/064.

OestrusSynchronisation Protocoland Blood Sampling

Oestrus synchronisation was conductedin the late rainy season (August to September). The goats were synchronised using 1ml containing 0.26 mg cloprostenol sodium(Synchromate$^{(R)}$ BREMER PHARMA, GMBH, Germany),The cloprostenol sodium was administered to each doe by a single deep intra-muscular injection (thigh). Treatment with cloprostenol sodium was carried out between 8.00am and 9.00am on day 0. The does were randomly allotted into 6 pens with 5 does each, and were allowed to stay together for one week with a proven buck in each pen for the purpose of oestrus detection and natural breeding. Thereafter, the does were separated from the buck and returned to the main flock.Five mililitres (5 ml) of blood sample was collected from each doe by jugular vein puncture on Days 0, 1, 2 and 3 of synchronisation. Day 0 sample was collected immediatly prior to injection of cloprostenol sodium (Pre-synchronisation sample).

Oestrus Detection and Breeding

Beginning from day 1 post-synchronisation, the treated does were observed visually for behavioural manifestation of oestrus twice daily between 8.00 am and 10.00 am, and 4.00 pm and 6.00 pm, respectively. The does were exposed to proven sexually active bucks in the ratio of 1: 5 (male: female) to aid oestrus detection (Abecia *et al.*, 2012). The does were considered to be in oestrus when they stood to be mounted by females (homosexual mount), or by males (heterosexual mounts). Other signs such as vigorous tail-wagging, reddened and swollen vulva, clear mucoid vaginal discharge, restlessness, frequent bleating and frequent adaptation of urination posture were also used to determine oestrus (Fatet *et al.*, 2011). Mated does were allowed to run with other does in the group. Oestrus activity occurring within 24 - 48 h (1-2days) was classified as synchronised.

Pregnancy Diagnosis

Pregnancy was diagnosed using real-time B-mode trans-abdominal ultrasound equipment (Aloka 500 V with a 3.5 MHz transducer, Corometrics medical systems, Wallingford, CT, USA). The procedure was carried out between days 30 and 35 after natural mating. Food and water were withheld over night for 12 hours before commencement of scanning in the morning (8.00 am and 10.00 am). Scanning was performed using the shaved hairless inguinal region of the does. The does were gently restrained by two persons on an examination table, while the hind legs of the does were folded up at the time of scanning for proper placement of the probe. An ultrasound

coupling gel was applied each time to the probe to develop good contact and to remove hair between probe and the animal skin. A doe was confirmed pregnant by imaging apparent conceptus (anechoic, elongated structure) within the uterine fluid.

Determination of Oestrus Response Rate, Pregnancy rate and Serum Oestradiol -17 β ProfileProfile

Oestrus response, and Pregnancy Rate, were determined as follows:
Oestrus response rate (%): The number of does that showed standing oestrus and were subsequently mated, over the total number of does in each treatment group multiplied by 100 (Omontense*et al.*, 2013).
Pregnancy rate (%): The total number of does that kidded divided by the total number of does mated multiplied by 100 (Sahare*et al.*,2009).
The Oestradiol-17 βassay was carried out using Microplate Enzyme Immuno-assay oestrogen test system (Accubind, ELISA Microwell; Monobind Inc, Lake Forest, CA 92630,USA:Product Code: 4925-300).

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Data Analysis

Oestrus response rate, and pregnancy rate were expressed as percentages. While serum oestradiol -17β concentration were expressed as mean (± SEM) and analysed using analysis of variance (one- way and Two-way repeated measures)and Duncan post hoc-test.Graphpad Prism (version 5.0) statistical package was used for the data analysis, Values of P< 0.05 were considered significant.

RESULTS

The oestrous response rate, following synchronization with $PGF_{2\alpha}$for Red Sokoto (RS), Sahelian (SH) and West African Dwarf (WAD) goats were 100.0%, 100.0%, and 0.0%, respectively as shown on Table 1. The pregnancy rate, following synchronization with $PGF_{2\alpha}$for Red Sokoto (RS), Sahelian (SH) and West African Dwarf (WAD) goats were 70.0%, 20.0%., and 0.0%, respectively.The oestradiol -17 β concentrations following synchronization with $PGF_{2\alpha}$for Red Sokoto (RS), Sahelian (SH) and West African Dwarf (WAD) goats that kidded and those that did not kid is shown in Table 2.

Table 1: Synchronization with Prostaglandin $F_{2\alpha}$ in Red Sokoto, Sahelian and West African Dwarf goats.

Fertility index	Breed		
	Red Sokoto (n=10)	Sahelian (n=10)	West African Dwarf Goats (n=10)
Oestrusresponse rate (%)	100.0 (10/10)	100.0 (10/10)	0.0 (0/10)
Pregnancy rate (%)	70.0 (7/10)	20.0 (2/10)	0.0 (0/10)

(n) = Number of animals that showed oestrus/ Became pregnant/Kidded

Table 2:Mean (±SEM) Serum Concentration of Oestradiol 17- β(pg/ml)in Red Sokoto, Sahelian, and West African Dwarf Goat Between Day 0 and Day 3FollowingOestrous Synchronization with Prostaglandin $F_{2\alpha}$

Breed	Oestradiol 17 β (ng/ml)				
	Day0	Day1	Day2	Day 3	Mean (±SEM)
RSK	357.00±111.2	300.00± 286.70	450±99.6	460.0 ±209.0	392 ±38.4[a]
RSN	0.00 ± 0.00	120.0± 10.0	0. 0±0.0	150±32.0	67 .± 39.45[b]
SHK	292.00±0.00	180.±5.0	502. 0 ± 0.0	417±0.0	348 ±70.62
SHN	138.00±323.00	180.±56	258.0 ± 85	99±91	168.0 ± 34.0[a]
WADN	1380.0±5.40	477± 34	327.0 ± 225	612± 147	388.0± 101.8

a, b = $p < 0.05$

(n) = Number of animals/Samples analysed

RSK =Red Sokoto Goat that Kidded

RSN = Red Sokoto Goat that did not Kid

SHK = Sahelian Goat that Kidded

SHN = Sahelian Goat that did not Kidd

WADN = West African Goats that did not kidded

DISCUSSION

The 100% synchronisation of oestrus achieved with prostaglandin in the present study is higher than the values of 64% and 84% following single and double injections, respectively, with prostaglandin in Brown goats have also been reported in the same environment (Ogunbiyi*et al*., 1980). This value is in agreement with 90% estrus response recorded in Nadooshani goats in Iran (Bitaraf*et al*., 2007). The differences in these results may be due to breed, nutritional status, prevailing meteorological parameters, dose and potency of the agent used, stage of oestrous cycle or stage of maturity of the corpus luteum (Niswender*et al*., 2000).The pregnancy rates of 70 % and 20 % recorded for RS and SH goats, respectively,is lower than values reported in Brown goats following double injections of $PGF_2\alpha$ (Ogunbiyi*et al.*, 1980). The higher pregnancyrates in Red Sokoto goats compared to the Sahelians suggests a better physiological adaptationof Red Sokoto goats as compared to Sahelianor West African dwarf goats to the Savannah agro-ecological zone.Furthermore, goats that exhibited sexual receptivity had higher levels of oestradiol 17 β throughout the Days 0,1,2 and 3 and in the overall. This may be due to the fact that high oestradiol 17β levels are believed to cause surge in GnRH and consequently LH peak resulting in spontaneous ovulation towards the end of oestrus (Rahman *et al.*,2008).

CONCLUSIONS

There was an increase in the oestrus response and fertility in Red Sokoto and Sahelian goats than West African Dwarf goats. The serum level of reproductive hormones (Oestradiol 17- β**)** were generally higher in Red Sokoto than in SHK and WAD following ~~prostsglandin~~prostaglandin-based oestrussynchronization. The poor ovarian response in WAD may be due to poor adaptability of the breed to Northern Guinea Savannah zone.

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