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Influence of short-term synchronization protocol and fixed timed AI on oestrus synchronization response, oestrus behaviour and pregnancy rate of two breeds of Nigeria indigenous goats

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Target Audience: *Goat farmers, Breeders, Scientists*

Abstract

The study evaluated the efficacy of short-term progestagen treatment on response to oestrus Synchronisation, oestrus behaviour and pregnancy rate following Artificial Insemination in 30 West African Dwarf (WAD) and 30 Red Sokoto (RS) indigenous goats. Each Breed was kept separately, the protocol consisted of a 9-day term protocol: on Day 0, all animals received 1ml of Cyclase along with insertion of a progesterone device (CIDR) into the anterior portion of the vagina with an applicator, 2ml of Equine chorionic Gonadotrophin (eCG) was administered concurrently with CIDR removal on Day 6, Fixed Time Artificial Insemination (FTAI) was done 52 hrs, after CIDR removal. All does were tested for pregnancy 30 days post AI using progesterone hormone measurement. Oestrus was monitored every 4 h after CIDR removal for 72 h. Results showed; 100% device retention rate for both breeds, oestrus response was higher (P<0.05) in WAD compared to RS (100% vs 83.3%) respectively, interval to onset of oestrus was shorter (P<0.05) in WAD than RS (24±0.25 h vs 31±0.32 h), Duration of oestrus was longer (P<0.05) in WAD than RS (44±0.4 h vs 36±0.6 h) and pregnancy rate was higher (P<0.05) in WAD than RS (83.3% vs 50%). Various oestrus behaviour evaluated recorded higher intensity for WAD than RS except for reduced feed intake. It is concluded that short-term synchronization protocol can be used as an alternative to long-term treatments in enhancing reproductive performance of Nigeria indigenous goats.

Key words: *Oestrus synchronization, West African Dwarf goat, Red Sokoto goats, Oestrus Behaviour, Pregnancy rate*

Description of Problem

Goat farming has great potentials to contributing immensely to economic impact of the Agricultural sector of the nation. Enhancing the productive characteristics of different breeds of goat and production of genetically valuable offspring requires the use of reproductive biotechnology tools of which oestrus synchronization and artificial insemination are inclusive. Oestrus synchronization protocols have been found to enhance reproductive performance of caprine (1-3, 20) and ovine (4) species. Synchronization agents employed play various roles: the progestagen induce oestrus earlier and initiate a more-tight oestrus synchrony (5) while supressing endocrine events that influence ovarian activity and ovulation. One of such progestagens is the controlled internal drug release dispensers

(CIDR) which have gained attention over other intravaginal devices probably due to absence of bacterial contamination and absorbance of vaginal fluids when in use (6) and the prostaglandin are used as luteolytic agents has been reported to eliminate potential corpora lutea. Gonadotrophins such as equine chorionic gonadotrophin (eCG) which is secreted by trophoblastic cells in the mare during gestation and is a convenient hormone to induce oestrus and ovulation in goats due to its dual activity (FSH and LH) and long half-life (7). Long–term protocols (14 days) have been previously used in Red Sokoto goats (2, 3), although it synchronized oestrus was associated with variable and low fertility (8-9). Short–term synchronization protocols have been established to enhance fertility over the conventional long–term synchronization protocol (10-14). Probably due to enhanced follicle turnover, healthy and matured follicles with the capacity to ovulate, increased pregnancy rate, and supraluteal levels of progesterone concentrations characterizes the short–term synchronization protocol. A reduction in time of treatment with progestagens may facilitate handling and minimize the loss of implants, vaginal discharge and infection, without compromising fertility (15). Investigation of short-term synchronization protocol following FTAI in two breeds of goats may offer a clear indication of whether oestrus synchronization response is influenced by breeds. There are however no studies to the best of our knowledge comparing the reproductive performance of Red Sokoto and West African Dwarf goats following short-term Synchronization Protocol and FTAI, hence the need for this study.

Materials and Methods

The study was carried out at the goat farm Unit of the Department of Animal Science Teaching and Research Farm, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt. The study was conducted between April and September (Year). A total of 60 goats, RSG (n=30) and WAD (n=30) were used for the experiment and goats of same breed were kept together in pen houses. All animals were fed *ad libium* with concentrates and clean water. They were allowed to graze in the morning hours, all animals were given prophylactic treatment prior to onset of the synchronization protocol. The synchronization protocol used was described by (16). The protocol consisted of a 9-day term protocol: on Day 0, all animals received 1ml of Cyclase along with insertion of a progesterone releasing device containing 0.3g of progesterone (CIDR, EAZI BREED, New Zealand) into the anterior portion of the vagina with an applicator. On Day 6, CIDR was removed and the retention rate was evaluated by counting the number of does that still had the intravaginal device in place. Does that retained the device then received 2ml of eCG i/m (Norvomon, Syntex Australia), Fixed Time Artificial Insemination (FTAI) was done 52 hrs, after CIDR removal. RSG semen from a buck based on previous successful breeding history was used. All animals were inseminated with the aid of a speculum with an in-built light source and pipette connected to it and am –pm rule was adopted. All does were tested for pregnancy 30 days post AI using hormone measurement.

Oestrus activity occurring within 72 hrs post withdrawal of progestagens was classified as synchronized. Oestrus response, time interval to initiation of oestrus, and duration of oestrus were evaluated. Oestrus response was calculated as the number of does that showed standing oestrus (heat) and subsequently, inseminated over the total number of does in each treatment group was expressed as a percentage. Time to initiation

of oestrus was evaluated as the interval (hours) from when the progestagen (CIDR) was removed to the time that the doe first showed standing oestrus expressed as mean ± standard error of mean (SEM), while duration of oestrus was measured as the time (hours) between the first and last standing oestrus expressed as the mean ± standard error of mean (SEM). Retention rate, pregnancy rate and oestrus response rate were expressed in percentages. Data on oestrus response, time to initiation of oestrus, and oestrus duration were analysed using SPSS 22.0. Student's t-test was used to compare means between treatment groups. Values of $P<0.05$ were considered significant.

Results and Discussion

At the end of 9–day treatment, the retention rate was 100% (60/60). Oestrus response was higher in WAD than in RS does (30/30 (100%) and 25/30 (83.3%)) (Table 1), respectively. Time to onset of oestrus was shorter ($P<0.05$) in WAD (24±0.25 h) than in RS (31±0.31 h) (Table 1). Oestrus duration was longer ($P<0.05$) in WAD (44±0.4 h), compared to RS (36±0.6 h), pregnancy rate was higher ($P<0.05$) in WAD than RS (25/30 (83.3%) vs 15/30 (50%)) (Table 1). Oestrus behaviour observed was of higher intensity in the WAD compared to RS except for reduced feed intake (Table 2).

Table 1: Response of RS and WAD does to short-term oestrus synchronization

Variables	RS (n=30)	WAD (n=30)
Oestrus Response (%)	83.3^{b}	100^{a}
Interval to Oestrus (h)	31 ± 0.31^{b}	24^{a} ±0.25
Duration of Oestrus (h)	36 ± 0.6^{b}	44^{a} ±0.4
Pregnancy rate (%)	50^{b}	83.3^{a}
Conception rate (%)	20/30	28/30

Superscripts indicate significant difference

Table 2: Oestrus behaviour signs of RS and WAD does treated with ST synchronization protocol during the treatment period

Variables	RSG	WAD	Prooestrus	Oestrus	Metoestrus	Dioestrus
Bellowing	*	**	---	+++	---	--
Bleating	*	**	+	+++	---	--
Vaginal mucus discharge	**	*	+	+++	---	---
Vaginal swelling and reddening	*	**	---	+++	---	---
Frequent urination	*	**	+	+++	---	---
Restlessness	*	**	---	+++	---	---
Reduced feed intake	**	*	+	+++	---	---
Mounting other female	*	**	---	+++	---	---

*+less intensity, **high intensity, --- Absent

The short–term synchronization protocol used in the present study was efficient in inducing oestrus response in both breeds of goats. The previous studies using short term protocol reported same in different breeds of goats (8, 10, 11, 16). The results on oestrus response obtained in the study is similar to that 82.1% (2) but lower than 100% reported

by (3) in RS, 95.5% in MAP/eCG treated does (17). Although oestrus response was higher ($P<0.05$) for WAD than RS, this may be accrued to breed differences which is in agreement with (5, 27) The study of (2, 17) reported higher oestrus response for eCG treated does compared to control. The high degree of oestrus synchrony obtained in the study could be due to the protocol employed in the study. The CIDR may have effectively prolong the luteal phase of the cycle, the combination of PGF and progesterone used seems to be very effective for rapid luteolysis of the caprine corpora lutea resulting in decreased progesterone level when the does are cycling, enhanced effect of eCG administered at device withdrawal which is crucial to increasing endogenous gonadotrophins in a manner that adequate gonadotrophin is available for induction of preovulatory events (2, 6). Therefore, it is reasonable to describe that a 5-6 d treatment is enough to induce oestrus response. The variation in the results obtained in the present study and previous research could be due to difference in goat breeds, synchronization agents and protocol, climatic elements in which the various research were conducted.

The 100% retention rate recorded in the study was higher than 89% (2) but in agreement with (3, 18, 19). The retention rate enhanced suppression of premature oestrus thereby enhancing onset of oestrus behaviour. The retention degree may vary due to duration of protocol, nature of the device, method of insertion and length of reproductive tract.

Overall pregnancy rate in the study using short–term protocol was 66.6% and is higher than 43.6% (5, 10) but in contrast to (11) who reported 80% for long term treatment. The enhanced pregnancy rate could be due to double AI and use of semen that provided higher sperm cells. In synchronized goats, the synchronizing agents were able to provide adequate endocrine environment for reproductive events culminating in pregnancy. The preliminary exposure to progesterone aids the pituitary LH secretion via a negative feedback, hence modifying the hypothalamic GnRH secretion. This endocrine scenario, culminates in synchronized LH secretion after CIDR removal and together with eCG injection are responsible for preovulatory follicle development and maturity resulting in ovulation and pregnancy.

Timing of onset of oestrus is crucial to occurrence of ovulation and time for artificial insemination. The breed effect observed in the study is in agreement with (28) but contrary to (5) The time to onset of oestrus for RS was longer that (29.3±4.6 hrs) reported in (2) but shorter than 49.0±0.83 hrs (2). The overall time to onset of oestrus in the study using short-term protocol is 27.5 h which is longer than 25.7 hrs in Sanen goats (11) but shorter than 29 hrs (21), 46 h in Togenburg goats (22).The eCG has been shown to reduce the interval from progestagen withdrawal to oestrus (23) but contrary to reports of (7) and enhance the efficiency of synchronization of oestrus and ovulation by enhancing ovarian activity (24) during the breeding season.

The breed effect observed in oestrus duration agrees with the study of (5, 28). The oestrus duration was similar (38.9± 5.1 hrs) in RSG (2) but shorter than 72.0±0.89 hrs (3), longer than 31.11±2.74 hrs (25) in WAD. The study of (7), which treatment is similar to ours reported 31 h in Turkish Saanen goats. The duration of the induced oestrus period of 37 hrs and 44 hrs for RSG and WAD respectively are within acceptable range. The study of (26) reported that oestrus period for goats tends to lasts between 24 hrs and 48 hrs following oestrus synchronization. The varying reports could be due to breed,

synchronization agents, nutrition and environmental conditions.

None of the synchronized does showed oestrus while the intravaginal devices were in place, in agreement with the study of (10) it could be ascertained that the dose of progesterone in the CIDR device absorbed from the vagina during the treatment was adequate to block the release of pituitary gonadotrophins, hence supressing premature oestrus.

Conclusion and Application

1. The overall findings of the study is an indicator for acceptable reproductive response in these breeds of goats following oestrus synchronization protocol.
2. Short- term synchronization method can be used to achieve important reproductive outcomes: enhanced onset of oestrus, oestrus duration and pregnancy rate.
3. Therefore, the obtained information in this study could be utilized for reproductive process optimization in Nigeria goat breeds and development of appropriate breeding programmes.
4. Future research needs to be conducted to evaluate the ovarian follicular dynamics and its relationship with fertility outcomes.

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