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OESTRUS RESPONSE AND FERTILITY RATES OF CROSSBRED SOWS FOLLOWING DINOPROST TROMETHAMINE (LUTALYSE®) TREATMENTS OF IN ZARIA, NIGERIA

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ABSTRACT

This study was carried out to evaluate oestrus response and fertility rates of crossbred sows in Zaria following treatments with Dinoprost tromethamine (Lutalyse®). Ten (n = 10) apparently healthy crossbred sows were randomly assigned to 2 treatment groups based on number of injections of Lutalyse®. Group 1 (n=5) received two injections of Lutalyse® (12.5mg) (days 0 and 13) while Group 2 (n=5) received three injections of Lutalyse® (Day 0, 7, 13). Oestrus was monitored twice daily from 0700 – 1000 and 1500 – 1800h. The fertility parameters determined in this study 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). The obtained variables from the study namely ORR, CR, PR and FR data 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. Graphpad Prism® data package for windows (2009) was employed for all statistical analyses. A value of $P < 0.05$ was considered significant. Fertility parameters showed no statistical significant differences between the groups. It is recommended that double injections of Dinoprost tromethamine (Lutalyse®) should be used for oestrus synchronization in sows on day 0 and 13 for effective results as no significant ($P>0.05$) differences were observed in both the double and triple injections of Dinoprost tromethamine (Lutalyse®) and two injections will save cost for the farmers as against triple injections of $PGF_{2\alpha}$.

Keywords: *Oestrus, Synchronization, Dinoprost tromethamine, Prostaglandins, crossbred sows, Fertility rate.*

INTRODUCTION

With today's exploding human population, the demands on meat protein are on the increase and pig production is gaining more importance in our economy and playing a leading role in agricultural income generation (FAO, 2015). The success and efficiency of pig farming mainly

depends on the reproductive performance of the pigs (Ramakrishnan, 2013). Pigs have been described as one of the most prolific and fast growing livestock that can convert food waste to valuable products. They excel above other red meat animals such as cattle, sheep and goat in converting feed to flesh. They also have short generation interval, high production potential, high prolificacy and high carcass yield. They adapt easily to environmental conditions (ILCA, 1992; Vicente *et al*., 2011). Pig Production has therefore been advocated as a short term measure towards alleviating the animal protein and calorie deficit, especially where there are no religious edicts preventing their production and consumption (Ajala *et al.*, 2007).

With intensification of pig-rearing, there is a need for the development of simple and effective methods of controlling the time of onset of oestrus and breeding in sows. Such programmes could improve batch farrowing, thus facilitating the efficient use of specialized labour and housing facilities (Brown, 2006; Bartlett *et al*., 2009). Oestrus synchronization is a valuable management tool for increasing pregnancy rate in sows (Brussow and Wahner, 2011). Oestrus synchronization methods in the pig vary and are all based either on controlling events leading to follicular maturation and ovulation or altering luteal lifespan (Estill, 2000).

Synthetic progestins have been developed and used in pigs for oestrus synchronization (Estienne *et al*., 2001; Van Leeuwen *et al*., 2011) among which is prostaglandin $F_{2\alpha}$. Prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) is not luteolytic in the sows until about day 12 of the oestrous cycle (De Rensis *et al*., 2012; Kouamo and Kamga-Waladjo, 2013; Tur, 2013). The explanation for the relative insensitivity of porcine *corpora lutea* (CL) to the luteolytic effect of $PGF_{2\alpha}$ prior to day 12 of the oestrous cycle is unknown (Estill *et al*., 1993).

There is much limitation with regard to the availability of methods of altering the oestrous cycle in the pig than their counterparts in cattle industry with regards to the use of exogenous prostaglandins (Estill, 2000) as sow's CL is refractory to the luteolytic effect of $PGF_{2\alpha}$ before day 12 (Estill *et al*., 1993; De Rensis *et al*., 2012). This insensitivity is considered to preclude the use of prostaglandin in oestrus synchronization programmes for swine (Przygrodzka *et al*., 2015).

This study was therefore designed to evaluate oestrus response and fertility rates of crossbred sows following double and triple injections of Dinoprost tromethamine (Lutalyse®).

MATERIALS AND METHODS

Study Location

The study was carried out at the Swine Farm Unit of the Swine and Rabbit Research Programme, 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 temperature 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%

Experimental Animals and Herd Management

Ten (n = 10) apparently healthy crossbred sows age between 2 and 3 years and weighing between 120 and 150 kg with an average body condition score of 3.0 (based on 0-5 scale of

scoring) were used for this study. The sows were identified by ear tag numbers. The crossbred sows were fed a diet containing 16% crude protein. The ration was formulated to meet the minimum nutrient requirements for breeding sows and boars as recommended by National Research Council (NRC) (1998). The ingredients for the diet were sourced and the ration was mixed in the feed mill in NAPRI, Shika, Zaria Water was given *ad libitum.*

Experimental Design

A total of ten (n = 10) crossbred sows were divided into two groups and the groups randomly assigned to one of two treatment protocols as described below: *Group 1 (n=5) – Double injection of Dinoprost tromethamine (Lutalyse®).*

Each of the sows received a dose of 12.5 mg (2.5 ml) Dinoprost tromethamine on days 0 (day of first injection) and 13 (day of second injection). The sows were then monitored for signs of oestrus. Those found in oestrus were bred using natural breeding.

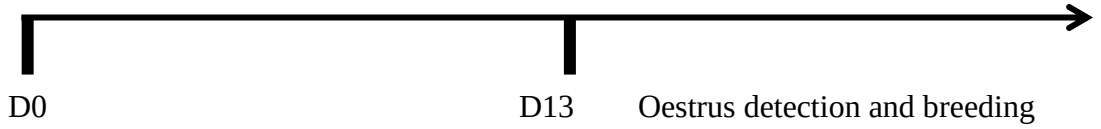


Figure 1: Group 1 treatment protocol - Double injections of Dinoprost tromethamine (Lutalyse®).

Group 2 (n=5) – Triple injection of Dinoprost tromethamine (Lutalyse®).

Each of the sows received a dose of 12.5 mg (2.5 ml) dinoprost tromethamine on days 0 (day of first injection), 7(day of second injection) and 13 (day of third injection). The sows were also monitored for signs of oestrus. Those found exhibiting signs of oestrus were bred using natural breeding.

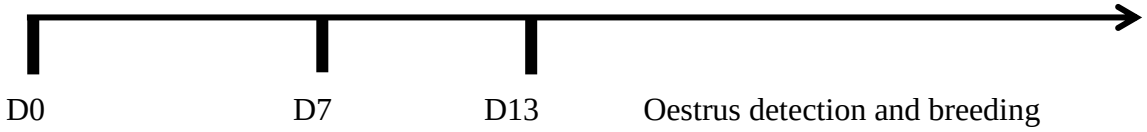


Figure 2: Group 2 treatment protocol - triple injections of Dinoprost tromethamine (Lutalyse®).

Oestrus Detection and Mating

The crossbred sows were observed visually for behavioural oestrus manifestation twice daily from 0700 to 1000 and 1500 to 1800 h) over a period of 21 days after treatment. Sows were considered to be in oestrus when they stood to be mounted by females (homosexual mount) or male (heterosexual mount). Those found expressing oestrus were mated using natural mating. Overall oestrus characteristics were evaluated on the basis of the following parameters:

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 $PGF_{2\alpha}$ injections of sows 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 bred 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 AND DISCUSSIONS

The results of this study have shown the efficacy of Dinoprost tromethamine (Lutalyse®) for oestrus synchronization in crossbred sows. All parameters of efficacy measures were similar between protocols (Table 1). However, on the overall TOO in the study was shorter than the interval reported by Dimitrov (2014) in gilts treated with progestins. This could be due to differences in the agents used, progestins being luteotrophic and $PGF_{2\alpha}$ luteolytic. This implies that $PGF_{2\alpha}$ could be preferred when reduction of non-productive days in sows is desirable.

Table 1: Onset and duration oestrus in crossbred sows following treatment with double and triple injections of Dinoprost tromethamine (Lutalyse®)

Fertility Parameters	**Groups**		**LOS**
	1 (N =5)	2 (N =5)	
TOO (h)	187.20 ± 8.98	176.00 ± 40.00	NS
DOO (h)	87.60 ± 4.49	86.60 ± 13.36	NS
ORR (%)	100	60	NS

KEY:
TOO = Time to onset of oestrus; DOO = Duration of oestrus; ORR = Oestrus response rate
LOS = Level of significant;
NS = Not significant ($P > 0.05$)

Appropriate pregnancy diagnosis however, must be put in place as prostagladins are known to cause abortion. Duration of oestrus (DOO) observed in this work with Lutalyse® was longer than previously reported with gonadotropins in sows (Kemp and Soede, 1996; Anderson, 2009). This suggests that exogenous prostaglandins might be better for oestrus synchronization in sows since maintaining a prolonged duration of oestrus enables greater success in conception during breeding (Kongsted and Hermansen, 2008). The observed good oestrus response rates in this work is an indication of the efficacy of Lutalyse® in oestrus synchronization in sows. The findings seems to confirm earlier reports that the porcine CL acquires luteolytic capacity much later in the oestrous cycle than the bovine CL (De Rensis and Peter, 1999, Diaz and Wiltbank, 2004).

Conception rate for both treatment protocols (Table 2) were comparable to values reported in sows using PG600 (Tummaruk *et al*., 2011), although the observed slight differences could be attributed to the differences in agents used. Pregnancy rates in this study were lowered than has been reported in gilts treated with gonadotropins and inseminated 24 h after treatment (Martinat-Botte *et al*., 2009; Estill, 2000). This might be, partly, due to breeding methods, synchronizing agents and possibly embryonic loss during implantation (Singha *et al.*, 2005) that could have resulted in a less than four embryos needed for pregnancy to be maintained in sows (Pitcher and Springer, 1997). Farrowing rate in group 2 sows in this study was low compared to the value obtained for sows treated with PG600 (Tummaruk *et al*. 2011), or in sows treated with eCG + LH (Kirkwood, 2006) On the other hand, farrowing rate in the group treated with double injections of lutalyse® on day 0 and 13 was higher than the previous reports of Tummaruk *et al*. (2011) and Kirkwood (2006). Similarly, litter size (LS) observed in this study is significantly ($P<0.05$) lower than that reported in sows treated with the luteotrophic agent Altrenogest (Dimitrov *et al*., 2010), or with eCG and eCG + LH (Kirkwood, 2006), This might be attributed to the use of different synchronizing agents.

Table 2: Conception rate, Pregnancy rate and Farrowing rate of crossbred sows following treatment with double and triple injections of Dinoprost tromethamine (Lutalyse®).

FERTILITY PARAMETERS	GROUPS		LOS
	1 (n =5)	2 (n =5)	
CR (%)	100	100	NS
PR (%)	80	60	NS
FR (%)	100	66.67	NS
LS (± SEM)	7.25 ± 1.44	7.50 ± 1.50	NS

KEY:
CR = Conception rate, PR = Pregnancy rate
FR = Farrowing rate, LS= Liter Size
LOS = Level of significant, NS = Not significant ($P > 0.05$)

CONCLUSION

The results of this study show that synchronization of the sow's oestrus using double injections of Lutalyse® 13 days apart and triple injections at days 0, 7 and 13 is possible and produces similar effects on sow's oestrus response and fertility parameters. It is therefore recommended that double injections at 13 days apart be used for oestrus synchronization as its saves cost and labour compared to three times injections.

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