Oestrus induction using fluorogestone acetate sponges and equine chorionic gonadotrophin in Red Sokoto goats

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Abstract

The objective of this study was to evaluate the effect of a progestagen treatment (fluorogestone acetate sponge) alone or in combination with equine chorionic gonadotrophin (eCG) on oestrus response in Red Sokoto (RS) goats. One hundred RS does were treated with 30 mg fluorogestone acetate (FGA) sponges for 14 days. At the end of the progestagen treatment, does that retained the sponges were allocated to two groups; FGAeCG and FGA. The FGAeCG group (n = 28) received 200 IU eCG i.m. concurrently with the sponge removal, while the FGA group (n = 28) did not receive eCG at sponge removal. Oestrus was detected twice daily (at 07:00 - 10:00 and 15:00 - 18:00) using sexually active bucks for five days following progestagen withdrawal. There was no significant difference in oestrus response between groups FGAeCG (82.1%) and FGA (78.6%). There was a significant difference in the time to the onset (29.3 ± 4.6 and 44.2 ± 6.3 h for the FGAeCG and FGA, respectively) and duration of the induced oestrus period (38.9 ± 5.1 and 22.7 ± 4.6 h for the FGAeCG and FGA groups, respectively). It is concluded that although both groups showed good oestrus synchronization rates, administration of eCG shortened the time to onset of oestrus and increased the duration of oestrus in Red Sokoto does.

Keywords: Oestrus, synchronization, fluorogestone acetate, eCG, Red Sokoto goats
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Introduction

There is an increasing gap between the growth rate in the global human population and the availability of animal protein, with developing countries being more vulnerable to this gap (Riaz *et al.*, 2012). Goats provide meat, milk and other by-products (Boyazoglu *et al.*, 2005). There is a considerable potential for increased goat production and this depends on the recognition of their significance in supplying proteins of high biological value in the forms of meat and milk (Mamabolo & Webb, 2005). Owing to the great potential that goat production signifies, various efforts are being made to apply reproductive biotechnologies, including oestrus synchronization, to maximize meat production.

Synchronization of oestrus is an important management tool that has been used to enhance reproduction in goats (Holtz, 2005; Omontese *et al.*, 2010; Riaz *et al.*, 2012). The methods most commonly adopted include the use of prostaglandins and progestagens (Abecia *et al.*, 2011). Various reports have described the use of intravaginal progestagens, accompanied by the administration of equine chorionic gonadotrophin (eCG), formerly called pregnant mare serum gonadotrophin (PMSG), following progestagen withdrawal to synchronize oestrus during the normal breeding season (Menegatos *et al.*, 1995), induce oestrus out of season (Karatzas *et al.*, 1997) and improve the ovulation rate (Greyling & Van Niekerk, 1990;

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Pandleton *et al*., 1992). eCG is a placental glycoprotein hormone prepared from the serum of pregnant mares (Abecia *et al*., 2012). However, the use of eCG involves more input costs for the producer. For progestagen treatment to be effective, it is necessary to have sufficient gonadotrophin available to initiate the preovulatory events (Powell *et al*., 1996). Progesterone and its analogues have an inhibitory effect on the release of the luteinizing hormone (LH) from the anterior pituitary so that the endocrine events that influence the maturation of the ovarian preovulatory follicles and their later ovulation are suppressed. Following the withdrawal of progesterone, oestrus and ovulation occur at a predictable time (Leboeuf *et al*., 1998).

It is important to know the rate of oestrus response, the time of initiation of oestrus and its duration after oestrus synchronization using progestagen treatment alone or in combination with eCG in order to develop a simple and effective protocol that can be adopted by goat producers. Therefore the objective of this study was to evaluate the effect of FGA sponge alone or in combination with eCG on oestrus response in Red Sokoto goats.

Materials and Methods

This experiment was conducted at the goat farm of the Small Ruminant Research Programme (SRRP), National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika-Zaria, Nigeria, between January and February (hot dry season). NAPRI is located in the northern Guinea Savannah zone of Nigeria between latitudes 11 ºN and 12 ºN and longitudes 7 ºE and 8 ºE at an elevation of 650 m above sea level, with an average annual maximum and minimum temperature of 31.0 ± 3.2 ºC and 18.0 ± 3.7 ºC, respectively. Shika-Zaria has an average annual rainfall of 1100 mm, usually lasting from May to October with a mean relative humidity of 72%, while the dry season lasts from November to April with mean daily temperatures ranging from 15 ºC to 36 ºC and mean relative humidity of between 20% and 37%.

One hundred apparently healthy and cycling Red Sokoto does were used for this study. Red Sokoto is the most widespread breed in Nigeria, accounting for over 65% of the goat population (RIM, 1992). It is a good meat breed, and is known for its suitability for fine leather (Adeyinka & Mohammed, 2006).

The does used in the study weighed 14.3 ± 2.4 kg, with body condition scores (BCS, range 1 - 5) of 2.5 - 3.5 (Spahr, 2005), were aged between 1.5 and 2 years, and had shown at least two oestrus cycles (19 - 21 days). The does were housed in a pen and allowed to graze in large paddocks, fed *Digitaria smutsii* (woolly finger grass) hay and a concentrate supplement (0.5 kg/day), and water was provided *ad libitum*. The does were treated with FGA intravaginal sponges (Pharmplex, Australia) for 14 days by inserting the sponge into the anterior portion of the vagina with an applicator. At the end of the progestagen treatment, the retention rate was evaluated by counting the number of does that still had the intravaginal sponge in place on day 14 of treatment. Does that retained the sponges were then allocated to two groups: A (n = 28) and B (n = 28). Group A received a single intramuscular injection of 200 IU eCG (PMSG-Intervet, Ireland) concurrently with progestagen withdrawal, while Group B received nothing. FGA sponges were removed by pulling the drawstring hanging from the vagina.

The does were placed with sexually experienced Red Sokoto bucks in the ratio of 1 buck to 10 does. The does were observed visually for behavioural oestrus manifestation twice daily (07:00 - 10:00 and 15:00 - 18:00) for five days after sponge withdrawal. The cardinal sign to determine oestrus response was standing to be mounted. Oestrus activity occurring within 120 h 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 mated over the total number of does in each treatment group, expressed as a percentage. Time to initiation of oestrus was evaluated as the interval (hours) from when the progestagen (FGA) was removed to the time that the doe first showed standing oestrus after being exposed to the buck 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 and oestrus response rate were expressed in percentages. Data on oestrus response, time to initiation of oestrus, and oestrus duration were analysed using SPSS 17.0. 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 14 days treatment, the retention rate was 56% (56/100). Oestrus response was higher ($P > 0.05$) in Group A than in Group B (23/28 [82.1%] and (22/28 [78.6%]) (Table 1), respectively. Time to

initiation of oestrus was shorter (P <0.05) in Group A (29.3 ± 4.6 h) than in Group B (44.2 ± 6.3 h) (Table 1). Oestrus duration was longer (P <0.05) in Group A than in Group B does (38.9 ± 5.1 and 22.7 ± 4.6 h) (Table 1), respectively.

Table 1 Response of Red Sokoto does to oestrus synchronization with fluorogestone acetate and equine chorionic gonadotrophin

Treatment group	Number of does (n)	Oestrus response (%)	Time to onset of oestrus (h) mean ± SEM	Duration of oestrus (h) mean ± SEM
FGA	28	78.6	44.2[a] ± 6.3	22.7[a] ± 4.6
FGAeCG	28	82.1	29.3[a] ± 4.6	38.9[a] ± 5.1
Total	56	80.35	36.75 ± 5.45	30.8 ± 4.85

[a] Mean values along the same row with same superscripts alphabets are statistically different (P <0.05).
FGA: FGA-30® sponge.
eCG: equine chorionic gonadotrophin.
n = number of does treated with progestagen.

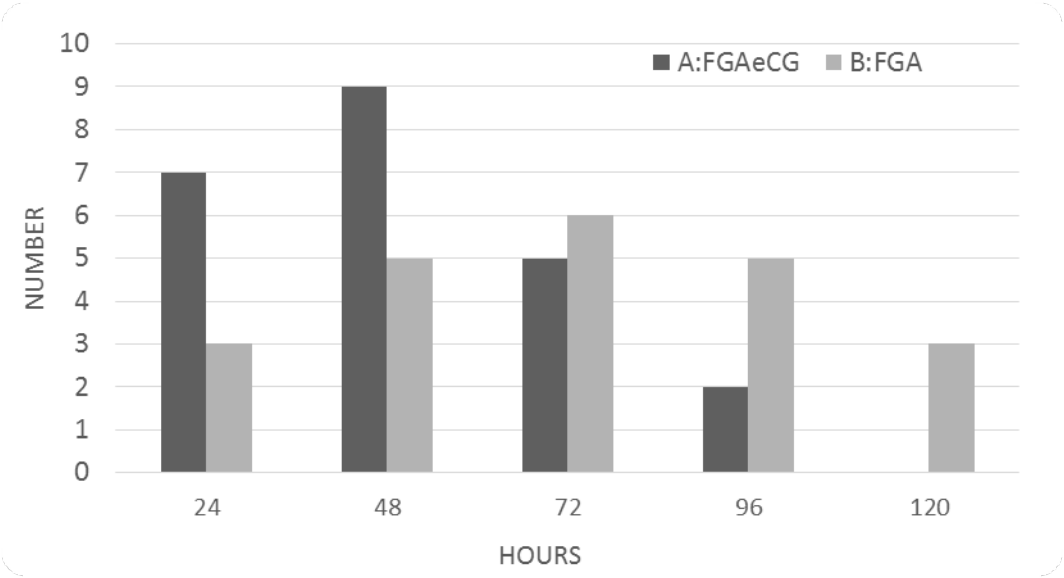

Figure 1 Tightness of synchrony of Red Sokoto does following 14-day progestagen (fluorogestone acetate, FGA) alone or in combination with equine chorionic gonadotrophin (eCG) (treatment FGAeCG).

The two oestrus synchronization protocols used in this study (fluorogestone + eCG [A] and fluorogestone alone [B]) were equally efficient in inducing oestrus response in Red Sokoto does, although the oestrus response was higher in the FGA + eCG treated does. This is probably owing to the oestrus-enhancing effect of eCG following progestagen treatment (Abecia *et al*., 2012; Omontese, 2012). It has been reported that for progestagen treatment to be effective, it is necessary to have sufficient gonadotrophin available to initiate the preovulatory events by increasing endogenous gonadotrophins with 'exogenous' gonadotrophin in the form of eCG (Powell *et al*., 1996).

The 56% retention rate obtained in this study was lower than the 89.9% and 100% reported by Omontese *et al*. (2010) in prepartum Red Sokoto does treated with CIDR and FGA sponges, respectively. Romano (1996) observed 100% retention in dairy goats treated with FGA throughout the period of his experiment. Factors such as intravaginal sponge texture and consistency (Alifakiotis *et al*., 1982), length of vaginal tract (Omontese *et al*., unpublished observations) and techniques employed in inserting the sponge (Romano, 1998) could influence sponge retention in the vagina.

Results from this experiment showed that the oestrus behaviour of the does in both groups (A and B) was on average 80.4% (Table 1). Does of Group A (FGA + eCG) showed a higher oestrus response of 82.1%. This indicates that administration of eCG (concurrently with sponge withdrawal) seemed able to stimulate more does to commence oestrus. This is lower than the 94% and 88% reported by Pendleton *et al*. (1992) in anoestrus dairy goats treated with norgestomet and FGA sponge, respectively. This value is also lower than the 100% recorded for Saanen and Nubian goats (Regueiro *et al*., 1999) and the 87% (Fonseca *et al*., 2005) recorded for Toggenburg goats. In addition, Dogan *et al*. (2004) reported a 100% oestrus response in Saanen does using FGA sponges in combination with 125 µg cloprostenol ($PGF_{2\alpha}$), similar to Ahmed *et al*. (1998) in Sudanese Nubian goats. However, the average oestrus response obtained in this study is higher than the 20% obtained by Omontese *et al*. (2010) in prepartum Red Sokoto does treated with FGA alone for 21 days and the 73.5% reported by Greyling & Van der Nest (2000) using intravaginal medroxyprogesterone acetate (MAP) sponges. It is, however, less than the 100% reported by Dogan *et al*. (2004) using MAP sponges in Saanen does. These variations may be owing to the effect of age and parity, breed, use of gonadotrophins, nutrition, treatment protocol, location, management and climate (Mani *et al*., 1992; Romano, 2002; Evans *et al*., 2004).

In the present study, most does in Group A (FGAeCG) exhibited oestrus earlier (P <0.05) and mostly within the first 72 hours after sponge withdrawal, while does in Group B (FGA) showed oestrus behaviour much later (Figure 1). Group A (FGAeCG) exhibited better tightness of synchrony with more than 75% of does in oestrus by day 3 (Figure 1). This is similar to the 77.5% reported by Omontese (2012) in Red Sokoto does treated with FGA for 15 days in combination with the intramuscular injection of 400 IU eCG concurrent with sponge withdrawal. The mean time to initiation of oestrus from sponge withdrawal (36.7 ± 5.4 h) for the two treatment groups (A and B) is less than the 45.3 ± 13.5 h reported by Romano (2002) in Nubian goats treated with FGA sponges. However, it is higher than the 30.0 ± 12.0 h and 27.2 ± 11.2 h reported by Fonseca *et al*. (2005) in Toggenburg goats treated with MAP sponges + eCG. Ungerfeld (2011) reported that the introduction of vasectomised rams in an oestrus synchronization protocol using prostaglandin hastened the onset of induced oestrus and increased the number of Corriedale×Merino ewes responding.

There was a significantly longer oestrus duration (mean ± SEM) in Group A (38.9 ± 5.1 h) than in Group B (22.7 ± 4.6 h) (Table 1). Mori & Kano (1984) and Greyling & Van Niekerk (1990) reported that synchronization with PGF2α or administration of progestagen together with PMSG lengthens oestrus duration by about 6 h, compared with natural cycles. Such prolongation of oestrus was observed in does in Group A. It seems that the mean duration for standing oestrus varies between animals and from one oestrus to another (Akusu & Egbunike, 1990; Teleb *et al*., 2003) and may be influenced by the number of services (Romano & Fernandez Abella, 1997). On the other hand, Hafez (1993) reported that the duration of oestrus is species dependent and varies slightly from one female to another within the same species.

Conclusion

FGA sponge alone or in combination with eCG is capable of synchronizing oestrus in Red Sokoto goat, but the administration of eCG following fluorogestone treatment shortens the time to onset of oestrus and lengthens the duration of oestrus in Red Sokoto does.

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References

Abecia, J.A., Forcada, F. & Gonzalez-Bulnes, A., 2011. Pharmaceutical control of reproduction in sheep and goats. Vet. Clin. Food Anim. Prac. 27, 67-79.

Abecia, J.A., Forcada, F. & Gonzalez-Bulnes, A., 2012. Hormonal control of reproduction in small ruminants. Anim. Reprod. Sci. 130, 173-179.

Adeyinka, I.A. & Mohammed, I.D., 2006. Accuracy of body weight prediction in Nigerian Red Sokoto Goats raised in North Eastern Nigeria using linear body measurement. Pak. J. Biol. Sci. 9 (15), 2828-2830.

Ahmed, M.M.M., Makawi, S.E. & Jubara, A.S., 1998. Synchronization of oestrus in Nubian goats. Small Rumin. Res. 30, 113-120.

Akusu, M.O. & Egbunike, G.N., 1990. Effects on estrous of West African Dwarf goats. Small Rumin. Res. 3, 413- 418.

Alifakiotis, T., Michailidis, I. & Gavnhdis, G., 1982. Induced breeding in anoestrous milking ewes on dairy breed: Comparison of norgestomet medroxyprogesterone and fluorogestone in two regimes of PMSG. Theriogenology 17, 603-610.

Boyazoglu, J., Hatziminaoglou, I. & Morand-Fehr, P., 2005. The role of the goat in society: Past, present and perspectives for the future. Small Rumin. Res. 60, 13 -23.

Dogan, I., Nurl, Z., Gunay, U., Soylu, M.K. & Sonmez, C., 2004. Comparison of fluorogestone and medroxyprogesterone intravaginal sponges for oestrus synchronization in Saanen does during the transition period. S. Afr. J. Anim. Sci. 34, 18-22.

Evans, A.C.O., Duffy, P., Crosby, T.F., Hawken, P.A.R., Boland, M.P. & Beard, A.P., 2004. Effect of ram exposure at the end of progestagen treatment on estrus synchronization and fertility during the breeding season in ewes. Anim. Reprod. Sci. 84, 349-358.

Fonseca, J.F., Bruschi, J.H., Santos, I.C.C., Viana, J.H.M. & Magalhaes, A.C.M., 2005. Induction of estrus in non-lactating dairy goats with different oestrus synchrony protocols. Anim. Reprod. Sci. 85, 117-124.

Greyling, J.P.C. & Van der Nest, M., 2000. Synchronization of oestrus in goats: dose effect of progestagen. Small Rumin. Res. 36, 201-207

Greyling, J.P.C. & Van Niekerk, C.H., 1990. Ovulation in the Boer goat doe. Small Rumin. Res. 3, 457-464.

Hafez, E.S.E., 1993. Reproduction in Farm Animals, 6th ed. Lea and Febiger, Philadelphia, USA. pp. 94-113.

Karatzas, G., Karagiannidis, A., Varsakel, A. & Brikas, P., 1997. Fertility of Fresh and frozen- thawed goats semen during the nonbreeding season. Theriogenology 48, 1049 - 1059.

Mamabolo, M.J. & Webb, E.C., 2005. Goat production survey- fundamental aspects to model goat production systems in southern Africa. *A Case study.* Agricultural Commission. pp. 1-8.

Mani, A.U., McKelvey, W.A.C. & Watson, E.D., 1992. The effects of low level of feeding on response to synchronization to oestrus, ovulation rate and embryo loss in goats. Theriogenology 38, 1013-1022.

Menegatos, J., Ghadio, S.E., Kartza, G. & Stoforos, E., 1995. Progesterone levels throughout progestagen treatment influence the establishment of pregnancy in the goat. Theriogenology 43, 1365-1370.

Omontese, B.O., 2012. Estrus synchronization in Red Sokoto Does using progestagens and gonadotrophin. MSc. thesis, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria.

Omontese, B.O., Rekwot, P.I., Makun, H.J., Obidi, J.A., Rwuaan, J.S. & Chiezey, N.P., 2010. Evaluation of EAZI-BREEDTM CIDR® and FGA-30® intravaginal sponges as synchronizing agents in Prepartum Red Sokoto Does. J. Vet. Res. 3 (3), 64-69.

Pendleton, R.J., Youngs, C.R., Rorie, R.W., Pool, S.H., Memon, M.A. & Godke, R.A., 1992. Comparison of fluorogestone acetate sponges with norgestomet implants for induction of estrus and ovulation in anestrous dairy goats. Small Rumin. Res. 8, 269-273.

Powell, M.R., Kaps, M., Lamberson, W.R. & Keisler, D.H., 1996. Use of melengestrol acetate-based treatments to induce and synchronize oestrus in seasonally anestrous ewes. J. Anim. Sci. 74, 2292-2302.

Regueiro, M., Clariget, R.P., Ganzábal, A., Aba, M. & Forsberg, M., 1999. Effect of medroxyprogesterone acetate and eCG treatment on the reproductive performance of dairy goats. Small Rumin. Res. 33, 223-230.

Riaz, H., Sattar, A., Arshad, M.A. & Ahmad, N., 2012. Effect of synchronization protocols and GnRH treatments on the reproductive performance in goats. Small Rumin. Res. 104, 151-155.

RIM, 1992. Nigerian livestock resources survey report by resource inventory and management (RIM) to Federal Department of Livestock and Pest Control Services (FDLPCS), Abuja, Nigeria.

Romano, J.E., 1996. Comparison of fluorogestone and medroxyprogesterone intravaginal pessaries for estrus synchronization in dairy goats. Small Rumin. Res. 22, 219-223.

Romano, J.E., 1998. The effect of continuous presence of bucks on hastening the onset of estrus in synchronized does during the breeding season. Small Rumin. Res. 30, 99-103.

Romano, J.E., 2002. Does in proestrus-estrus hasten estrus onset in does synchronized during the breeding season. Appl. Anim. Behav. Sci. 77, 329-334.

Romano, J.E. & Fernandez Abella, D., 1997. Effect of service on duration of oestrus and ovulation in dairy goats. Anim. Reprod. Sci. 47, 107-112.

Spahr, L.I., 2005. "Body condition scoring in meat goats," Penn State College of Agricultural Science, 23, pp. 11-15.

Teleb, D.F., Gabr, M.K. & Gaafar, K.M., 2003. Manipulation of lactation and suckling on the resumption of postpartum reproductive activity in Damascus goats. Small Rumin. Res. 49, 183-192.

Ungerfeld, R., 2011. Combination of the ram effect with $PGF_{2\alpha}$-estrous synchronization treatments in ewes during the breeding season. Anim. Reprod. Sci. 124, 65-68.