



Research Article

Progesterone Concentrations during Uterine Involution in Sahelian Goats

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ABSTRACT

**Keywords:**

Progesterone,  
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Ovarian activity,  
Uterine involution

This study was conducted to investigate ovarian activity by measuring the serum progesterone levels of Sahel goats during uterine involution. A total of 35 pregnant Sahel goats with ages between 24-42 months old and body weights between 30-40kg were used for this study. The pregnant does were obtained from the large animal clinic, faculty of Veterinary Medicine, University of Maiduguri, Borno State, Nigeria. Blood samples were collected via the jugular vein of does at postpartum days 1, 3, 7, 14, 21 and 28 respectively. Thereafter, serum was harvested from the blood and progesterone levels were determined using Enzyme-linked immunosorbent assay (ELISA) kit (EliKine™ Progesterone ELISA Kit). The maximum and minimum serum progesterone concentration was reported on day 28 and day 21 postpartum to be  $1.079 \pm 0.09\text{ng/ml}$  and  $0.390 \pm 0.05\text{ng/ml}$  respectively. The serum progesterone level continues to decrease gradually from postpartum day 3 ( $0.761 \pm 0.04\text{ng/ml}$ ) and postpartum day 14 ( $0.620 \pm 0.03\text{ng/ml}$ ) respectively. Thereafter, the serum progesterone concentration starts to increase and reached the highest level on postpartum day 28 ( $1.079 \pm 0.09\text{ng/ml}$ ). This result also shows that there is no ovarian activity for a prolonged period of time after parturition, suggesting that the interval between time of parturition and resumption of ovarian activity in Sahel goat is day 28 postpartum. Therefore, it could be concluded that, serum progesterone concentration measurement is a precise biological marker for the detection of ovarian activity during the postpartum period.

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## INTRODUCTION

In Nigeria, an estimated population of goats was estimated around 53.3 million (Ojo *et al.*, 2015) comprises of the Sahel and West African Dwarf breeds as the two most important breeds of goats in the country (Ogah, 2016). Sahel goats are among the best reared breeds in northern part of Nigeria where they comprise over 70% of the total goat population (Bokko, 2011). Over the years, goat production has been one of the most important ways to improve the incomes of impoverished livestock keepers, reduce poverty, and achieve sustainable agriculture and universal food security (Yakubu and Achapu, 2016).

Uterine Involution is the reduction in the size of the genital tract following parturition; it happens on a decreasing logarithmic scale, with the biggest change occurring in the first few days after parturition (Badawi *et al.*, 2014). The uterus shrinks and contracts rapidly, especially between days 3 and 10 postpartum, as evidenced by assessments of uterine weight and length, uterine body diameter, and previously gravid horn (Noakes *et al.*, 2019). The morphology and physiology of the uterus undergo a number of fascinating changes throughout the postpartum period that is necessary for the uterus to resume its normal reproductive activity of this organ (Greyling, 2000).

Uterine involution and ovarian activity recovery are essential for the commencement of a future pregnancy and serve as hallmarks of the preceding period. Uterine involution is the process by which the postpartum uterine diameter in a properly cycling animal returns to its former non-pregnant size (Takayama *et al.*, 2010). In ruminants, the completion of uterine involution and the return of sexual activity after parturition often depend on a number of variables, including diet, offspring nursing, and parturition season (Delgadillo *et al.*, 1998; Yavas and Walton, 2000). There are no data or literature information about postpartum uterine involution in Sahel goats in Nigeria and so, the

present study is considered very important and necessary to provide information that can be useful for improving reproductive efficiency. The objectives of this study were to determine serum progesterone levels and relationship between uterine involution during postpartum periods in Sahel goats by using Enzyme-linked immunosorbent assay (ELISA) kit.

## MATERIALS AND METHODS

### Study Area

This study was carried out in Maiduguri, the capital and largest urban city of Borno state in the Northeastern part of Nigeria. The city is located between latitudes 11° and 14° N and longitudes 10 ° and 14 ° E within the conventional Sahel zone, and has a total landmass of 543 square kilometers (Mshelia *et al.*, 2015).

### Experimental animals

This study was conducted on 35 pregnant Sahel goats with ages between 24-42 months old and body weights between 30-40kg. The pregnant does were obtained from the large animal clinic, faculty of Veterinary Medicine, University of Maiduguri, Borno State, Nigeria. The pregnant does were managed under semi-intensively system where feed and water are provided in abundance throughout the period of the research.

### Ethical Clearance

Before commencement of the research, ethical clearance was obtained from the Animal Use and Ethics Committee (AUEC) of the University of Maiduguri.

### Blood Sampling

After successful parturition, blood samples (5mls) were collected from each does on postpartum day 1, 3, 7, 14, 21 and 28 respectively, through the jugular vein using sterile syringe and needle into an additive free vacutainer tubes. The blood was allowed to clot for 6-12 hours and then centrifuged at 2000-3000 rpm for 10 minutes to obtain the serum. The serum were harvested in cryotubes and deep-frozen at -80 °C till required for progesterone concentration assay (Goel *et al.* 2016).

**Progesterone Concentration Assay**

Serum progesterone concentration was measured using Enzyme-linked immunosorbent assay (ELISA) kit (EliKine™ Progesterone ELISA Kit). The analytical sensitivity of the assay was 0.04ng/ml, and the intra and inter-assay coefficients variation of progesterone recorded were 2.6% and 3.28%, respectively. The measuring range of the assay was 0.1–20ng/ml.

**Statistical analysis:**

The Data obtained from the research were subjected to Analysis of Variance (ANOVA) using IBM SPSS statistical software (version 20). The result was summarized and expressed as Mean ± standard deviation calculated using descriptive statistics and values at a significance

level of  $p < 0.05$  were considered statistically significant.

**RESULTS**

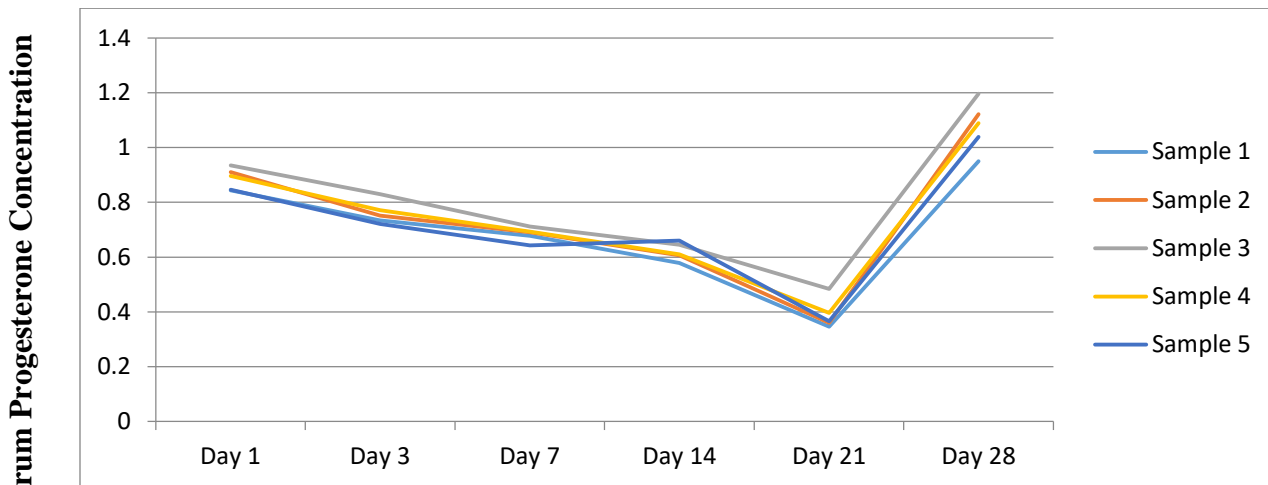
**Serum Progesterone concentration**

The maximum serum progesterone concentration was reported on day 28 postpartum ( $1.079 \pm 0.09$ ng/ml) and the minimum level on day 21 postpartum ( $0.390 \pm 0.05$ ng/ml) respectively. The serum progesterone level continues to decrease gradually from postpartum day 3 ( $0.761 \pm 0.04$ ng/ml) and postpartum day 14 ( $0.620 \pm 0.03$ ng/ml) respectively. Thereafter, the serum progesterone concentration starts to increase and reached the highest level on postpartum day 28 ( $1.079 \pm 0.09$ ng/ml) (Table 1).

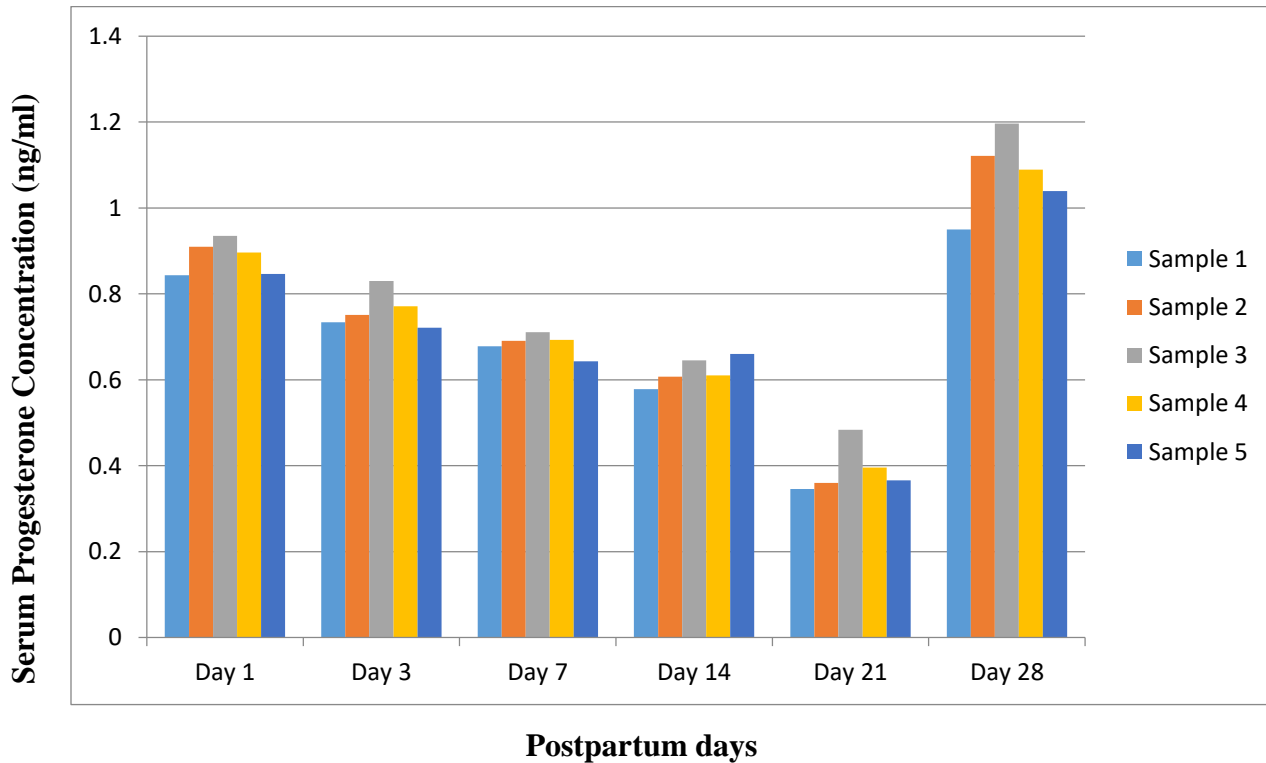
**Table 1: Progesterone (P<sub>4</sub>) concentration during uterine involution in Sahel goats**

P <sub>4</sub> Conc.	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28
Sample 1	0.843	0.734	0.678	0.578	0.346	0.950
Sample 2	0.910	0.751	0.691	0.607	0.360	1.121
Sample 3	0.935	0.830	0.711	0.645	0.484	1.196
Sample 4	0.896	0.771	0.693	0.610	0.396	1.089
Sample 5	0.846	0.721	0.643	0.660	0.366	1.039
<b>Mean ± SD</b>	<b>0.886 ± 0.04</b>	<b>0.761 ± 0.04<sup>a</sup></b>	<b>0.683 ± 0.02<sup>a</sup></b>	<b>0.620 ± 0.03<sup>a</sup></b>	<b>0.390 ± 0.05</b>	<b>1.079 ± 0.09</b>

Mean values with same superscripts shows no significant difference at  $P < 0.05$



**Figure 1:** A line chart showing the mean Serum Progesterone concentration (ng/ml) from day 1 to 28 postpartum



**Figure 2:** A bar chart showing the mean Serum Progesterone concentration (ng/ml) from day 1 to 28 postpartum

**DISCUSSION**

Progesterone is a major steroid hormone that regulates morphological and physiological changes in the female genitalia (Abd-Elnaeim & Al-Kheraije 2012). In the present study, all the does examined during the different stages of involution period showed a state of ovarian inactivity during postpartum day 1–21, as indicated by the low serum progesterone level. This concur to the findings of Goel *et al.* (2016), who reported that progesterone levels are low for the first 60days of suckling periods in Jakhrana goats, which vividly indicates no ovarian activity.

The progesterone concentration in the postpartum goats assumes a general and common trend starting with lower level which gradually increases to reach a level of  $1.079 \pm 0.09$ ng/ml. The concentration remained at low

level at the time of parturition from days 1–21. It then increased and remained high on day 28 indicating that regular ovarian activity did not reoccur up to 21 days postpartum. This tally with the findings of Badawi *et al.* (2014), who reported that minimum and maximum levels of progesterone was observed in Nubian goats at postpartum day 27 and 7 respectively. The lower level of progesterone (<1.00ng/ml) in the present study indicates no ovulation during suckling period of first 21 days after kidding and is consistent with earlier report in Shiba goats as reported by Takayama *et al.* (2010). This is also in agreement with the studies of Khanum *et al.* (2007) in dwarf goats, who reported that during postpartum anestrous period, the progesterone concentrations remained at lower levels (between 0.1 and 0.9ng/ml) and specified an increase in concentration with the resumption of

postpartum cyclicity. The current findings also suggests that, there was a drastically decrease in the progesterone levels of Sahel goats in the first few days of parturition. However, with the return of postpartum ovarian cyclicity, there was a decrease level of progesterone hormone at day 21 and an increase in the level on day 28 postpartum respectively. This statement is in accordance with Badawi *et al.* (2014), who reported an increase of Progesterone levels in Nubian goats after complete uterine involution. The results indicated that the Progesterone concentrations decreased slowly from day 3 and reached a peak value on day 27 postpartum, but increased rapidly to minimum levels on day 28 postpartum. These results are in contrast to the findings of Takayama *et al.* (2010) in Shiba goats and Badawi *et al.* (2014) in Nubian goats. This might be due difference of breeds, and geographical location.

The findings of this study reveal that uterine involution was achieved after postpartum day 28. This tallies with the findings of Hayder and Ali (2008) who documented that uterine involution ends at 30 days postpartum and much longer reported in Nubian goats (Atta *et al.*, 2012). This difference in the postpartum period could be due to breeds difference, research methodology, and seasonality (Badawi *et al.*, 2014). According to the findings of Medak and El-Daek, (2015), progesterone level of progesterone in Barbary ewes was less than 1 ng/ml, and it began to rise at days 77

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postpartum. The productivity of the Sahel goats can be enhanced by the development of their reproductive potentials and the postpartum period is critical for reproductive efficiency of breeding animals. The understanding of these changes will enhance our knowledge on the reproductive performance of the Sahel goat.

## CONCLUSION

In conclusion, uterine involution under normal conditions using progesterone was completed by day 28 Postpartum in Sahel goats. The interval between parturition and the first postpartum estrous is an important characteristics which contributes to the reproductive efficiency in Sahel goats. Early diagnosis of uterine involution in Sahel goats facilitate early rebreeding of doe and reduce kidding interval, thus increase number of kidding per year. The low level of circulating progesterone concentration observed in this study is suggestive of ovarian inactivity in Sahel goats particularly in circumstances where suckling of the goat kids is not practical or not desired.

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## CONFLICT OF INTEREST

The authors declare that, there is no conflict of interest.

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