RESEARCH ARTICLE (Open Access)

Oestrus synchronization using two intravaginal progestagens (FGA and CIDR) for eCG-estrus induction in indigenous Red Sokoto goats during the cold dry season.

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Abstract

The efficiency of two progestagen for eCG-estrus induction and pregnancy was evaluated in indigenous Red Sokoto goats during the cold dry season. One hundred (n=110) Red Sokoto does were allocated to two groups and treated with devices containing progesterone (CIDR group; *n* = 50) or fluorogestone sponges (FGA group; *n* = 60) for 15 days. At withdrawal of intravaginal progestagens, does that retained the progestagens were further allocated to two groups per progestagen type with one half treated with 400 IU eCG (CIDR group; n = 18, CIDReCG; n = 19) and (FGA group; n = 20, FGAeCG; n = 21). All does were grouped with bucks. Does in estrus were identified twice daily (morning and evening) during a 120 h observation period and bred. Pregnancy was determined by trans-cutaneous ultrasonography 30 days later. Progestagen retention rates were 74 % (CIDR) and 68 % (FGA). There were significant differences among treatments for does in estrus (CIDR: 22 %, CIDReCG: 84 %, FGA: 45 %, FGAeCG: 95 %). The average time interval from withdrawal of progestagen to onset of estrus was 39.8±3.5, 32.4±3.0, 55.6±3.6 and 28.2±1.9 h. Duration of estrus was 23.9±1.1, 29.9±0.6, 15.1±0.9 and 90.0±4.9 in the CIDR, CIDReCG, FGA and FGAeCG groups, respectively. Pregnancy rates (CIDR: 100 %, CIDReCG: 87 %, FGA: 89 %. FGAeCG: 80 %) did not differ significantly with treatment. The use both progestagens plus intramuscular administration of eCG improved estrus response rates and compact synchronization but did not significantly improve pregnancy rates in Red Sokoto does during the cold dry season.

Keywords: Red Sokoto; Progestagen; Gonadotrophin; Cold dry season; Pregnancy.

1. Introduction

There is an increasing gap between the growth rate in human population and the availability of animal protein to cater for their dietary needs. Most African countries are vulnerable to this gap compared to the developed countries. Efforts aimed at improving fertility rates of goats involve the application of reproductive biotechnologies such as estrus synchronization and ovulation [20]. Estrus synchronization enables kidding over a limited period thereby allowing producers to give optimum care for the dams and kids. Importantly, producers are able to breed their goats so they can kid at the time of the year when pasture is more abundant. Two method commonly used to synchronize estrus in goats include the use of prostaglandins and progestagens [1]. The use of intravaginal progestagens followed by administration of pregnant mare's serum gonadotrophin (PMSG) to synchronize estrus and to improve ovulation rate has been reported in sheep and goats [16, 9, 26, 17, 8].

In Nigeria, goats are kept for economic reasons and serve as source of animal protein to support the national program on meat self-sufficiency. Red Sokoto (RS) goat accounts for over 60 % of the Nigerian goat population [21]. They are a good meat breed and are known for its suitability for fine leather [2]. Intravaginal progestagens maintained in situ for 21 days without gonadotrophin administration has been used to synchronize estrus in Red Sokoto does [18]. Responses to gonadotrophins are equivocal, inconsistent and variable being influenced by factors such as treatments and breed [5]. The use of estrus

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synchronization for small ruminant livestock production in Nigeria is still predominantly under investigation and information on estrus synchronization using different progestagens and equine chorionic gonadotrophin (eCG) in indigenous Red Sokoto goats is nonexistent. Information on the effect of type of progestagen and use of gonadotrophin on estrus response and pregnancy during the hot dry season is invaluable for ensuring successful assisted reproductive techniques (ART's) application in the Nigerian goat industry. This will be useful in the design of an intensive and cost-effective breeding programme. The objective of the present study was to compare the effectiveness of two different intravaginal progestagens (EAZI-BREED CIDR® and FGA-30®) with or without the additional eCG administration on the nature of synchronized estrus and pregnancy rate in RS goats during the cold dry season.

2. Materials and methods

2.1 Study location

This experiment was carried out at the goat pens of the Small Ruminant Research Programme (SRRP), National Animal Production Research Institute (NAPRI), Shika, Ahmadu Bello University, Zaria, Nigeria. Zaria is situated in the Northern Guinea Savannah zone of Nigeria between latitude 11 ^{0}N and 12 ^{0}N and between longitude 7 ^{0}E and 8 ^{0}E at an elevation of 650 m above sea level. Zaria is characterized by a tropical climate with three distinct seasons; the cold dry (November - February), hot dry (March - April), rainy seasons (May – October). Daily temperatures range from 13 ^{0}C to 30 ^{0}C with a relative humidity of 23 % during the dry seasons. In the study area, the harmattan period which is the initial part of the dry season is from November to February and is usually characterized by cold weather and dry dusty winds. The average monthly rainfall for the rainy season was 153.2 mm with a range of 32.4 to 300.8mm, while the dry seasons were characterized by a total lack of rainfall.

2.2 Experimental design

One hundred and ten (n=110) healthy Red Sokoto does, weighing 15 – 21 kg with body condition scores 2.5 – 3.5 (1 being thin and 5 being obese), aged between 1.5 - 2 years were included in this study. The does were identified by means of plastic ear tags. Does were allowed to graze within large paddocks, fed *Digitaria smutsii* (wooly finger grass) hay and concentrate supplement (0.5 kg/day). Water was provided *ad libitum.* Initially, the does were divided into two groups; the CIDR treated groups (n=50) received EAZI-BREED® CIDR® (0.3 g of progesterone, InterAg, Hamilton, New Zealand) while the FGA treated group (n=60) received FGA-30® (30 mg, Chronogest, Intervet, The Netherlands) for 15 days. Does that retained the progestagens after a 15-day treatment were further subdivided into two, one half received 400 IU eCG i.m. (PMSG-Intervet, Ireland) concurrent with progestagen withdrawal (CIDReCG, n=19; FGAeCG, n=21) while the other half received nothing (CIDR, n=18; FGA, n=20).

2.3 Estrus detection and Natural mating

Does were placed with experienced intact fertile Red Sokoto bucks (ratio 1 buck to 10 does) and observed visually for behavioral estrus manifestation twice (0700-1000 and 1500-1800 hours) daily for 5 days after sponge withdrawal. Standing to be mounted was the cardinal sign used to determine estrus response. Time interval to onset of estrus, duration of estrus and mounts per estrus periods was evaluated. Pregnancy status was determined by trans-cutaneous ultrasonography using a Real-time B-mode trans-cutaneous ultrasonography (Aloka 500V Corometrics Medical Systems, Wallingford CT, USA) with a 3.5 MHz linear array transducer 30 days after natural mating.

2.4 Data and Statistical analyses

Progestagen retention, estrus response and pregnancy rates were expressed in percentage. Data on time to initiation of estrus, estrus duration and mounts per estrus period were expressed as mean ± standard error of mean (SEM). Data collected were analyzed using ANOVA while estrus response and pregnancy rates were compared using Chi-square test (SPSS 17.0 for windows; SAS Institute, Cary, NC, USA). Statistical level of significance was set at $p < 0.05$.

3. Results

There were no significant differences found in retention rates between both progestagens (CIDR: 74 %, FGA: 68 %). The frequency of does in estrus, interval from device withdrawal to estrus onset, duration of estrus, number of mounts per estrus periods and pregnancy rates are presented (Table 1). Estrus response rates were higher ($P<0.05$) in the CIDReCG (84 % [16/19]) and FGAeCG (95 %

[20/21]) group than in the CIDR (22 % [4/18]) and FGA (45 % [9/20]) group. Estrus was more compact in the FGAeCG and CIDReCG groups than in the FGA and CIDR groups (Table 2). Estrus response rates were generally higher ($p < 0.05$) in the FGA alone and FGAeCG treated does than in the CIDR alone and CIDReCG, respectively. The mean interval from progestagen withdrawal to onset of estrus differed significantly ($p < 0.05$) between the CIDReCG (32.4±3.0), CIDR (39.8±3.5), FGAeCG (28.2±1.9) and FGA (55.6±3.6) groups, respectively (Table 1). Similarly, the duration of induced estrus period differed significantly between the CIDReCG (29.9±0.6), CIDR (23.9±1.1), FGAeCG (90.0±4.9) and FGA (15.1±0.9) groups, respectively (Table 1). Higher more mounts per estrus period ($p < 0.05$) were observed in the CIDReCG (7.2±1.35) and FGAeCG (14.0±2.1) than in the CIDR (3.9±0.2) and FGA (6.0±0.4) groups, respectively. There were no significant differences ($p > 0.05$) in pregnancy rates (87 % [14/16]), 100 % [4/4]), (80 % [16/20]) and (89 % [8/9]) between the CIDReCG, CIDR, FGAeCG and FGA groups, respectively.

Table 1: Estrus response and pregnancy rate of Red Sokoto goats following estrus synchronization using progestagens (FGA and CIDR) and eCG.

Parameters	*CIDR*	*CIDReCG*	*FGA*	*FGAeCG*
Number of does	18	19	20	21
Estrus response (%)	4 [a] (22)	16 [b] (84)	9 [c] (45)	20 [bd] (95)
Time to onset of estrus (h)	39.8±3.5[a]	32.4±3.0[a]	55.6±3.6[c]	28.2±1.9 [d]
Duration of estrus (h)	23.9±1.1[a]	29.9±0.6[a]	15.1±0.9[c]	90.0±4.9 [d]
Mounts per estrus period	3.9±0.2 [a]	7.2±1.35[b]	6.0±0.4[bc]	14.0±2.1 [d]
Pregnancy rate (%)	4 (100)	14 (87)	8 (89)	16 (80)

[abcd] Different superscripts in the same row indicate a significant difference ($p < 0.05$)

Table 2: Tightness of synchrony of Red Sokoto goats following estrus synchronization using two different progestagens (FGA and CIDR) and eCG.

Hours	*CIDR*	*CIDReCG*	*FGA*	*FGAeCG*	*Total*
24 hours	1 (25 %)	4 (25 %)	1 (11.1 %)	6 (30 %)	10 (20.4 %)
48 hours	3 (75 %)	4 (25 %)	5 (55.6 %)	6 (30 %)	18 (36.7 %)
72 hours	0 (0 %)	4 (25 %)	2 (22.1 %)	5 (20 %)	11 (22.4 %)
96 hours	0 (0 %)	3 (20 %)	1 (11.1 %)	3 (15 %)	7 (14.3 %)
120 hours	0 (0 %)	1 (5 %)	0 (0 %)	0 (0 %)	1 (2.0 %)
Total	4 (100 (%)	16 (100 %)	9 (100 %)	20 (100 %)	49 (100 %)

4. Discussion

This study evaluated the efficiency of two different progestagens with or without eCG treatment for synchronizing estrus in Red Sokoto (RS) goats during the cold dry season. Retention rate was higher in the CIDR (74 %) than FGA (68 %) treated does, respectively. Both rates obtained in this study are less than the report of Romano [24] who recorded a 100 % retention rate using FGA® in dairy goats. The higher CIDR retention rate observed in this study disagrees with the previous work of Omontese et al. [18] who recorded a higher FGA (100 %) retention than CIDR (88.89 %) in Red Sokoto does. The frequency of does in estrus treated with progestagen alone (CIDR: 22 % and FGA: 45 %) was lower than that observed in the progestagen plus eCG treated does (CIDReCG: 84 % and FGAeCG: 94 %). This higher estrus response observed for does treated with progestagens and equine chorionic gonadotrophin (eCG) is similar but lower than the reports of Ungerfield and Rubaines [27] in Polwarth ewes treated with progestagens and 380 IU PMSG (CIDR: 91.5 % and FGA: 95.9 %). It is also lower than the 100 % obtained by Dogan et al. [6] in Saanen does treated with MAP and FGA with 750 IU PMSG, the 100 % recorded for Saanen and Nubian goats [20] and the 87 % for Toggenburg goats [9]. However, it is higher than the 65 % reported by Greyling and Van der Nest [10] using halved 60 mg intravaginal MAP sponges in Boer goats and the 20 % previously reported by Omontese et al. [18] in Red Sokoto does treated with FGA® alone for 21 days. The higher estrus response rates obtained may be attributed to the inclusion of eCG in the CIDReCG and FGAeCG groups compared with the CIDR and FGA groups. Variations in estrus response rates as observed in this study compared with that obtained by other researchers may be due to effect of age, parity, nutrition, breed, treatment protocol, location, management and climate [14, 10, 27, 28, 12].

The time to onset of estrus reported in this study ranged from 28 to 55 h following progestagen

withdrawal. Researchers have reported the time to onset of estrus to occur within 6 – 120 h following progestagen withdrawal [10, 27, 28, 12, 18]. Romano [24] reported 60.5 h in Nubian does while Ola and Egbunike [15] reported between 40 – 72 h for West African Dwarf goats. In this study, the eCG treated does had shorter time to onset of estrus after progestagen withdrawal. This can be attributed to the FSH and LH-like activity of eCG when administered 48 h before or at progestagen withdrawal thereby stimulating follicular growth and time of ovulation [13].

Longer duration of estrus observed in the progestagen plus eCG treated does corroborates the findings of Omontese et al. [17] in Sahel goats. Higher mounts per estrus periods observed in the progestagen plus eCG treated does in this study corroborates the findings of Oyedipe et al. [19] in Yankasa ewes. This may be attributed to the stimulatory activity of eCG following progestagen withdrawal. Other workers have reported various responses of does to the additional administration of eCG following progestagen withdrawal. These variations may be explained by differences in breed, species, nutrition, season, use of gonadotrophin, presence of females in proestrus/estrus and presence of males after sponge removal [24, 3, 23]. Overall pregnancy rate was higher in the CIDR (93.5 %) group than the FGA (84.5 %) group. This is higher than the 52.6 % and 50 .0 % recorded by Dogan et al. [6] in Saanen does treated with MAP and FGA respectively. It is also higher than the 33.33 % reported by Bello [4] in does treated with FGA-30® alone for 12 days. It is reported that progestogen plus eCG treatment permits a wide degree of variation in conception rate among flocks [11].

5. Conclusion

In conclusion, both progestagens (CIDR® or FGA-30® sponge) in combination with eCG were efficient in synchronizing estrus in Red Sokoto goats during the cold dry season. In addition, the administration of eCG following progestagen treatment improved tightness of synchrony but did not significantly enhance pregnancy rates in Red Sokoto does during the hot dry season.

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