Comparative Responses of West African Dwarf Goats to Three Oestrus Synchronizing Agents

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ABSTRACT

The comparative response of West African Dwarf goats to prostaglandin F2α, sheep Veramix sponge and Sil-Oestrus implant was studied. Twenty-four normo-cyclic West African Dwarf does aged between 3 and 4 years weighing between 12 and 14 kg were assigned to 3 groups of eight does per group after equalization of body weight. The first group was treated using Prostaglandin F2α (Dinoprost *tromethamine*) (Lutalyse®), the second group treated with Sil-Oestrus® implant (375 mg progesterone) while the third group was treated with Veramix® intravaginal sponge (60 mg medroxyprogesterone acetate). Oestrus detection was carried out by teasing the does four times daily (0800, 1200, 1600 and 2000 hours) using one breeding buck per set of does. There were reductions in weight at oestrus, which may be due to restlessness and slight anorexia normally associated with oestral period. The interval from treatment to onset of oestrus in the three methods was 42.0±4.0, 42.3±4.8 and 65.8±2.0 hours from end of treatment for Dinoprost *tromethamine*, Sil-Oestrus and Veramix sponge respectively. There was significant effect ($P<0.05$) in the period of the day (66.7%) during which onset of oestrus was observed in the morning (a.m.) in contrast to 25.0% and 8.3% observation for the noon and p.m. periods respectively. It was also found out that oestrus duration of 37.5% of the oestri were of the long duration, which is significantly higher ($P<0.05$) than the medium and very long oestrus observed which were 33.3% and 4.2% respectively. The proportion of oestrus of short duration was 25.0%. In conclusion, the three agents and methods are suitable for oestrus synchronizing in the West African Dwarf goat; however the choice of either agent or method will depend on access to the drugs as well as economic consideration.

Key words: Lutalyse, oestrus, prostaglandin, Sil-Oestrus, West African Dwarf Goats.

INTRODUCTION

Ruminants play an important role in the economy of Nigeria. Meat and milk obtained from these animals constitute the major source of animal protein for a greater part of the population (1). Their by-products such as hides, skin and bone serve as raw materials for some agro-based industries, thereby serving as a source of foreign exchange. Furthermore, they have a vast potential in mixed farming. Their dung may be used as manure to nourish the soil and improve forage growth (2).

The West African Dwarf (WAD) goat is the most important livestock species in the forest zone of Southern Nigeria because of its relative *trypanotolerance*. It plays an important role in the lives of smallholder farmers with mixed cropping system and low-income workers, as it provides mainly meat and cash through sales. The WAD goat is generally managed extensively like other species of domestic ruminants in Nigeria.

Oestrus synchronization is a process whereby a group of animals are induced to come on oestrus (heat) using drugs or chemicals. This enables the animals to be mated or inseminated artificially at the same time and facilitates controlled breeding and kidding or parturition. The main aim of oestrus synchronization is to abbreviate the interval required to

mate a group of eligible females. Oestrus synchronization is beneficial to the herdsman as it reduces the time needed to observe oestrus, provides a useful management aid for planning the use of animals and facilities and reduces labour cost in terms of care of the newborn (1, 3). Fertility of goats synchronized for oestrus using two 8 mg injections of Prostaglandin F2α 11 days apart and bred by natural service has been investigated (4, 5). An alternative to the subcutaneous implantation of norgestamet (medroxyprogesterone acetate), but obviously relying on the same principle, is the progesterone-releasing intravaginal Coil Veramix Sponge which is placed in the vagina for 12 days (6), implantation being accompanied by the injection of 5 mg oestradiol benzoate and 50 mg progesterone. The vaginal pessaries or subcutaneous implants provide progesterone / progestagen cover over a 14-day insertion period. The interval from cessation of treatment to the onset of oestrus varies with season, age and breed of the doe or ewes and the type and amount of the progestagen or progesterone used. Attempts by Oldham (7) to synchronize ewes with natural methods were based on the sudden exposure of ewes to rams during the anoestrous season and also the injection of bovine colostrums.

The aim of this study was to determine and compare the effectiveness of Lutalyse, sheep Veramix intravaginal sponge and Sil-Oestrus implant as synchronizing agents in the West African Dwarf goat.

MATERIALS AND METHODS

Location and Climate

The study was carried out at the Small Ruminant Unit, University of Ibadan, Nigeria. The mean temperatures ranged from 24ºC to 33ºC and relative humidity from 46.3% to 81.0% in January and April respectively.

Experimental Animals

The animals, which consisted of 24 normocyclic West African Dwarf (WAD) does, aged between 3 and 4 years, were purchased from a local market. The animals weighed between 12 and 14 kg and were randomly assigned to 3 groups of eight does per group after weight equalization.

Management of Experimental Animal

The animals were allowed to graze between 0700h and 1800h and housed at night (1800h-0700h) in groups of eight in roofed houses with floor covered with wood shavings as bedding. The wood shavings were changed fortnightly during the rainy season and once a month during the dry season. The pens measured 4.70 x 3.14 m in size. While the nursing pens measure 3.15 by 1.19 m. The feeding included cassava (*Manihot esculata*) peeling and concentrate supplement [Table 1].

Table 1: Composition and Proximate Analysis of Standard Goat Ration.

(A) Composition

Ingredients	% component
Corn meal	20
Wheat offal	20
Palm kernel	16
Brewer's grains	40
Groundnut cake	3.5
Salt	0.4
Mineral/ premix	0.1
Total	100

(B) Proximate Analysis

Chemical composition	% component
Crude protein	3.86
Fat	6.16
Crude fiber	10.06
Ash	13.42
Moisture content	2.69
Energy	2271.45 Cal / kg

Source; Akusu *et al*; (35)

The weights of the animals were determined weekly using a suspension balance.

Oestrus Synchronization

The animals were assigned to 3 groups namely: A, B and C. Group A does were administered two 10 mg intramuscular (I/M) injection of Prostaglandin F2α (PGF2α) (Dinoprost tromethamine, Upjohn Coy, Kalamazoo, USA) 11 days apart. Group B does received a subcutaneous (S/C) implant of Sil-oestrus® (Abbott Laboratories, S.A. Athens, Greece) containing 375 mg (10%) progesterone in a silicone elastomer matrix. The medial aspect of the forelimb (the flank region) was shaved clean and disinfected with Chlorhexidine (Hibitane®, RxMed) and dewaxed with methylated spirit (Apacco Methis®,Apacco Pharmaceutical, Nigeria). A local

anaesthetic (lignocaine hydrochloride Labcalin®, Laborate pharmaceutical, India) was injected into the operative site and about 2-3 cm incision was made on the skin with a scalpel blade over the auxiliary muscles. The implant was inserted into the sterile canula and implanted by means of the sterile trocar. The canula was pushed up under the skin to a length of 7 cm before releasing the implant. After withdrawal of the applicator (trocar and canula), the skin was sutured with 3/0 nylon suture material. The implant was left in the flank for 11 days, after which it was removed. The skin was sutured, using 3/0 nylon suture material. Post-operative medication consisted of 1 ml per 10 kg body weight of oxytetracycline dehydrates (Oxytet-LA; Eagle Chemical Co. Ltd; Seoul, Korea).

Group C does were treated with sheep Veramix® intravaginal sponge (Upjohn Ltd, Fleming Way, Crawley, Sussex) containing 60 mg Medroxy Progesterone acetate (MAP).

Fig.1: Site of application of Sil-Oestrus® implant. Note that the animals were placed on dorso-lateral recumbency. The forelimb was restrained at an angle of approximately 90^0. The implant was inserted into the medial aspect of the forelimbs at a distance of 5-6 cm from the site of incision.

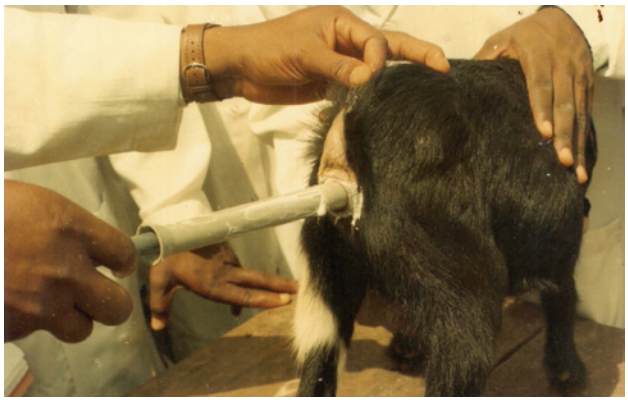

Fig. 2: Intravaginal insertation of Veramix® sponge using trocal and canular after lubrication.

Each doe received a sponge. The sponge was first lubricated with an antibiotic cream and inserted into the vagina using a lubricated applicator.

Oestrus Detection

The does were teased four times daily: 0800, 1200, 1600 and 2000 hours using one breeding buck per set of does. Duration of teasing was about 20 minutes per pen. Each teaser buck carried on its ventral side a rubber apron, which extended from the medial part of the axilla to the anterior aspect of the scrotal neck. The length and breadth of the aprons ranged from 12-20 cm, respectively for the small and large bucks. The aprons were secured in place with elastic strings tied on the dorsal aspect of each buck in order to prevent mating or coitus, where coitus is defined as a process of erection, intromission and ejaculation.

Duration of Standing Oestrus

In order for effective teasing of all does in each pen, any doe on heat was isolated from the pen so that bucks could direct their attention to other does. It was observed that bucks devoted their attention to a doe that accepted mounting.

The period of the day when oestrus was first observed was divided into three periods: does that were first observed in oestrus at 0800h-1100h were grouped at antemeridian (a.m.), at 1130-1530 hours as noon, and at 1600 and 2000h as post meridian (p.m.). Does on oestrus were then inseminated or served.

Statistical Analysis of Data

Data were subjected to statistical analyses by using analysis of variance as described by Steel and Torrie (8) and SAS (9). Paired comparisons were done using the student "t" test where applicable. For all tests, $P<0.05$ was considered significant.

RESULTS

Veramix® intravaginal sponge and the Sil-oestrus® implants used were all intact at the end of experiment. None were removed or lost into the animal. Microbiological examination showed that the sponges were not infected with any pathogenic bacteria, although there was some degree of vaginal mucus matting of sponges.

Effect of Treatment on Weight Changes

Weight changes in each of the does used for the study are shown in Table 2. The mean weights at the onset of the studies were 17.0±3.9, 17.5±3.6 and 17.0±2.5 kg for Lutalyse® Veramix® and Sil-oestrus® treated does, respectively. The mean weights however at oestrus were 16.5±3.5, 17.0±3.3 and 16.6±2.3 for Lutalyse® Veramix® and Sil-oestrus® treated does, respectively. Reduction in the weights of does at oestrus is most likely due to restlessness and anorexia normally associated with oestral period.

Table 2: Distribution of Animal Weights (Kg) at the onset of study and at oestrus per treatment group.

GROUP	LUTALYSE®		VERAMIX		SIL- Oestrus	
Onset	At oestrus	Onset	At oestrus	Onset	At oestrus
16.4	16.0	16.0	16.0	14.4	14.6
17.2	16.8	14.7	14.0	18.6	18.0
22.2	21.0	17.6	16.9	16.7	15.7
23.8	22.9	12.8	13.0	15.8	15.2
13.8	13.2	22.5	21.5	19.2	18.8
12.3	12.4	23.0	22.0	21.0	20.7
15.8	15.7	19.5	19.2	17.6	16.9
14.3	14.0	13.6	13.6	12.6	13.0
Mean 17.0	16.5	17.5	17.0	17.0	16.6
± SEM 3.9	3.5	3.6	3.3	2.5	2.3

Oestrus Synchronization

Oestrus was synchronized in all the does by the three methods used in this study. The interval from treatment to onset of oestrus was 42.00±4.00 (range 36.00-48.00h), 42.25±4.80, (36.00-48.00) and 65.75±22.01 (48.00-120.00) hours from end of treatment for Lutalyse®, Sil-oestrus® and Veramix® sponge, respectively. The interval was significantly longer in Veramix sponge (P<0.05) than those for Lutalyse® and Sil-oestrus® implant treated does, which were not significantly different (P>0.05) from each other (Table 3).

Duration of Oestrus

The mean duration of standing oestrus in WAD does was 31.11±1.74h. There were significant variations (P<0.05) between and within animals from one oestrus to the other. Out of a total of 24 does that were observed and served, none returned to oestrus, indicating a conception rate of 100%.

Table 3: Mean Comparative Response of West African" dwarf Does to Oestrus Synchronization Agents: interval from treatment of onset of oestrus (Hours).

GROUP A LUTALYSE®	GROUP B VERAMIX® SPONGES	GROUP C SIL-Oestrus® IMPLANT
N =8	N =8	N =8
42.00	66.00	40.00
38.00	120.00	40.00
42.00	58.00	42.00
36.00	72.00	48.00
40.00	62.00	48.00
48.00	48.00	36.00
48.00	48.00	48.00
42.00	52.00	36.00
Mean 42.00a	65.75b	42.25a
± SEM 4.00	22.01	4.84

a, b: Means differently lettered along the row are significantly different at p<0.05.
KEY
GROUP A: Animals treated with Lutalyse
GROUP B: Animals treated with Veramix sponges
GROUP C: Animals treated with Sil-Oestrus implant

Diurnal Variation in Oestrus Duration

There was significant effect (P<0.05) in the period of the day (66.67%) during which onset of oestrus was observed in the morning (a.m.), in contrast to 25.0% and 8.33% observations for the noon and p.m. periods, respectively (Table 4). However, the duration of standing oestrus was not significantly (P>0.05) affected by time of the day: the duration of standing oestrus at a.m. was 28.07 h, noon was 33.10 h and 25.72 h for the p.m. Majority of does in which oestrus was first observed during the a.m. and p.m. periods exhibited medium, long and very long oestri in contrast to oestrus of short

Table 4: Diurnal effects on the occurrence and duration of oestrus (24 observations).

Time of the day	*N*	Occurrence %	Duration Mean±SEM (hour)
a.m.	16	66.67a	28.07±2.12
Noon	06	25.00b	33.10±4.04
p.m.	02	8.33c	25.72±4.07

a, b, c: Percentages differently lettered down the column are significantly different at P<0.05.
KEY:
a.m.: Antemeridian 08:00 – 11:00 hours
Noon: 11:30 – 15:30 hours
p.m.: Post meridian 16:00 –20:00 hours

Table 5: Classification of oestrus duration

Classification	Short	Medium	Long	Very long	Total
	<15h	16-26h	27-37h	>38h	
N	6	8	9	1	24
%	25.00d	33.33b	37.50a	04.17c	100
Mean duration (hours)	11.41±0.74d	20.14±2.84c	31.14±1.56b	53.52±1.18a	31.11±2.74

a, b, c, d: Percentages differently lettered along the same row are significantly different at P<0.05.

duration which were least in occurrence (Table 4). On the other hand, oestrus durations of medium classification were observed to occur with the least frequency in does which were first observed to be in oestrus during the noon period.

The occurrence of each oestral classification within time of the day expressed as a percentage of total observations is presented in Table 5. The a.m. group of oestri was generally more prevalent in each classification than the noon and p.m. groups. Similarly, the percentage of oestrus at noon was more than that for the p.m. group, although oestri of medium duration in the p.m. group were more frequent than in the noon group. Within each group, oestri of longer duration were more prevalent in the a.m. and noon groups, while in the noon group, oestri of medium duration were least (Table 5).

Classification of Oestrus Duration

The mean duration of oestrus for the different classes is shown on Table 5. A classification of 24 observed oestrus into short (<15 hr), medium (16-26 hr), long (27-37 hr) and very long (>38 hr) duration showed that 37.5% of the oestri were of the long duration, while the medium and very long oestrus were observed in 33.3% and 4.17% of the does respectively. The proportion of oestrus of short duration was 25.0%. These values showed that the oestrus of long duration was significantly (P<0.05) longer than medium and very long, as well as short. There were significant variations (P<0.05) between short, medium and very long oestrus durations.

DISCUSSION

The three-oestrus synchronization agents, effectively synchronized oestrus in West African Dwarf does. The high degree of synchronization achieved with the progestational agents was similar to previous reports in goats (10, 11) and sheep (12, 13, 14).

Despite the different routes of administration employed, none of the agents was either lost into the animal or out of the animals. This indicates safety of the materials used, thus preserving the breeding life of the does; since losing any of the synchronization materials, especially Sil-oestrus® implants, may precipitate nymphomania.

The variations observed in the onset of oestrus at the termination of the treatments by the does have also been reported by various workers (6, 11, 15). The properties of the progestagens used, the dose of progesterone or the route of administration could be responsible for the time interval required for complete synchronization in does treated with Sil-oestrus® implants and vaginal sponges (6, 16, 17). Of these two progestagens, there was shorter interval to oestrus post – treatment by the does given Sil-oestrus® implant and Lutalyse®. This is similar to the duration of 41.67±2.22 hours and 42.33±1.96 hours reported for Lutalyse® and Sil-oestrus®, respectively, by Oyediji *et al*., (6). There was no significant difference (P>0.05) in the interval from treatment to onset of oestrus in Lutalyse® and Sil-oestrus®, despite the fact that they are different agents, of different concentration. The higher dose of progesterone in Sil-oestrus® (375 mg/implant) compared to 60 mg/sponge in Veramix® sponge (with different route of administration) could be responsible for the significant difference observed between the values of Lutalyse® (42.00±4.0 hours), Sil-oestrus 42.25± 4.8 hours) and that of Veramix® Sponge (65.75±22.0 hours). It is quite possible that absorption is faster subcutaneously with Sil-oestrus® than with the intravaginal route in Veramix® sponge.

The Prostaglandin F2α (Lutalyse®) activity in synchronizing oestrus in does was similar to the reports of Oyediji *et al*., (6) in sheep. Naqvi *et al*; (11) observed that the interval from treatment to onset of oestrus in ewes was 41.4±5.6 hours, which is similar to 42.0±4.0 hours observed in this study. The interval to oestrus following the second administration was similar to the report of Oyediji, (14), but shorter than the observations of Sanwal *et al*., (18) and Kusakari *et al*. (10) in ewes.

The oestrus duration (OD) in the goat is known to vary with the breed (3, 19, 20, 21). Robertson (22) and Prasad and Bhattacharya (23) quoted ranges of 32-40 h and 36-46 h respectively. Prasad (24) had reported; 38 h in nulliparous Barbari nannies. The mean duration of 31.11±2.74 h observed in the WAD goat was similar to the report of

Sahni and Roy (25) for WAD goat and also in the Kambing Latjang goat indigenous to Malaysia reported by Banumathi and Mukherjee (26). Some of the earlier reports of OD in the WAD goat in Nigeria (27) had a range of 20-40 h. Otchere and Nimo (28) reported a mean OD of 17 h (12.9-20.4) for the WAD goat in Ghana while Akusu, (3) reported a range of 16.83-45.50 h with a mean of 31.11±1.74 h in WAD goat in Nigeria. The mean, in this study is similar to the reported OD mean of Akusu, (3). However, OD in WAD goats was remarkably shorter than the 67.2 h reported by Camp *et al*; (29) in Nubian breeds and the Pygmy goat reported by Jarosz *et al*., (20) which probably was the longest OD of 96 h.

The observation that some oestri were first recorded in the morning (antemeridian) period confirmed earlier reports (3, 26) in the Katjang goats where 86.6% and 65.6% of oestrus occurred in the morning respectively. However, onset of oestrus in the WAD goat was noticed at anytime of the day agrees with the observation of Mishra and Biswas (30) in Deshi goats and Akusu, (3) in WAD does. Prasad (24) reported that a relatively larger number of Barbari nannies had their onset of heat during 16h and the least number at 24 h. Although these reports on onset of oestrus are consistent, it would be difficult to ascribe any relationship between the photoperiod and temperature to the onset and cessation patterns of oestrus in the goat (23). While the cooler parts of the day were significantly favourable in the frequency of the onset of oestrus, the duration of oestrus, which probably is of primary importance in breeding, was not significantly influenced in the goat and the WAD sheep (31). The role of heat stress can therefore not be sustained as more oestri were first observed at noon than the relatively cooler evening. Until there is further experimental evidence, the differences in frequency in onset of oestrus could be traceable to the synthesis of hormones necessary for oestrus manifestation, which continues even when animals are asleep. On the other hand, the release of these hormones is enhanced in the early hours of the day and continues throughout the day.

The time interval between observations in this study was considered adequate and similar to the observation pattern in the WAD sheep (31) and goats (23) and is believed to be important in practical goat breeding and management. It is relevant to mention that Orji and Steinbach (31) had earlier reported that significant differences were not observed in oestrus duration in ewes when oestrus detection was carried out either four times or twice daily. There is a paucity of information in the classification of OD in literature. Akusu reported oestrus duration and classification to be of importance in determining the time of insemination (3). The occurrence of oestrus of short duration would be of practical significance in breeding. The observed 25% of oestrus of short duration would present a problem of successful breeding especially in the p.m. period. This is because does that were on heat after the p.m. observation and whose oestri durations were less than 12 h would not be bred at a.m. However, the p.m. period only accounted for 2.41% of oestrus of short duration. Therefore, the breeding schedule which involved exposure of does thrice daily was considered favorable as it enabled all does in oestrus, irrespective of oestrus duration to be teased, mated and or inseminated.

Although there were weight changes in all the does with the various treatments after oestrus probably due to restlessness, aggressiveness, and anorexia that accompanied the oestrus period, the differences in weight were not significant. This indicated that none of the agents affected the weight of the does negatively.

When fertility trials were carried out, all the does were found to be pregnant. This indicates that the three methods and routes of oestrus synchronization did not affect fertility in any way. This is similar to the reports of Allinson and Robinson (32) in sheep, Colas (33) and Mazzarri *et al*. (34) in ewes, they observed higher fertility rates with higher sperm concentration of $8x10^6$ spermatozoa/ml and with fresh semen.

In conclusion, these observations showed that progestagens and PGF2α are suitable for synchronizing oestrus in West African Dwarf does. Therefore, the choice of either agent or method will depend on access to the drugs as well as on economic consideration. However, the ease of administration of PGF2α makes it a drug of choice in oestrus synchronization in WAD goats.

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