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ESTRUS INDUCTION AND SYNCHRONIZATION POTENTIAL OF THE PITUITARY EXTRACT OF AFRICAN CATFISH (*Clarias gariepinus*) ON MARADI GOATS

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Abstract

This study aimed to investigate the estrus (heat) inducing potential and possible ovulation synchronizing potency of the pituitary gland extract of African catfish (*Clarias gariepinus)* on Maradi goats using vaginal exfoliative cytology as a reference point. Three groups (A, B and C) comprising a total of 21 does (n= 7), aged 18 to 24 months, weighing 16-18kg and with an average body condition score (BCS) of 3-3.5 were used. They were acclimatized for two weeks during which they were certified healthy. Their cyclicity was established one month before the commencement of the study. Group A is the positive control group, B is the test/extract group and C is the negative control group. The pituitary glands were obtained from 15 bloodstock catfish and these were used to prepare the extract administered to the does. Lecireline was administered to the positive control group, while normal saline was administered to the negative control group and the pituitary extract was administered to the test group. Baseline exfoliative vaginal cytology showed that there was no statistically significant difference in estrus stages across the groups ($P<0.05$); Results showed a trend suggesting that, the pituitary extract of African catfish (*Clarias gariepinus*) induced estrus (Heat) with 28% of synchronization in the extract group as compared to that of Lecirelin which was 57% at 24 hours post-treatment. While at 36 hours post-treatment, 43% was achieved with the extract and 57% with Lecirelin. The negative control which was normal saline at 24hrs after prostaglandin showed onset of estrus at 48 hours post-treatment. The group showed that the tightness of synchrony was weaker compared to the Lecirelin and Pituitary extract. It was concluded that Pituitary extract of African catfish (*Clarias gariepinus*) induced estrus at 24-36 hours post-treatment. It was therefore recommended that the pituitary extract be used in the synchronization protocols of Does.

Keywords: Estrus, Synchronization, Pituitary, Catfish, Goats, Vagina.

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1.0 Introduction

The livestock production industry over the years have spurred up the interest of a lot of individuals who are interested in the rearing of farm animals either for commercial purposes or for personal consumption (Thornton and Gerber, 2010). With an increasing interest of farmers in this industry; comes the need for the search of better ways or methods through which reproductive practices can be engaged maximally for these farmers to be able to meet the ever-growing demand of the market. In livestock production, goat farming is one of the areas that is mostly being engaged by these farmers. Generally, goat meat is a significant source of nutrients, particularly in developing nations, which are primarily tropical areas. Goat meat is very popular among Asian, African, and Caribbean people (Hoffman & Cawthorn, 2014). Goat meat is a lean, high-quality protein that contains various nutrients such as riboflavin, iron, vitamin B12, zinc, and potassium. It is also a good source of protein while being low in calories (Hallal, 2022). If an animal's ability to survive and reproduce is compromised, the profitability of any goat meat operation may suffer significantly (Breeds and Production Traits of Meat, 2015).

Goats exhibit an estrous cycle that lasts for approximately 21 days on average but may vary depending on breed or environmental factors (Jamie, 2021). Short cycles are more common in young does and early in the breeding season, while longer cycles tend to occur later in the season as does transition into anestrus (Davila *et al*., 2018). Based on behavioural and structural changes, the estrous cycle can be divided into two distinct phases - follicular and luteal. Furthermore, it is further broken down into several stages including proestrus, estrus, metestrus, and diestrus (Ajayi and Akhigbe, 2020). During proestrus (which lasts for 2-3 days), there is a decrease in progesterone production, corpus lutuem regresses coupled with a slight increase in estrogen production. These

changes are primarily driven by FSH and LH hormones. Amongst many reproductive practices that could be engaged in production, estrus induction and ovulation synchronization is a crucial tool for managing reproduction where artificial insemination (AI) is used to breed most of the animals (Wolfe, 2015). Also, goat farmers who want to use AI to improve the genetic merit of offspring could benefit from these technologies (Goats, 2019). Estrous synchronization shortens the time necessary for determining estrus (heat) before artificial insemination (AI) is instituted. However, timed AI (TAI) is even more effective, saving time, money, and labor by allowing all animals to breed on the same day without heat checking. Estrous synchronization, which often entails the administration of series of hormones to encourage a group of cows, heifers or does to be fertile at a particular time period is a crucial component of a successful AI program, this makes it simpler to identify when the cows or does are in heat (Beal, 1998). Producers have employed estrous synchronization and manipulation to give uniform lamb and kid meat production and dairy sheep and goat milk production, to concentrate effort and labor costs, and to plan for lambing and kidding time. A variety of estrous synchronization strategies have been tried to enhance ovulation rate outside of the breeding season (Hassan & Kutzler, 2021). According to recent research, the use of sequential hormones for induction and synchronization is a crucial practice in the livestock production industry (Smith, 2022a). However, the soaring costs associated with purchasing these hormones have become exorbitant due to the prevailing economic instabilities (Johnson, 2023a). Consequently, these high costs have resulted in a significant barrier for poor farmers who are unable to afford the expenses required for this practice (Johnson, 2023a

This financial constraint not only prevents these farmers from benefiting from the practice but also diminishes the potential profit that could have been obtained by engaging in it (Brown, 2020). Despite all of these instabilities arising, the livestock production industry still remains a viable sector and this is being reflected by the increasing interest of small, medium, and large-scale farmers trooping into this sector. Because of how promising this industry is, and its daily expansion, researchers' interest has been spurred up into seeking out other means or methods through which estrus induction and synchronization can be achieved in farm animals; thereby by-passing the cost being incurred in the use of the conventional hormonal method.

The estrous cycle is a physiological process in which a series of hormones interact at various stages to bring about changes in the female reproductive tract, making it conducive for conception (Smith, 2022b). This cycle involves hormonal modifications that prepare the female reproductive tract for potential fertilization (Johnson, 2023b). Gonadotropins are glycoprotein hormones secreted by gonadotropic cells of the anterior pituitary gland of vertebrates (Pierce and Parsons, 1981). The gonadotropins act on the gonads, controlling gamete and sex hormone production. According to recent research, gonadotropins refer to hormones that have the ability to stimulate the gonads, also known as sex glands, in order to facilitate their reproductive or endocrine functions (Smith, 2022c). In males, these glands are the testes while in females the ovaries. Follicle stimulating hormone (FSH) and luteinizing hormone (LH) are two of the gonadotropins (Yadav, 2008). These hormones (FSH and LH) are produced and stored in the anterior pituitary gland. The utilization of pituitary extract from African catfish and other fish species has been employed to promote breeding (Johnson, 2022). Once injected with a pituitary extract from a catfish of identical size, the female catfish will respond (Gertjan de Graaf, 1994). Sexually mature fish generate gonadotropic hormones and the cycle changes in their concentration in the pituitary gland can be connected to

the reproductive cycle of the fish (Houssay (1951). Ubah *et al* (2023), carried out research on Wistar rats with results showing that pituitary extract of *C. gariepinus* has the capacity to induce estrus in Wistar rats because of its gonadotropic effects. A reproductive management technique that promotes concentrated breeding and facilitates the production of uniform offspring and effective management of pregnant does, can be accomplished by administering exogenous hormones that modify the physiological processes involved in the sexual cycle (Smith, 2022d). The other non-hormonal methods of achieving estrous synchronization involves the use of light control (i.e., the light-dark effect) or through the buck effect (i.e., the exposure of a doe to a buck). In the doe, the window of this opportunity is generally greater during the luteal phase which apparently appears to be of longer duration and more responsive to manipulation (Wildeus, 2000, Holtz, 2005). The protocols that are employed in estrous synchronization involves the use of different hormones in sequential order; with variations in time of administration that aids in controlling the corpus luteum (CL) functions, stimulate follicular development and regulate ovulation (Smith, 2022e). This study aimed to investigate the estrus (heat) inducing potential and possible ovulation synchronizing potency of the pituitary gland extract of African catfish (*Clarias gariepinus* on Maradi breed of goats using vaginal exfoliative cytology as a reference point.

2.0 Materials and Methods

2.1 Description of Study Area

This study was conducted at the farm space of the Veterinary Teaching Hospital, Faculty of Veterinary Medicine, University of Abuja permanent site, Gwagwalada Abuja. The university is located within the capital city of Nigeria, lying between latitude 8º25 and 9º25North of the equator and longitude 6º45 and 7º45 East of Greenwich. University of Abuja permanent site has a hot,

humid and tropical climate. Its major element has regimes that are intermediate from those of the southern and Northern region of the country (Abdullahi *et al*, 2012). The temperature varies from 21-26.7^{o} yearly with total annual rainfall of approximately 1,650mm. The month of July, August, and September records approximately 60% of the annual rainfall (Itiowe *et al.,* 2019).

2.2 Experimental animals and acclimatization.

The University of Abuja Institutional Animal Ethics Committee, Nigeria, approved the experiments conducted in the current study (UAECAU/2024/005). The experimental animals used for the research were twenty-one (21) adult Maradi goats aged 18 to 24 months, weighing between 16 to 18 kg and with body condition scores (BCS) ranging between 3 to 3.5. As a means of identification, the animals were all tagged with the aid of neck tags according to their groups and thereafter they were all kept in a well-ventilated pen, with 12 hours of light and 12-hours dark cycle for the duration of the study. The goats were fed ad *libitum* with a feed combination of millet farm residue, beans farm residue, concentrate (maize) and groundnut farm residue twice daily, with adequate provision of clean water at intervals. They were acclimatized for two weeks during which they were certified healthy. Their cyclicity was established one month before the commencement of study.

2.3 Experimental Design

The study involved the use of twenty-one (21) apparently healthy does, this does were randomly assigned to three (3) groups; with each group having a total of seven (7) does. *GROUP A* being the positive control group, *GROUP B* the test/extract group and *GROUP C* the negative control

group. The baseline vaginal smear for vaginal cytology was collected which was to aid in establishing the estrus phases of the does after which they were all treated with a modified progesterone-prostaglandin protocol for 9 days. 100mg/2ml progesterone ampoule was reconstituted with 3ml of paraffin wax so as to get a concentration of 20mg/ml, with the reconstituted progesterone, all the does within each group were injected at a dose of 10mg/animal per day; and this was done for 9 days. On the 8th day of the progesterone administration, 1ml of prostaglandin was also administered to the does after the progesterone shots for the day and vaginal cytology was taken. On the 9th day of the progesterone treatment, the pituitary extract of African catfish was administered to the test group, Lecirelin was administered to the positive control group and normal saline was administered to the negative control group. Vaginal smears were then taken from the first 24 hours till 92 hours once daily at 24hours interval.

3.4 Collection of Pituitary Gland

Pituitary gland was collected according to the modified method of Ubah *et al.,* (2023). Briefly, fifteen fish were humanely sacrificed and the heads were cut off with the use of a sharp knife. Thereafter, the dorsal part of the head was separated from the ventral portion. The dorsal part was cleaned and the bones were taken apart carefully with a bone cutter and the pituitary gland (Fig.1) was collected. Male brood stocks were used so as to confirm sexual maturity by measuring size of gonads and semen motility of the male catfish, this indicated functional gland and adequate amount of the gonadotropic hormone content of the pituitary glands extracted.

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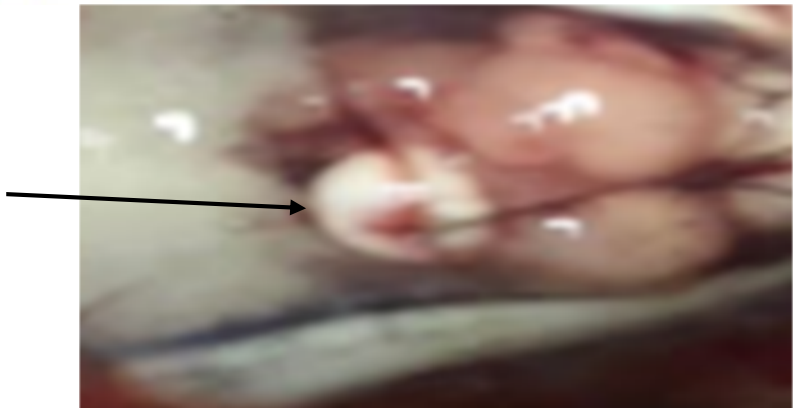

Fig. 1: Pituitary gland (arrow) at the base of the brain of the brood stock of African Catfish during extraction.

2.4.1 Preservation of the Pituitary Gland

Upon successful extraction of the pituitary glands, the glands were preserved in acetone immediately. The acetone solution was changed with a fresh solution after 8-12 hours. The acetone was completely drained at 24 hours and the glands were air dried on paper towel. After proper drying was done, they were placed in an adequately capped vial and properly sealed until they were needed for use.

2.4.2 Preparation of the Pituitary Extract

The pituitary glands that were preserved in the vial were gently removed from the capped vial and weighed with the use of FA2104A analytical weighing balance, dispensed into a laboratory mortar and ground into fine powder. Normal saline was added to the mortar containing the pituitary gland at ratio of 5mls of normal saline to 10mg of pituitary gland. This combination was mixed gently with a laboratory pestle to achieve homogeneity. The homogenized solution was decanted into a centrifuge bottle and gently shaken. The decanted solution was centrifuged at a rate of 5000 rpm

for 5 minutes. The supernatant produced after centrifugation was collected using a 5 ml syringe. After collection, the experimental extract group was injected intramuscularly.

In Positive Control (Group A), the 7 does in this group were individually weighed and each was administered with 2mls of Lecirelin intramuscularly. Test / Extract (Group B), the 7 does in this group were weighed individually and thereafter injected with the Pituitary extract intramuscularly according to their body weight at a dose rate of 1.5mg/kg, Negative Control (Group C) normal saline was administered to the does within this group serving as the negative control.

2.5 Vaginal cytology (Smear)

With the use of cotton tipped swab; wetted with ambient temperature physiological saline, vaginal swab was collected from the does with a baseline value recorded and continuous collection was done at the interval of 24hours, 36hrs, 48hours, 72hours and 92 hours post gonadotropic agents treatments on day 9. The vulva lips were gently parted with digital manipulation and the swab stick was inserted into the vagina through the orifice, the swab was gently rotated and rolled against the vaginal wall and then gently removed. Cells were transferred to a clean dry glass slide by rolling the swab across the slide in two different rows. The slides were air dried and then stained using Giemsa stain. The stage of the estrous cycle was determined based on the presence or absence of leukocytes, cornified (anucleated) epithelial and nucleated epithelial cells (Figs.2 and 3). According to the modified method of Santos *et al*., (2015).

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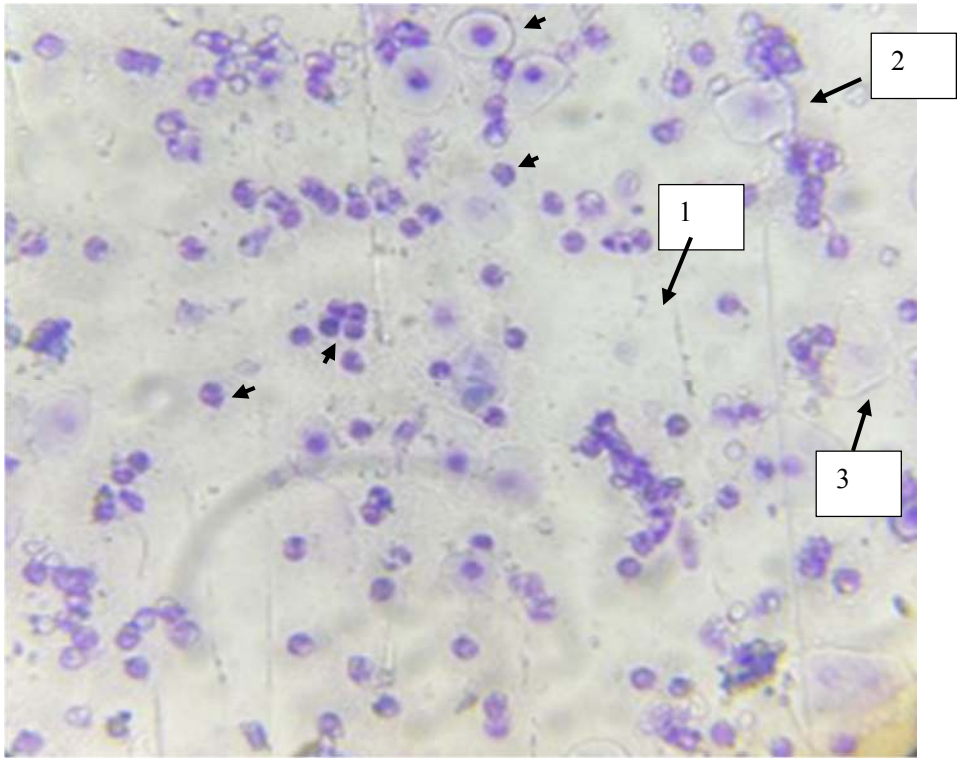

Fig. 2: Vaginal cytology at x100 magnification showing the proestrus stage of the cycle with predominance of parabasal cells (arrow heads) and a few superficial cells (1,2 and 3).

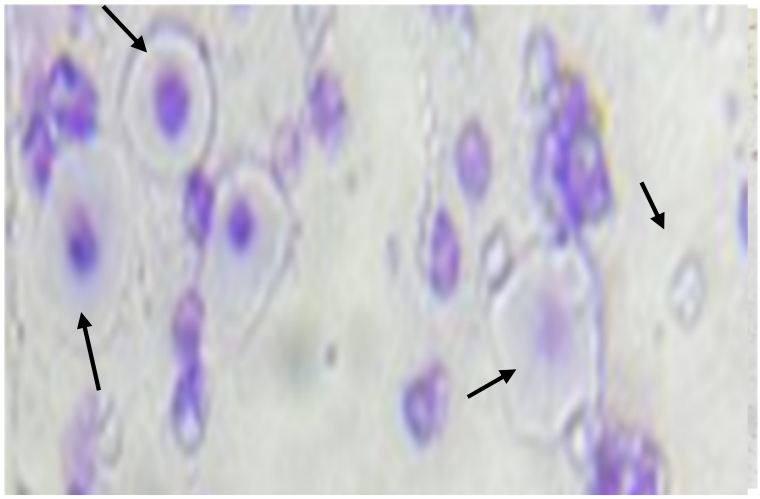

Fig. 3: Vaginal cytology at x40 magnification showing the estrus stage of the cycle with predominance of superficial cells (arrows).

2.6 Statistical Analysis

Data were expressed as mean ± SEM and Stages of estrous cycle in different groups were analyzed using Chi-square test using SPSS Version 25 (2017) and P values (<0.05) were considered statistically significant.

3.0 Results

3.1 Vaginal Cytology (Smear)

Baseline vaginal cytology showed that group A had 29% of the does in proestrus phase, 0% at estrus, 14% at metestrus, and 57% at diestrus. While in group B, 28% of the does were at proestrus, 0% in estrus, 29% in metestrus, and 43% in diestrus. In group C, 28% were at proestrus, 19% estrus, 0% in metestrus, and 43% at diestrus (Table 1). There was no statistically significant difference (P >0.05) between the groups per estrus stage analyzed at day 0 (baseline).

At post-PGF_2 alpha day 8 of progesterone treatment, result showed that in group more animals were in proestrus across the groups, in group A, 57% of the does were in proestrus phase, While in group B, 43% of the does were at proestrus, In group C, 43% were at proestrus,. About equal no of the animals were also in diestrus. No animal was in estrus (Table 2). There was no statistically significant difference (P>0.05) among the groups analyzed per estrus stage.

At 24 hours post-Lecirelin and pituitary extract treatment, results showed that in group A, 29% of the does were in the proestrus phase, group B, 43% of the does were at proestrus In group C, 43% were at proestrus,. In group A - 57% were at estrus, In group B 28% while C had 0% estrus diestrus (Table 3). There was no statistically significant difference (P>0.05) between the groups analyzed

At 36 hours post-Lecirelin and Pituitary extract treatment, the result showed that group A had 29% of the does in the proestrus phase, group B, 4% of the does were at proestrus In group C, 57% were at proestrus group A had 57% at estrus, group B had 43% in estrus while group C had 0% in estrus

(Table 4). There was no significant difference (P>0.05) between the groups per estrus stage. At 48 hours post-Lecirelin and Pituitary extract treatment, the result showed that in group A, 28% of the does were in the proestrus phase, in group B, 28% of the does were at proestrus, In group C, 43% were at proestrus, group A had 29% at estrus, group B had 14% in estrus while group C had 14% estrus diestrus (Table 5). There was no significant difference (P>0.05) between the groups per estrus stage. At 72 hours post-Lecirelin and Pituitary extract treatment, the result showed that in group A, 0% of the does were in the proestrus phase, group B, had 14% of the does at proestrus, while in group C, 0% were at proestrus. Group A had 29% at estrus, group B had 14% in estrus, while group C had 28% estrus, group A had 57% at metestrus, and 14% at diestrus, group B had

29% in metestrus, and 43% in diestrus while group C had 29% in metestrus, and 43% at diestrus (Table 6). There was no significant difference (P>0.05) between the groups per estrus stage.

At 96 hours post lecirelin and pituitary extract treatment, the result showed that in group A, 0% of the does were in the proestrus phase, 14% at estrus, 57% at metestrus, and 29% at diestrus. While in group B, 0% of the does were at proestrus, 28% in estrus, 43% in metestrus, and 29% in diestrus. In group C, 14% were at proestrus, 14% in estrus, 43% in metestrus, and 29% at diestrus (Table 7). There was no significant difference (P>0.05) between the groups per estrus stage analyzed.

Table 1: Baseline (day 0) of Estrus stages (%) of different groups as shown by vaginal cytology

Parameters	**GROUP A**	**% per phase**	**GROUP B**	**% per phase**	**GROUP C**	**% per phase**	**P-Value**	**L O S**
Proestrus	2.00	28.57	2.00	28.57	2.00	28.57%	1.00	NS
Estrus	0.00	0	0.00	0	2.00	28.57	0.11	NS
Metestrus	1.00	14.29	2.00	28.57	0.00	0	0.31	NS
Diestrus	4.00	57.14	3.00	42.86	3.00	42.86	0.83	NS

L O S = Level of Significance; N S = Not Significant (P>0.05)

Table 2: Estrus stages (%) of different group's post-PGF2 alpha day 8 as shown by vaginal cytology

Parameters	**GROUP A**	**% per phase**	**GROUP B**	**% per phase**	**GROUP C**	**% per phase**	**P-Value**	**L O S**
Proestrus	4.00	57.14	3.00	42.86	3.00	42.86	0.83	NS
Estrus	0.00	0	0.00	0	0.00	0	-	nc

Metestrus	0.00	0	0.00	0	1.00	14.29	0.35	NS
Diestrus	3.00	42.86	4.00	57.14	3.00	42.86	0.83	NS

L O S = Level of Significance; N S = Not Significant (P>0.05); nc = not computed

Table 3: Estrus stages (%) of different groups 24 hours post gonadotropin agent treatment as shown by vaginal cytology

Parameters	**GROUP A**	**% per phase**	**GROUP B**	**% per phase**	**GROUP C**	**% per phase**	**P-value**	**L O S**
Proestrus	2.00	28.57	3.00	42.86	3.00	42.85	0.82	NS
Estrus	4.00	57.14	2.00	28.57	0.00	0	0.06	NS
Metestrus	0.00	0	0.00	0	1.00	14.29	0.35	NS
Diestrus	1.00	14.29 %	2.00	28.57 %	3.00	42.86	0.50	NS

L O S = Level of Significance; N S = Not Significant (P>0.05)

Table 4: Estrus stages (%) of different groups 36 hours post treatment as shown by vaginal cytology

Parameters	**GROUP A**	**% per phase**	**GROUP B**	**% per phase**	**GROUP C**	**% per phase**	**P-value**	**L O S**
Proestrus	2.00	28.57	1.00	14.29	4.00	57.14	0.22	NS
Estrus	4.00	57.14	3.00	42.86	0.00	0	0.06	NS
Metestrus	1.00	14.29	2.00	28.57	0.00	0	0.31	NS
Diestrus	0.00	0	1.00	14.29	3.00	42.86	0.12	NS

L O S = Level of Significance; N S = Not Significant (P>0.05)

Table 5: Estrus stages (%) of different groups 48 hours post treatment as shown by vaginal cytology

Parameters	GROUP A	% per phase	GROUP B	% per phase	GROUP C	% per phase	P-value	L O S
Proestrus	2.00	28.57	2.00	28.57	3.00	42.86	0.81	NS
Estrus	2.00	28.57	1.00	14.29	1.00	14.29	0.73	NS
Metestrus	2.00	28.57	2.00	28.57	1.00	14.29	0.77	NS
Diestrus	1.00	14.29	2.00	28.57	2.00	28.57	0.77	NS

L O S = Level of Significance; N S = Not Significant (P>0.05)

Table 6: Estrus stages (%) of different groups 72 hours post treatment as shown by vaginal cytology

Parameters	GROUP A	% per phase	GROUP B	% per phase	GROUP C	% per phase	P-value	L O S
Proestrus	0.00	0	1.00	14.29	0.00	0	0.35	NS
Estrus	2.00	28.57	1.00	14.29	2.00	28.57	0.77	NS
Metestrus	4.00	57.14	2.00	28.57	2.00	28.57	0.45	NS
Diestrus	1.00	14.29	3.00	42.86	3.00	42.86	0.42	NS

L O S = Level of Significance; N S = Not Significant (P>0.05)

Table 7: Estrus stages (%) of different groups 96 hours post treatment as shown by vaginal cytology

Parameters	GROUP A	% per phase	GROUP B	% per phase	GROUP C	% per phase	P-value	L O S
Proestrus	0.00	0	0.00	0	1.00	14.29	0.35	NS
Estrus	1.00	14.29	2.00	28.57	1.00	14.29	0.73	NS
Metestrus	4.00	57.14	3.00	42.86	3.00	42.86	0.83	NS
Diestrus	2.00	28.57	2.00	28.57	2.00	28.57	1.00	NS

L O S = Level of Significance; N S = Not Significant (P>0.05)

Discussion

The pituitary extract of the African catfish as well as that of other fish species has been utilized to encourage breeding once it is injected with a pituitary extract from a catfish of identical size, the female catfish will respond (Gertjan de Graat, 1994). Vaginal exfoliative cytology is a sensitive indicator of the stage of the estrous cycle in several species, presumably reflecting the balance of estrogen and progesterone effects (George, 1954). From the results obtained from this study, the baseline estrus stages of vaginal cytology, in group A, 29% of the does were in the proestrus phase of the cycle, 57% in diestrus, 14 % in metestrus and none in estrus. In group B, 43% were in diestrus, 28% in proestrus, 29% in metestrus and none in estrus. While in group C, 43% were in diestrus, 0% in metestrus, 29 % in estrus and 28% in proestrus. The results obtained from the vaginal cytology showed that the does were all cycling. Looking at the number of does in each phase of the cycle, across the groups, It was obvious that a good number of the does were in their diestrus phase before the commencement of the progesterone treatment. Cyclicity was thus established in the experimental animals. At post-PG_{F2} alpha day 8 as shown by vaginal cytology

Before Lecirelin and Pituitary extract treatment, the vaginal cytology results obtained showed that all the groups had 0% in estrus, which is an indication of proper synchronization of the does by the use of progesterone. In the doe, the window of opportunity for synchronization is generally

greater during the luteal phase which appears to be of longer duration and more responsive to manipulation (Wildeus, 2000, Holtz, 2005). The protocols that are employed in estrous synchronization involve the use of different hormones in sequential order; with variations in time of administration that aid in controlling the corpus luteum (CL) functions, stimulate follicular development and regulate ovulation (Smith, 2022e). At this point across the three groups, most of the animals showed proestrus stage A =57%, B = 43%, and C = 43% probably because prostaglandin was administered that same day before samples were collected. Once prostaglandin was injected progesterone levels would start decreasing and this is in line with Larson and Randle, (2008) who stated that during proestrus (which lasts for 2-3 days), there is a decrease in progesterone production,

At 24 hours post treatment group A had 57% at estrus, group B 28% while C had 0% estrus although the differences were not significant but, it showed a trend of response to Lecirelin and Pituitary extract. It was an indication that most animals that received Lecirelin 24 hours after prostaglandin came in estrus within another 24 hours. The trend was followed by animals that received Pituitary extract while those that received normal saline 24 hours after prostaglandin were slower in response and did not show any animal in estrus in another 24 hours. This means that the Pituitary extract was able to fast-track response to prostaglandin just like Lecirelin but with a smaller number of animals. This observation is in agreement with the finding of Ubah *et al.,* (2023), who reported the gonadotropic activity of the pituitary extract of African catfish in mammals using Wistar rats as models. The increase in the number of estrus does in 24 hours post-extract administration from 0% to 28.57% strongly suggested that the strength of estrus synchronization potential of the extract was high. This observation will be in favour of artificial insemination (AI) programs since the timing of artificial insemination (AI) relative to the onset of estrus is vital for the success of the AI program; which is because both the sperm and ovum have a short lifespan in the ruminant reproductive tract (Ali *et al.,* 2020). At 36 hours post-Lecirelin and Pituitary extract treatment, the result showed a similar trend with the 24-hour picture while group C showed zero percent of the animals in estrus. This also emphasized that the peak of estrus in the two groups was between 24 and 36 hours. In group A, 57% of the does were still in estrus at 36 hours, 29% were in proestrus, 14% in metestrus and 0% in diestrus. In group C, 57% were in proestrus, 0% in estrus, 0% in metestrus and 43% in diestrus. Comparing the results obtained

from groups A, B, and C at 36 hours post-treatment showed that at 36 hours a considerable number of the does treated with the extract and Lecirelin were in estrus while those in group C that were given normal saline had none of its does in estrus. Therefore, for maximum result in the case of artificial insemination in does synchronized with this extract to be obtained, the does should be inseminated at 36 hours post administration of the extract. Also, the results obtained at these specific time intervals are in agreement with that observed by Muhammad *et al.,* (2008); who asserted that the duration of estrus in does is about 30-36 hours. 48 hours post-treatment results showed that in group A, the number of does in estrus dropped from 57% as seen at 36 hours to 29%, this still suggested that the synchronization strength of the Lecirelin was higher at 36 hours. 28% were in proestrus, 29% in metestrus and 14% in diestrus. Also in group B, there was a drop in the number of does in estrus from 43% seen at 36 hours to 14%; suggesting that for optimum insemination results to be obtained in does synchronized with Pituitary extract, they should be inseminated at 36 hours post-treatment. 28% were in proestrus, 28% in metestrus and 29% in diestrus.

In group C, there was a change in the number of does in estrus from 0% as seen at 36 hours post treatment to 14%, At 48 hours post-Lecirelin and Pituitary extract treatment, the result showed that group C had 14% estrus which means late induction in that group, that is to say that prostaglandin only treatment was very slow to induce estrus. Looking at 72 and 96 hours post gonadotropin treatments normal saline (Group C) had 28% and 14% estrus respectively. This showed that the tightness of synchrony was weak. There was a smaller number of animals that came in estrus at each point in time over a protracted period of three days. Unlike groups A and B that had a bulk of the animals that came in estrus within a short range of 24 to 36 hours and the percentage decreased by 48 hours. At 96 hours post treatment the three groups had most of the animals in the progesterogenic phase of the cycle that is either metestrus or diestrus. This is a good picture of cyclicity showing that 120 hours after prostaglandin treatment most of the animals transcended into the dry period, which is expected after estrus and subsequent ovulation. Corpus luteum would have been formed and progesterone production would have peaked. This agrees with Larson and Randlea (2008). who stated that, during diestrus (which lasts for 10-12 days there is a predominant surge of progesterone production by an activity of the corpus luteum. It was concluded that the Pituitary extract of African catfish (*Clarias gariepinus*) induced estrus (Heat) with 28% of

synchronization in the extract group as compared to that of Lecirelin which was 57% at 24 hours post-treatment. While at 36 hours post-treatment, 43% was achieved with the extract and 57% with Lecirelin. It was therefore recommended that for maximum results concerning fertility, Pituitary extract of African catfish should be used in estrus induction and synchronization with insemination carried out at 24-36 hours post-treatment.

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