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Fertility Parameters in Crossbred Sows Treated with Cloprostenol Sodium (Synchromate®) in Zaria, Nigeria

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SUMMARY
This study was carried out to evaluate fertility parameters in crossbred sows in Zaria, following treatment with Cloprostenol sodium (Synchromate®). Ten (n = 10) apparently healthy crossbred sows were randomly assigned to two equal treatment groups based on number of injections of 500µg Synchromate®. Group 1 received two injections on days 0 and 13, while Group 2 received three injections on days 0, 7 and 13. Oestrus was monitored visually for signs of oestrus twice daily from 0700 – 1000h and 1500 – 1800h. The fertility parameters evaluated were: oestrus response rate (ORR), time to onset of oestrus (TOO), duration of oestrus (DOO), conception rate (CR), pregnancy rate (PR), farrowing rate (FR) and litter size (LS). Data on ORR, CR, PR and FR were expressed in percentages while TOO, DOO and LS were expressed as mean ± SEM. Student t-test and Tukey's post-hoc test were used to compare the percentages and mean values between the groups. The Graphpad Prism® data package was used for statistical analysis and values of $P<0.05$ were considered significant. Fertility parameters TOO, DOO, LS, ORR, CR, PR, FR for Group 1 (187.20 ± 8.98h, 87.60 ± 4.49h, 7.25 ± 1.44, 100 %, 60 %, 80 % and 100 % respectively) and Group 2 (176.00 ± 40.00h, 86.60 ± 13.36h, 7.50 ± 1.50, 60 %, 100 %, 80 % and 66.67 % respectively). The differences in fertility parameters between the groups were not statistically significant. It is recommended therefore that double injections of cloprostenol sodium (Synchromate®) should be used for oestrus synchronization as it increases fertility parameters in cross bred sows at 13 days apart.

Key words: Fertility parameters, crossbred sows, cloprostenol sodium, Zaria.

INTRODUCTION
Pig (*Sus scrofa*), is one of the sources of animal protein in Nigeria. Pig production which is both in the hands of government institutions and private individuals represents the fastest way of increasing animal protein since pigs grow at a faster rate and reproduce sooner with larger number of offspring compared with cattle, sheep or goats (Ajala, 2003; McGlone, 2013).

Globally, the rise in human population is associated with protein malnutrition

(reference), especially in the developing countries. To reduce the scourge of protein malnutrition, there is a need to find cheaper alternative sources of high quality dietary protein (FAO, 2015). Improving the reproductive performance of pigs is a necessary approach to increasing the availability of animal products to meet the geometric rise in human population (Vicente *et al.*, 2011*)*. Prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) is not luteolytic in sows until about day 12 of the oestrous cycle (De Rensis *et al*., 2012; Kouamo and Kamga-Waladjo, 2013; Tur, 2013). Synthetic progestins were developed and used in sows for oestrus synchronization (Estienne *et al*., 2001; Van Leeuwen *et al*., 2011).

Oestrus synchronization is a valuable management tool for increasing the conception rate in sows (Brüssow and Wahner, 2011). Several techniques have been developed to induce oestrus. Oestrus synchronization methods in the sow varies and are all based either on controlling events leading to follicular maturation and ovulation or altering luteal lifespan (Estill, 2000).

Information on effective, practical and achievable oestrus synchronization protocols which will enable farmers improve on the reproductive efficiency of their herd using exogenous $PGF_{2\alpha}$ (natural and synthetic) is scarce. The control of the sow oestrous cycle is necessary if these gains must be harnessed and this has been a goal of intensive scientific investigation over a long time (Caraba *et al*., 2012).

The specific objective of this study was therefore to evaluate some fertility parameters following Cloprostenol sodium treatment of crossbred sows in Zaria, Nigeria.

MATERIALS AND METHODS

Study location

The study was carried out at the Swine and Rabbit Research Programme of the National Animal Production Research Institute (NAPRI), Shika, Ahmadu Bello University, Zaria. Zaria is located in the Northern Guinea Savannah zone of Nigeria between latitude 11°N and 12°N and between longitude 7°E and 8°E at an elevation of 650 m above sea level. The average annual maximum and minimum temperatures are 31.0±3.2°C and 18.0±3.7°C, respectively and 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 daily temperatures of 15-36°C and mean relative humidity of between 20–37% (Kowell, 1986; Sawa and Buhari, 2011).

Experimental animals and management

Ten (n = 10) apparently healthy crossbred sows belonging to the Swine and Rabbit Research Programme of the NAPRI, Shika, Zaria were used for the study. Sows between 2-3 years of age, 120-150 kg bodyweight and with an average body condition score of 3.0 using the 0 - 5 scale (from most emaciated to the fattest) were used for the study. The sows were identified by ear tag numbers.

The sows were fed ration containing 16% Crude protein. The ration was formulated to meet the minimum nutrient requirements for breeding sows and boars as recommended by the National Research Council, (1998). The ingredients for the ration were sourced at the NAPRI feed store and the ration was mixed in the feed mill at NAPRI, Shika, Zaria. Water was given *ad libitum.*

Experimental design

A total of ten (n = 10) crossbred sows were randomly divided into two equal groups:

Group 1 (n=5) – Double intramuscular doses of 500µg Cloprostenol sodium (Synchromate®).

Each of the five sows received a dose each of 500µg (2 ml) Cloprostenol sodium injection on days 0 (day of first injection) and 13 (day of second injection). The sows were monitored for signs of oestrus

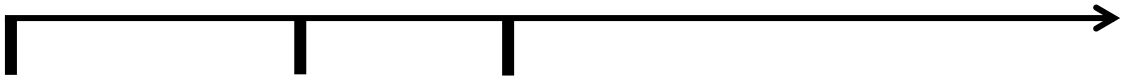
Group 1: Double injection of 500µg Cloprostenol sodium (Synchromate®)

D0 D13 Oestrus detection and breeding

Group 2 (n=5) – Triple intramuscular doses of 500µg Cloprostenol sodium (Synchromate®).

Each of the five sows received a dose each of 500µg (2 ml) of Cloprostenol sodium on days 0 (day of first injection), 7 (day of second injection) and 13 (day of third injection). The sows were monitored for signs of oestrus as in Group 1. Sows that exhibited signs of oestrus were bred using natural breeding.

Group 2: Triple injections of cloprostenol sodium (Synchromate®)



D0 D7 D13 Oestrus detection and breeding

following the first injection. Sows that exhibited signs of oestrus were bred using natural breeding.

Oestrus detection and mating

The sows were observed visually for behavioural oestrus manifestation twice (0700-1000 and 1500-1800 h) daily from commencement of the study for 21 days. Sows were considered to be in oestrus when they stood to be mounted by other females (homosexual mount) or male (heterosexual mount). The following fertility parameters were also evaluated:

I. Oestrus response rate (ORR %): the total number of sows showing standing oestrus and subsequently mated over the total number of sows in each treatment group expressed in percentage.

II. Time to onset of oestrus (TOO): the interval (h) between $PGF_{2\alpha}$ treatment and standing oestrus expressed as mean±standard error of mean (± SEM).

III. Duration of oestrus (DOO): the interval (h) between the first and last standing oestrus expressed as mean ± standard error of mean (± SEM).

IV. Conception rate (CR %): the number of sows that failed to return to oestrus 19 to 22 days after natural mating divided by the number of sows that came on heat and were bred expressed as percentage

V. Pregnancy rate (PR %): the number of sows bred that failed to return to oestrus 19 to 22 days after natural mating divided by the number of sows in each treatment group, expressed as a percentage.

VI. Farrowing rate (FR %): the number of sows farrowing divided by the number of sows mated, expressed in percentage.

VII. Litter Size (LS): The numbers of piglets born by the number of sows that farrowed expressed as mean ± standard error of mean (± SEM).

Data analyses

Variables such as oestrus response rate, pregnancy rate, conception rate, and farrowing rate were expressed in percentages. Data on duration of oestrus, time to onset of oestrus and litter size were expressed as mean±SEM. Student t-test and Tukey's post hoc test were used to compare the mean values between the groups. Graphpad Prism® data package for windows (2009) was employed for all statistical analyses. A value of $P<0.05$ was considered significant.

RESULTS

Time to onset of oestrus (Mean± S.E.M) was 177.60±17 h and 168.00 ± 19.60 h, Duration of oestrus (Mean ± S.E.M) was 96.00 ± 3.79 h and 86.50 ± 5.85 h, Litter size (Mean ± S.E.M) was 8.6 ± 0.33 and 10.00 ± 2.65 for groups 1 and 2 respectively. There were no statistically significant ($P > 0.05$) differences between the groups. (Table 1). Oestrus response rates were 100% and 80% , Conception rates were 80% and 100% , Farrowing rates were 60 % and 75 % for groups 1 and 2 respectively. Pregnancy rates was 80 % for both groups (Table 2). There were no significant ($P > 0.05$) differences between the groups.

DISCUSSION

The results of this study showed the efficacy of Cloprostenol sodium (Synchromate®) for oestrus synchronization in crossbred sows in Zaria. All fertility parameters evaluated in sows administered double or triple doses of Synchromate® were similar.

The mean values of TOO (177.60 ± 17 and 168.00 ± 19.60 h for groups 1 and 2, respectively) was shorter than the time interval reported by Dimitrov (2014) in gilts treated with progestins (341.4±54.6 h). This could be due to differences in the agents used, progestins being luteotrophic while $PGF_{2\alpha}$ is luteolytic. This implies that $PGF_{2\alpha}$ should be preferred when reduction of non-productive days in sows is desirable. However, appropriate pregnancy diagnosis must be put in place as Prostaglandins are also abortifacient (reference). Duration of oestrus (DOO) (96.00±3.79 and 86.50±5.85 h for groups 1 and 2, respectively) observed with $PGF_{2\alpha}$ was longer than previous reports of 46 to 53 h and 40 to 60 h with gonadotropins in sows (Kemp and Soede, 1996; Anderson, 2009). This suggests that exogenous prostaglandins might be better

Table 1: Time to onset of oestrus, duration of oestrus and litter size of crossbred sows following treatment with double and triple doses of Cloprostenol sodium (Synchromate®)

Fertility Parameters	Groups		Los
	1 (n =5)	2 (n =5)	
TOO (h)	177.60±17.00	168.00±19.60	NS
DOO (h)	96.00±3.79	86.50±5.85	NS
LS (± SEM)	8.60±0.33	10.00±2.65	NS

KEY:

TOO = Time to onset of oestrus DOO = Duration of oestrus

LS = Liter size LOS = Level of significant

NS = Not significant (P>0.05)

Table 2: Oestrus response rate, Conception rate, Pregnancy rate and Farrowing rate of crossbred sows following treatment with double and triple doses of Cloprostenol sodium (Synchromate®)

Fertility Parameters	Groups		Los
	1 (n =5)	2 (n =5)	
ORR (%)	100	80	NS
CR (%)	80	100	NS
PR (%)	80	80	NS
FR (%)	60	75	NS

KEY:

ORR = Oestrus response rate CR = Conception rate

PR = Pregnancy rate FR = Farrowing rate

LOS = Level of significant NS = Not significant (P>0.05)

for oestrus synchronization in sows since maintaining a prolonged duration of oestrus enables greater success in conception during breeding. Farrowing rate (FR) was also not significantly different between 2 or 3 injections protocols. However, FR (60 % and 75 % for groups 1and 2, respectively) was lower compared to 83.2% in sows treated with PG600 (Tummaruk *et al*., 2011), 84.2% in sows treated with eCG + LH (Kirkwood, 2006) and 82.2% in primiparous sows on a 3-day regumate feeding (Forgerity *et al*., 1995). This difference might also be due to different synchronizing agents, protocols and possibly breed of sows. Litter size (LS) (8.6±0.33 and 10.00±2.65 for groups 1 and 2, respectively) was lower than 12.06±2.67, 10.7±3.2 and 10.3±3.1 in sows treated with luteotrophic agent Altrenogest (Dimitrov *et al*., 2010), eCG and eCG + LH (Kirkwood, 2006), respectively. It was also lower than 10.1 and 10.4 using 3-day and 7-day regumate feeding of primiparous sows (Forgerity *et al*., 1995). This might be due to the use of different synchronizing agents. Oestrus response rates observed in this work were good. However, the inclination to a lower oestrus response observed in groups 2 might be that second injection of the drugs at day 7 could have induced some level of resistance on the CL to the effects of exogenous $PGF_{2\alpha}$ before the 3rd injection on day 13. This finding may indicate that the porcine CL acquires luteolytic capacity much later in the oestrous cycle than the bovine CL as reported by De Rensis and Peter (1999). This also is in agreement with the reports of Diaz and Wiltbank (2004) that pigs CL acquire their luteolytic capacity at about day 13 of the oestrous cycle.

Conception rate for both groups were high when compared to values obtained in heifers with single injections of a prostaglandin analogue on day 7 (Moment and Seguin, 1984) and in Nubian goats treated with double injections of cloprostenol sodium at 11 days apart (Gayling and Van Niekerk, 1996), but comparable to values reported in sows using PG600 (Tummaruk *et al*., 2011). These differences in conception rates from various works can be attributed to the effects of differences in species and agents used.

Pregnancy rates of 80% for both groups were not affected by the protocol. The lower pregnancy reported in this study is contrary to the high rate observed in gilts treated with gonadotropins and inseminated 24 h after treatment (Martinat-Botte *et al*., 2009; Estill, 2000). The lower rates observed in this study might be, partly, due to breeding methods and possibly, embryonic loss during implantation (Singha *et al.,* 2005), arising from a less than four embryos needed for pregnancy to be maintained in sows (Pitcher and Springer, 1997).

CONCLUSION

Fertility parameters of sows administered double or triple doses of 500µg Cloprostenol sodium were similar and were generally good. It is therefore recommended that double injections at 13 days apart be used for oestrus synchronization in sows as its saves cost and labour compared to triple injections.

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