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Full Length Research Paper

MECHANISMS INVOLVED IN THE CONTROL OF REPRODUCTIVE PERFORMANCE IN WEST AFRICAN DWARF GOATS FED DIFFERENT PROTEIN LEVELS

[1]N. Wachida, [1]P.M. Dawuda and [2]E.O. Oyedipe

[1] Department of Veterinary Surgery and Theriogenology, College of Veterinary Medicine, University of Agriculture P. M. B. 2373 Makurdi Benue State, Nigeria. p_dawuda@yahoo.co.uk
[2] Department of Veterinary Theriogenology and Production, College of Veterinary Medicine, University of Ilorin P. M. B 1515 Ilorin Kwara State, Nigeria.eooyedipe@yahoo.com

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The objectives of this study were to evaluate the effect of three protein levels on (1) some reproductive parameters of West African Dwarf (WAD) goats such as number of oestrous cycles, lengths of oestrous cycles and (2) fertility in terms of conception, abortion, kidding, twining and kids survival. Nutritional treatment groups were: high protein supplementation (28.24 %), medium protein supplementation (18.94 %) and low protein supplementation (10.3 %). Five (5) adult does aged between 1-1½ years (body weight of 9-12 kg) were assigned to each treatment group. The does grazed native grass pastures supplemented with a concentrate ration of the different protein levels fed at 5 % of body weight in the mornings and were weighed weekly throughout the experimental period. Oestrus activities were monitored visually for 2 hours in the morning and evening for five days. Thereafter, all does were synchronized using intravaginal progesterone release device (CIDR). On removal of the device after 19 days, a fertile buck was introduced to detect heat and mate does on heat. Blood samples were collected twice a week and serum was harvested throughout the study period to determine progesterone concentration. Results of this study indicate that the three levels of protein supplementation neither affected the number of oestrous cycles nor the lengths of oestrous cycles (p > 0.05) in cyclic does. Different protein levels significantly (p < 0.05) affected kid's survival. There were no significant differences (p > 0.05) on oestrous response, conception, abortion, kidding and twining in does fed different protein levels. In conclusion, low protein level intake affected reproductive performance of West African Dwarf does by lowering conception, twining, kidding and kid survival rate...

Keywords: *Protein Supplementation; Reproductive Efficiency*.

Corresponding Author: ndumariwachida@gmail.com

INTRODUCTION

It has been reported that reproduction is an important component of any husbandry system and this can be affected by nutrients supply especially protein (Restage *et al*. 2006). The productivity of goats is fostered by the efficient utilization of nutrients made available from adequate supply of energy and protein. This is because the reproductive axis is very sensitive to the adequacy of nutrition and store of metabolic reserve (Walden-Brown and Becquerel, 2000). Blood metabolites such as glucose, urea, non-esterifies fatty acid (NEFA) and β-hydroxyl-butyrate and other metabolic hormones (insulin, somatrophin, thyroxin cortisol, prolactin and IGF-1) are considered to be limiting factors and may serve as a signal either at the gonadal or hypothalamo-pituitary axis to regulate reproduction (Chilliard *et al.* 1998). In addition, weather conditions such as temperature, humidity, sunshine, and wind velocity have been shown to negatively or positively influence the nutritional need of goats (Lassoued and Atti, 1996).

Although goats adapt to high temperatures and humidity, they do experience reproductive problems associated with nutritional deficiencies particularly from low quality forage as a result of adverse weather conditions. Therefore, it has been advocated that in addition to grazing, goats should be supplemented with concentrate feed when the forage they graze does not meet their nutritional requirement (Luginbuhl and poore, 1998).

Over the last two decades, several studies have addressed the interaction between nutrition and reproduction with particular interest on sheep and goat (Robinson, 1990; Smith *et al.,* 1991, Brown, 1994, O'Callaghan and Boland, 1999., Martin *et al.* 2004). These reports have focused mainly on the ewe with relatively few information on the doe. Vinoles (2003) reported that in females, the most prominent effect of under nutrition occurs around the time of mating, which affect ovulation, embryo survival and twining rate. This negative effect of under nutrition could be due to the negative feedback of negative energy balance (NEBAL) on the hypothalamo-pituitary ovarian axis leading to the complete absence or sub-optimal release of LH that is needed for ovulation and for embryo survival (Rhind, 1992, O'Callaghan and Boland, 1999, Dawuda *et al.* 2004). It has been shown that animal performance will increase if there is better feeding and management (Opara *et al.* 2005) and also variations in nutrient intake (both quality and quantity) that occurs in livestock farming systems have major effects on ovulation rate of sheep and goat (Doney *et al.* 1982) moderate effect in the pig (Aherne and Kirkwood, 1985); and minor or no effects in the rabbit (Partridge, 1989).

Rhind and McNeilly(1986) observed that increase in ovulation rate arising from improved body condition was accompanied by higher circulating concentrations of FSH and LH during the late luteal and follicular phases of the oestrous cycle. However, in other studies done by (Rhind *et al*., 1989; Xu *et al*. 2005) they found out that this was not the case; they observed that the influence of a high feeding level on ovulation rate appeared to be mediated by an enhanced LH pulse frequency during the follicular phase. It has also been reported that the high protein appears to enhanced LH pulse frequency and amplitude during the follicular phase, resulting in an LH surge and subsequent ovulation (Rhind *et al.* 1985). Therefore, inadequate nutrient especially

protein in both quality and quantity can be a major limiting factor in small ruminant reproduction especially in tropical Africa were nutrient supply is affected by seasonal changes. This study was designed to study the mechanism(s) whereby under nutrition affects reproductive performance of WAD goat in Nigeria.

MATERIAL AND METHOD

Study Location

This study was carried out at the University of Agriculture, Makurdi Benue State, Nigeria. Makurdi lies approximately on Latitude $7^0.44'$ N and Longititude $8^0.54'$ E, with a temperature range of 22.5 ^{0}C to 40 ^{0}C and an annual rain fall of 1,290 mm (Time and Tor, 2006).This study was conducted between October 2012 and April 2013.

Experimental design, oestrus synchronization and blood collection

Does were kept and fed their normal ratio diet for 4weeks to acclimatized prior to the start of the experiment. Does were then fed a supplemented diet containing varied levels of protein for 5 months. Thereafter, oestrus of all does were synchronized using intravaginal progesterone releasing device (CIDR) for 19 days before removal. Following CIDR removal a fertile buck was introduced to roam with the does. Oestrus was detected by visual observation in the morning (6-8am) and evening (5-7pm) for at less 2 hours for each occasion. Oestrus signs were recorded (a doe that stood to be mounted was considered to being in oestrus).Blood was collected through the jugular vein twice a week into non heparinised bottles from the period of acclimatization until the end of the experiment for the determination of progesterone in peripheral blood circulation. Blood samples were kept in ice pack and transported to the laboratory within 1 hour of collection where it was centrifuged and serum harvested and stored at –20^{0}C

Supplement preparation

Feed ingredients from raw materials such as maize offal, rice offal, soya bean cake; bone meal and salt were used to compound feeds. The chemical compositions of the feed supplement were determined by proximate analysis.

Experimental diets

Three (3) experimental diets designated T1, T2 and T3 representing high, medium and low crude protein levels of 28.24%, 18.94% and 10.03% respectively were formulated as presented in (Table1)

Table 1. Composition of experimental diets (kg)

Ingredient	T1	T2	T3
Soya bean cake	37.50	23.00	-
Rice offal	19.500	34.00	57.00
Maize offal	40.00	40.00	40.00
Bone meal	2.00	2.00	2.00
Salt	1.00	1.00	1.00
Total	100	100	100

Proximate analysis of the experimental diet:

The proximate analysis of the experimental diet is presented on Table 2

Table 2. Proximate analysis of the experimental diet

Composition	T1	T2	T3
Ash (%)	11.31	12.07	11.61
CP (%)	28.24	18.94	10.03
C F (%)	13.94	14.01	13.89
E.E(fat and oil) (%)	19.13	19.63	19.20
DM (%)	90.45	90.04	90.17
ME (KJ/kg	35.15	36.36	35.23

CP = Crude protein, CF = Crude fibre, DM = Dry matter, EE = Ether Extract, ME = Metabolisable Energy

Experimental animals

Animals were purchased from small holder goat farmers in Tarka on geographical positioning system (GPS) N 07.36302 and E 009.04538 and Guma on geographical positioning system (GPS) N 07.781760 and E 008.62059, Local Government Areas of Benue State. Fifteen adult WAD does aged 1-1½ years and a buck of 5 years old were selected based on the following characteristics that are common to WAD goat: -well proportioned small body size, with short broad legs, short head with a straight nose and upright ears. They are known to display variation in coat colour that ranges from black, brown, pied, mottled (Odubote, 1994a; Ozoje and Mbgere, 2002). Age was estimated using dentition (Wosu, 2002).

Housing

Animals were kept in a dwarf–walled corrugated roofed house covered with wire meshand divided into 3 sections (pens). Each pen was 6 by 10 meters. The three pens were provided with a large perimeter fence.

Management

On arrival animals were weighed using a weighing scale (by Harson Emperor's Model 89), faecal and blood samples were collected and screened for parasites. Animals with parasitic infestation were treated appropriately. The screening was repeated two weeks after first treatment to ensure the animals were all negative of gastrointestinal and blood parasites.Animals were kept for acclimatization for one month before the start of the experiment. Pregnancy examination by ballottement and

ultrasonography was carried out on the does to ensure that none of them was pregnant. During the period of acclimatization does were fed on grass, maize offal and salt lick for 4 weeks before nutritional treatment. During this period all animals received pestes des petits ruminants (PPR) vaccine manufactured by the National Veterinary Research Institute (NVRI) Vom, Jos, Plateau State. Nigeria as recommended by the manufacturer. Oestrus activity was monitored by visual observation, in the morning from 6 - 8 am and in the evening from 5 -7 pm, respectively. Mineral salt block and clean drinking water was provided ad-libitum. The animals were dewormed every month with albendazole suspension before synchronization of oestrus and mating.

Experimental period

The animals were identified with the use of ear tags and randomly assigned to three experimental groups. Five (5) does were allotted into each group and fed concentrate diets containing 28.24%, 18.94%, 10.03 % crude protein as supplement respectively. The buck was kept with the does throughout the experimental period.

Experimental groups and diet treatment

Group 1 (T1): This group was fed a concentrates diet at 5 % of their body weight in the morning before grazing. This diet provided a normal energy ration of 28.24 % crude protein daily throughout the experimental period.

Group 2 (T2): This group was fed a concentrates diet at 5 % of their body weight in the morning before grazing .This diet provided a normal energy ration of 18.94 % crude protein daily throughout the experimental period.

Group 3 (T3): This group was fed a concentrates diet at 5 % of their body weight in the morning before grazing. This diet provided a normal energy ration of 10.03 % crude protein daily throughout the experimental period.

Diet treatment lasted for six months (180 days).The end of this treatment period coincided with the end of the dry season and the beginning of the raining season. The rains promoted vegetation growth resulting in availability of lush forage. All animals were weighed weekly to measure their growth rate throughout the experimental period.

Definition of oestrus cycle lengths:

Oestrus cycle lengths were defined in this study to be either short, normal or long based on the following criteria.

Short oestrous cycle is the cycle that is less than 17 days

Normal oestrus cycle is the cycle that is form 17 – 25 days

Long oestrous cycle is the cycle that is greater than 25 days

Serum hormonal analysis

Enzyme-Linked Immunosorbent Assay (ELISA) kits (AccuBind, USA) and ELISA Reader (Dynextech, USA) were used to analyse for the presence of progesterone in the serum sample.

Data analysis

Data were analysed using one way ANOVA (Statistical Package for Social Science version 16 BMI-US) for oestrous cycle length, Values ($p < 0.05$)

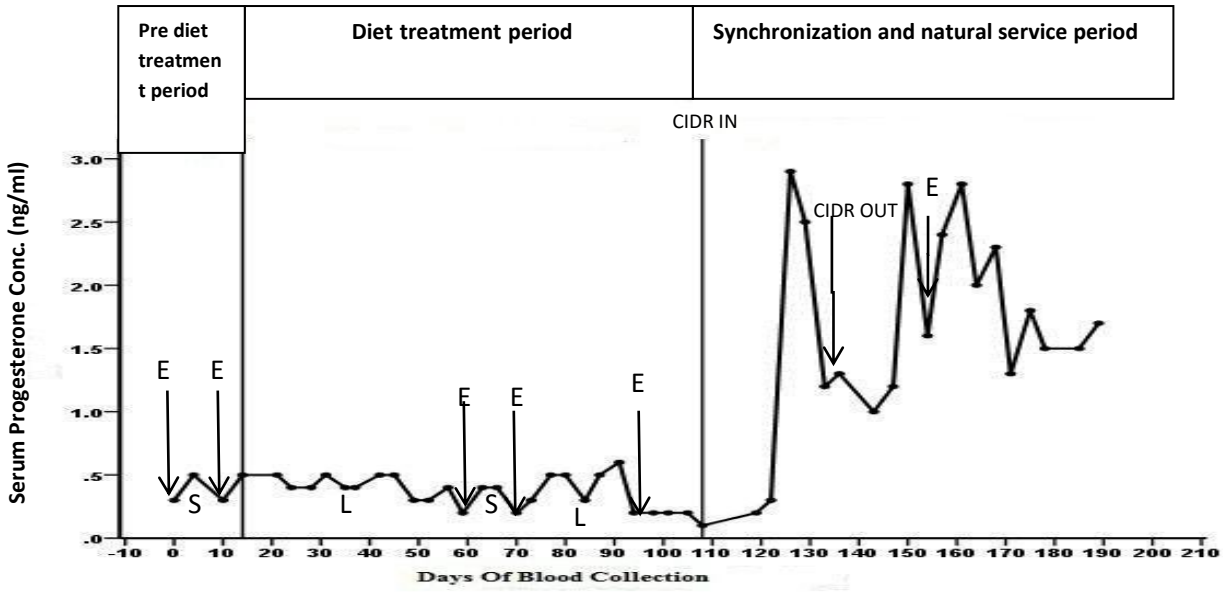
were considered statistically significant. Oestrus, conception, abortion, kidding and twining were analysed using one way ANOVA (X ± SEM) then subjected to chi-square.

RESULT

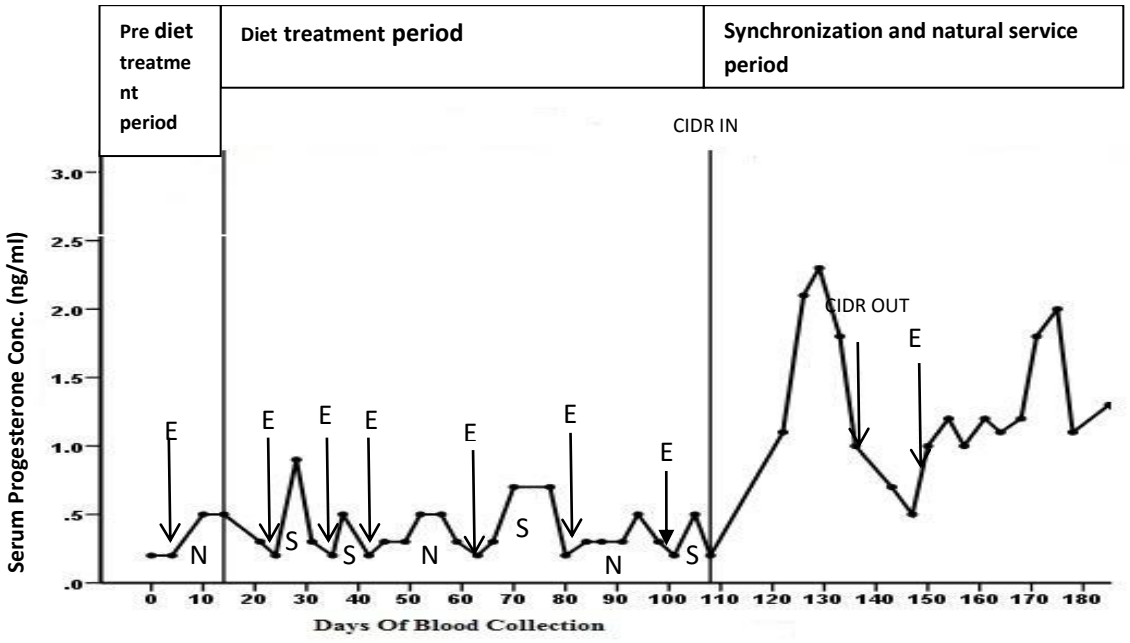
Effect of dietary protein level on ovarian activity and conception:

The does on high protein diet supplementation group had 3-6 oestrous cycles each before introduction of CIDR (Figure a, b, c, d, e). These oestrous cycles were short, normal or long. One animal had one short (10 days), one normal (25 days) and one long (45 days) oestrous cycles respectively (Figure1a). Another animal had two normal (20 and 25 days) and four short (10, 10, 10 and 15 days) oestrous cycles, respectively (Figure 1b). The third animal had one normal (24 days), three short (15, 15 and 15 days) and one long (30 days) oestrus cycles, respectively (Figure 1c). The fourth animal had one short (13days) and three normal (20, 21 and 25 days) oestrous cycles respectively (Figure 1d). The last animal in this group had two short (12 and 15 days) and one long (29 days) oestrous cycles, respectively (Figure 1e). Following CIDR withdrawal all does on high protein diet showed oestrus a day later. Five does were mated by a fertile buck. Following mating none of the does was seen on standing oestrus. This was confirmed by the high progesterone concentration less (Figure 1a, b, c, d, e).

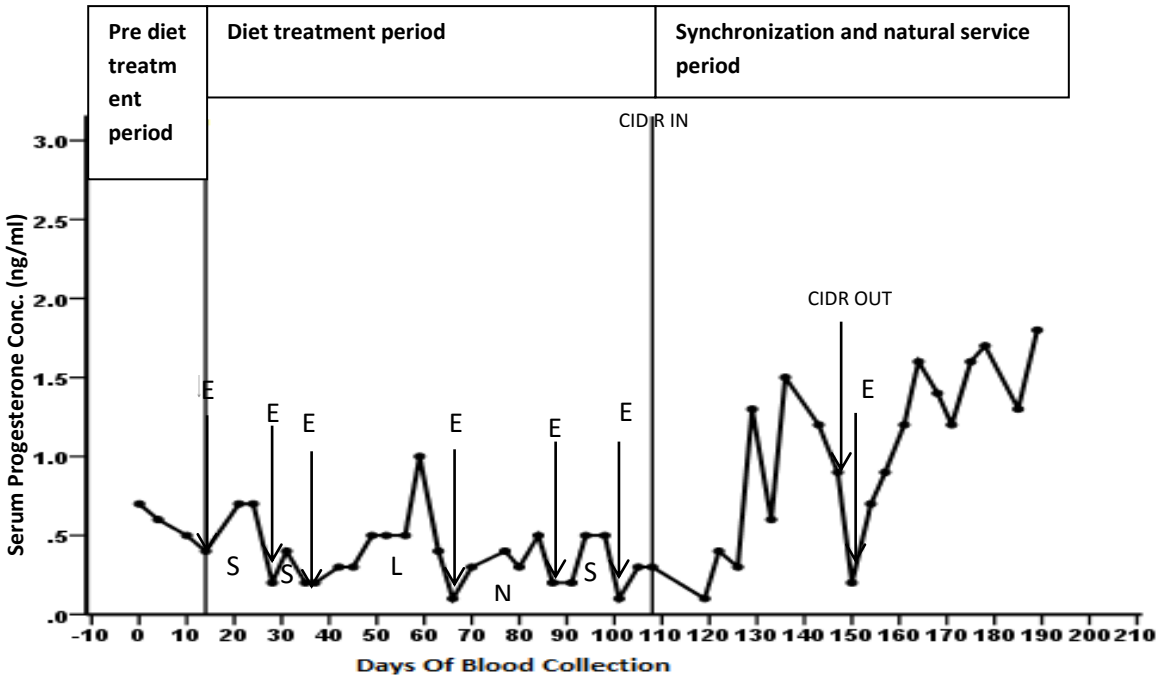
(a) Animal 344



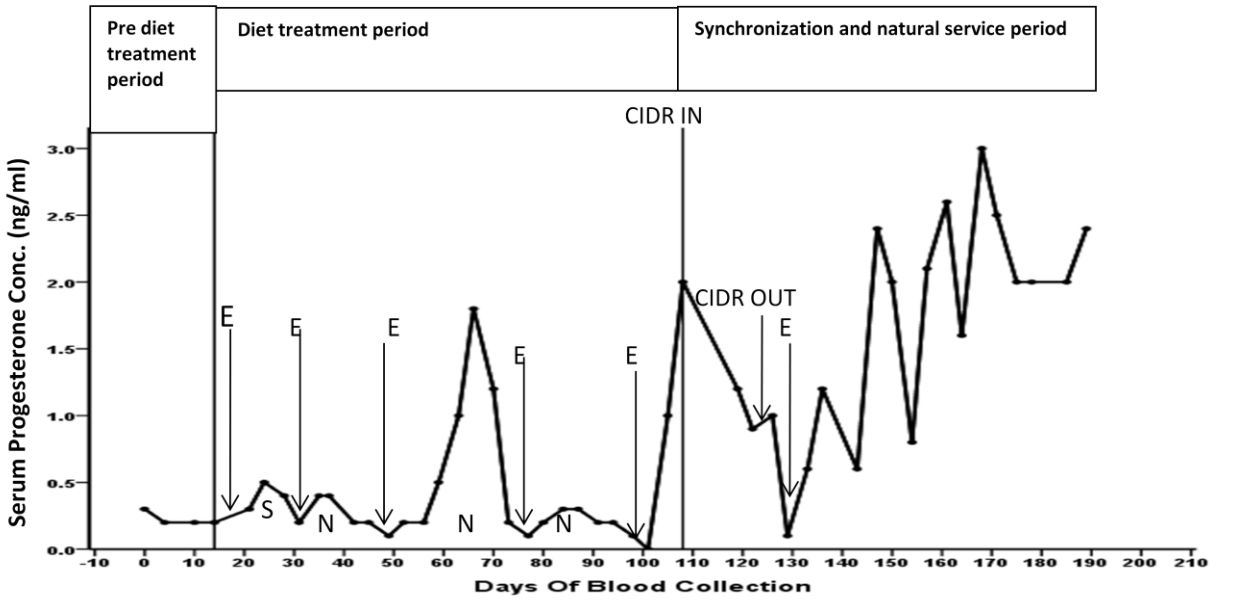
(b) Animal 345



(c) Animal 346



(d) Animal 348



(e) Animal 349

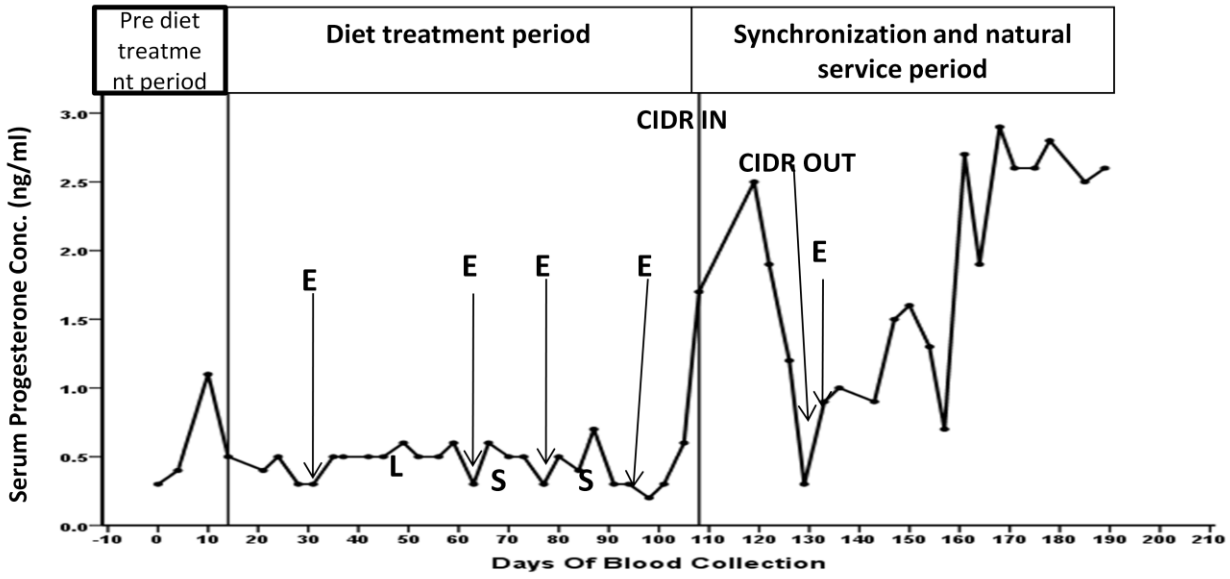
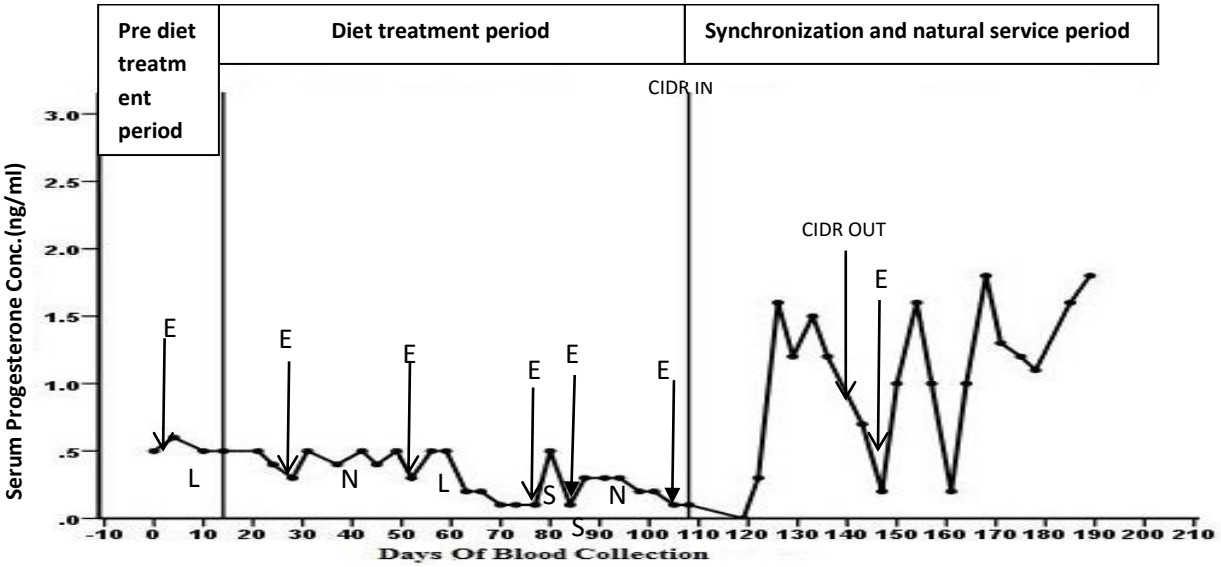


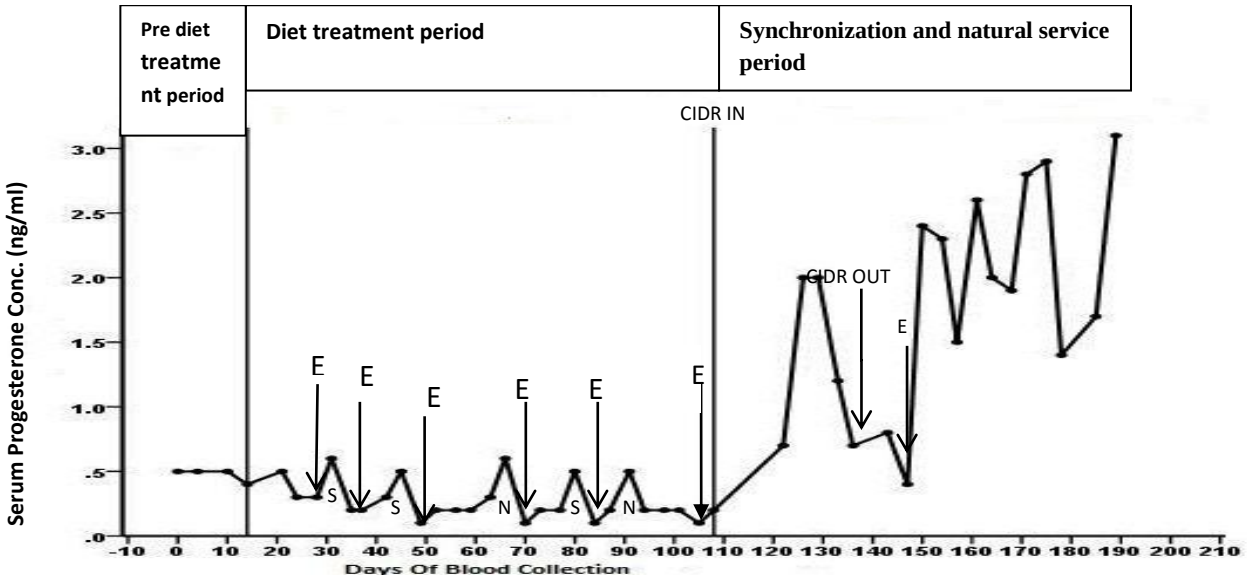
Figure 1. Serum progesterone concentration of five does (a, b c, d and e) on high protein diet supplementation. (E= Oestrus, CIDR IN= insertion of CIDR; CIDR OUT removal of CIDR, L= Long oestrus cycle, N= Normal oestrus cycle, S= Short oestrus cycle)

The does on medium protein supplementation group had 3-5 oestrous cycles, each before introduction of CIDR (Figure 2 a, b, c, d, e) these oestrous cycles were short, normal or long. One animal had one long (30 days), two normal (17 and 20 days) and a short (15 days) oestrous cycles, respectively (Figure 2a). Another animal had two normal (20 and 20 days) and three short (10, 15 and 15 days) oestrous cycles, respectively (Figure 2 b). The third animal had two long (30 and 40 days) and one short (15 days) oestrous cycles, respectively (Figure 2 c). The fourth animal had one short (10 days), two normal (18 and 21 days) and one long (30 days) oestrous cycles, respectively (Figure 2 d). The last animal in this group had two short (10 and 12 days), a normal (19 days) and a long (30 days) oestrous cycles, respectively (Figure 2 e). Following CIDR withdrawal all does in this group showed oestrus within 1-2 days later. These does were mated by a fertile buck. None of the those was seen on standing oestrus. This was confirmed by the high serum progesterone concentration (Figure 2 a, b, c, d, e).

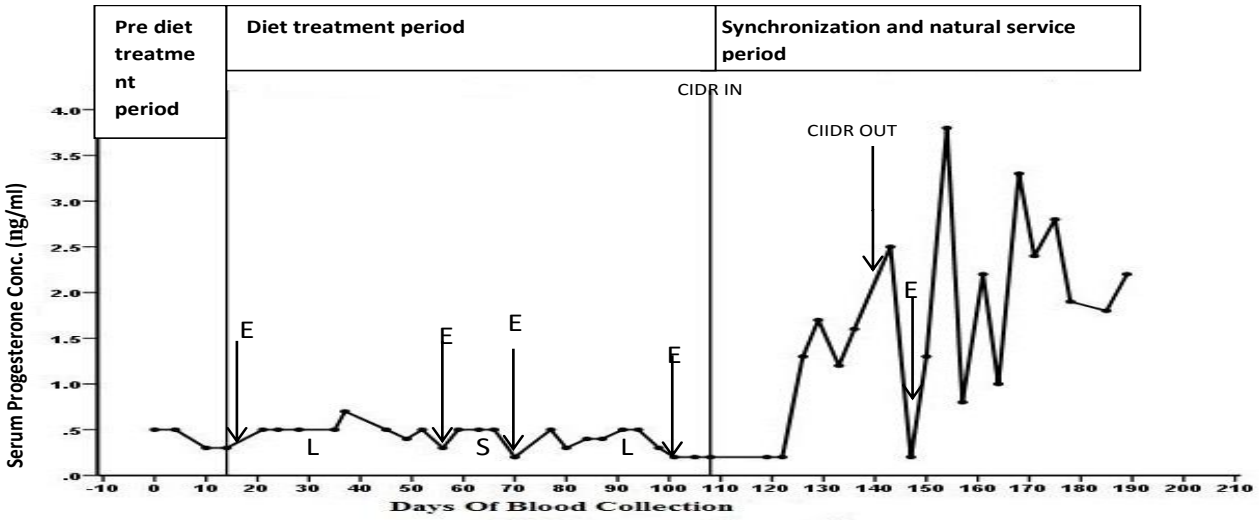
(a) Animal 337



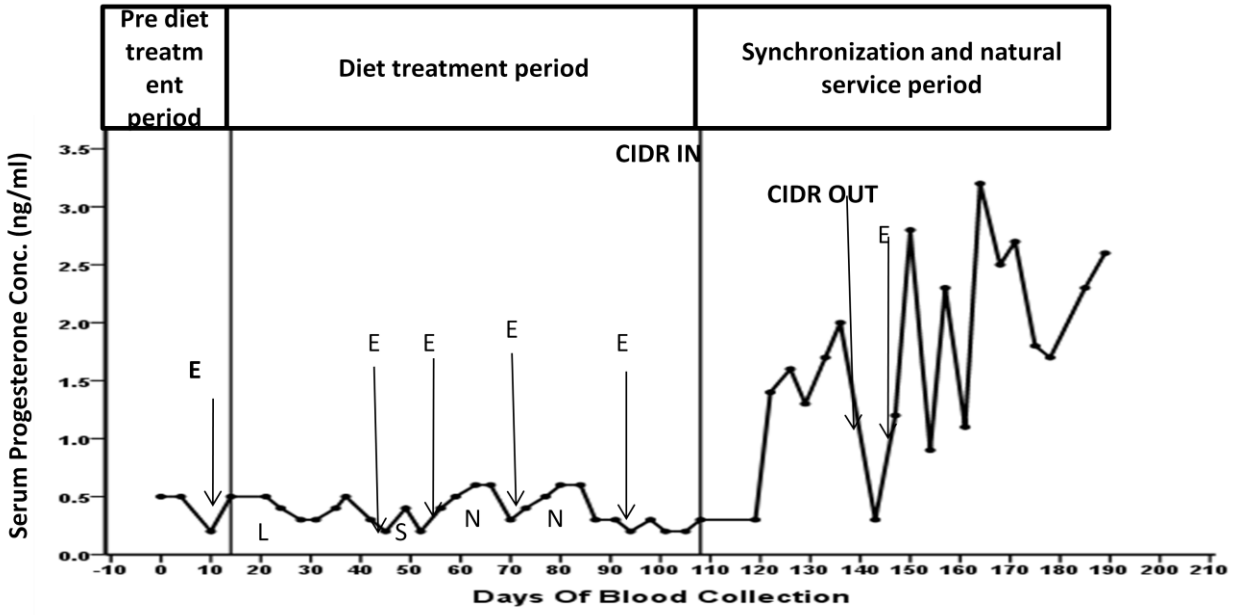
(b) Animal 338


Pre diet treatment period
Diet treatment period
Synchronization and natural service period
CIDR IN
CIDR OUT
E
S
N
Serum Progesterone Conc. (ng/ml)
Days Of Blood Collection

(c) Animal 339



(d) Animal 340



(e) Animal 343

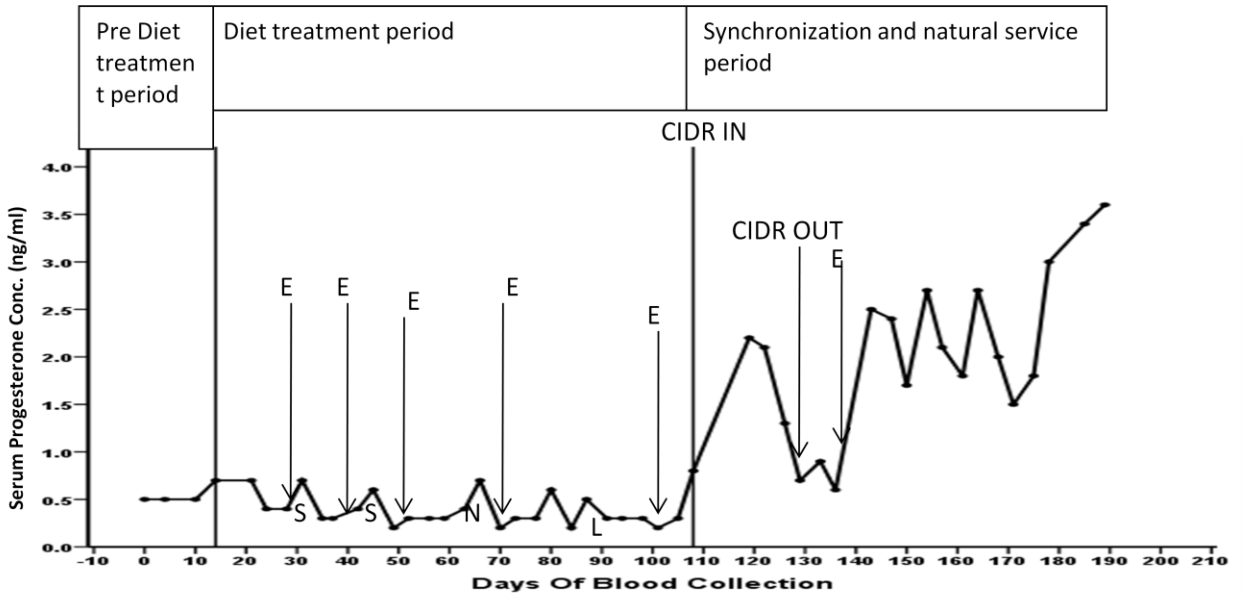
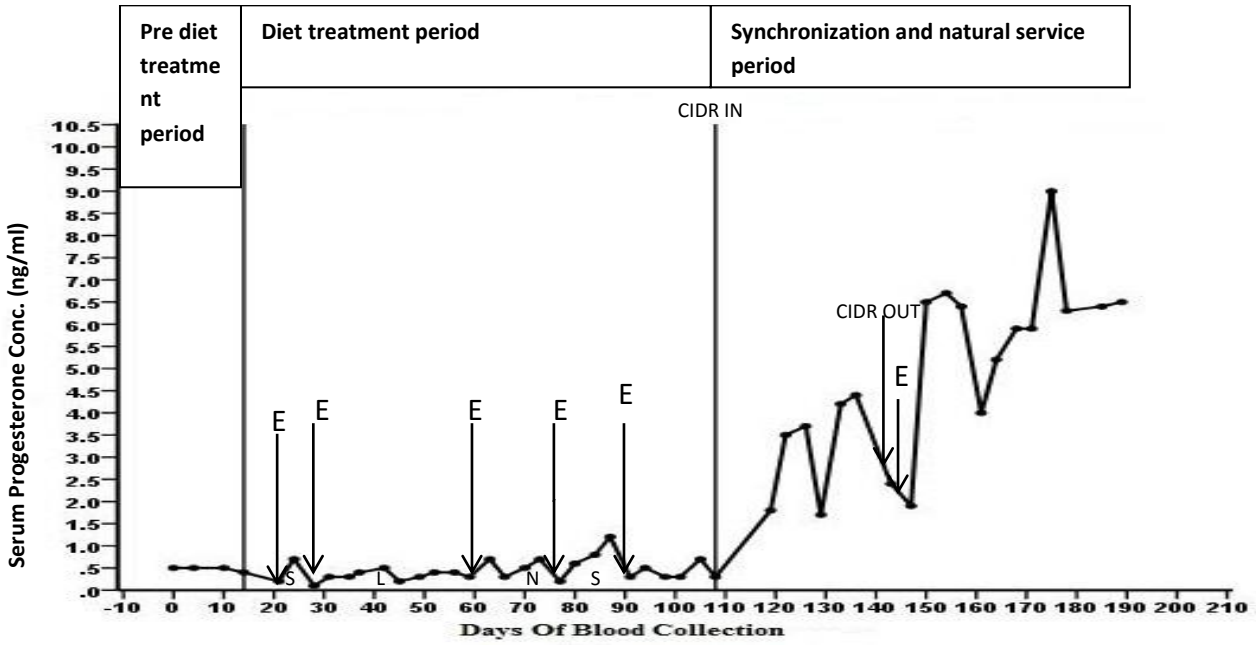


Figure 2. Serum progesterone concentration of five does (a, b c, d and e) on medium protein diet supplementation

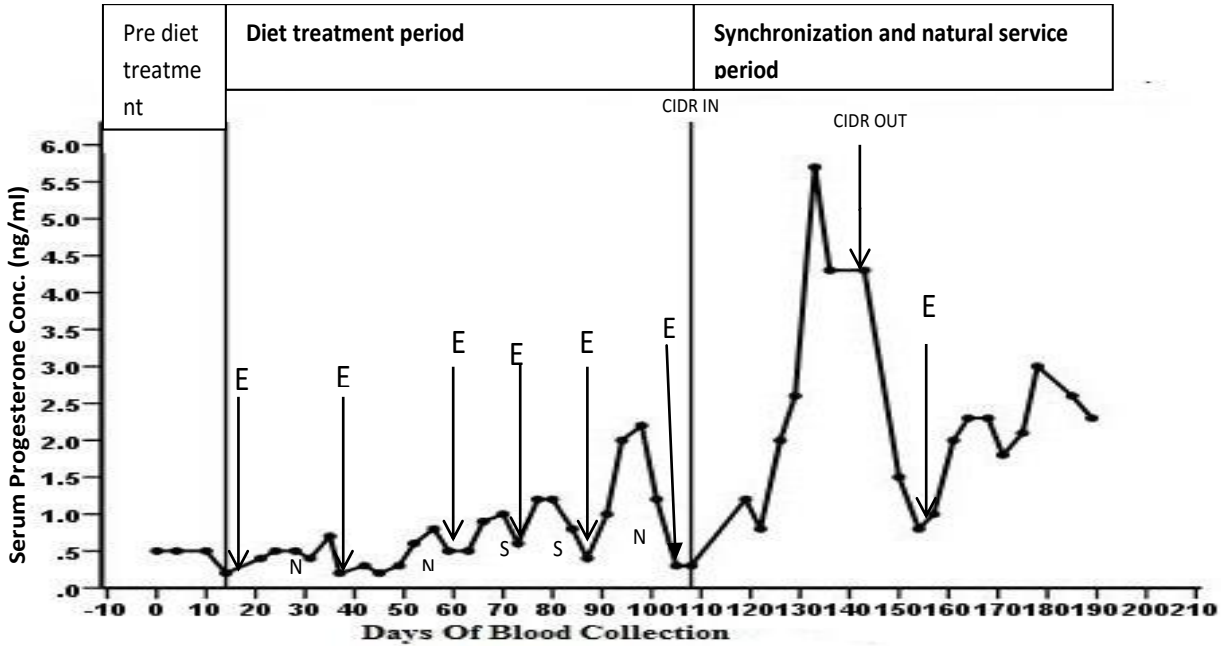
(E= Oestrus, CIDR IN = Insertion of CIDR, CIDROUT =Removal of CIDR, L= Long oestrous Cycle, N= Normal oestrous cycle, S= Short oestrous cycle)

Those on low protein supplementation diet had 4-5 oestrous cycles each before introduction of CIDR (Figure a, b, c d, e). These oestrous cycles were short, normal and long, respectively (Figure a, b, c, d, e). One animal had one normal (20 days), two short (10 and 15 days) and one long (40 days) oestrous cycles (Fig. 3 a). Another animal had two short (12 and 15 days), three normal (20, 20 and 22 days) oestrous cycles, respectively (Figure 3 b). Third animal had two long (38 and 40 days) and two short (10 and 10 days) oestrous cycles, respectively (Figure 3 c). The fourth animal had a short (11 days) a normal (20days) and a long (35days) oestrous cycles, respectively (Figure 3 d). The fifth animal had a short (10 days), two normal (19 and 21 days) and long (26days) oestrous cycles, respectively (Figure 3 e). Following CIDR withdrawal all does in this group showed oestrus 1-2 days later. These does were mated by a fertile buck. Four of these does was not seen on standing oestrus as confirmed by high serum progesterone concentration above 1 ng/ml (Figure 3 a, b, d, e). One animal returned to oestrus after mating as which was confirmed by the presence of low serum progesterone concentration below 0.5ng/ml (Figure 3 c).

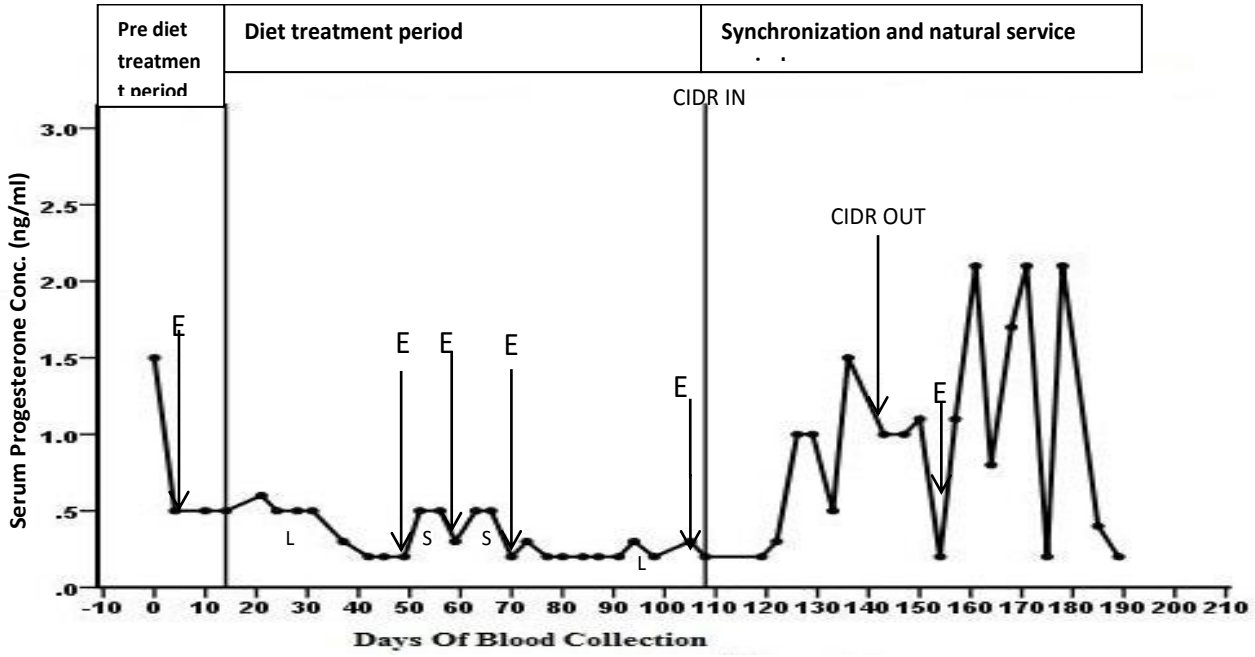
(a) Animal 332



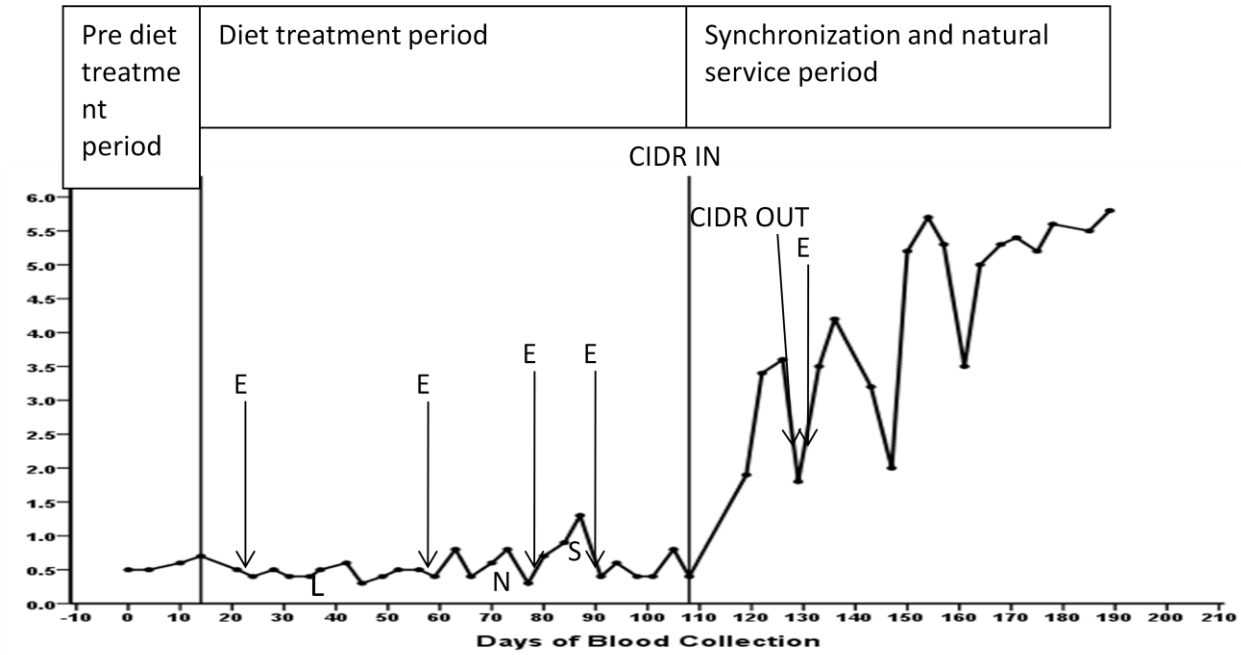
(b) Animal 333



(c) Animal 336



(d) Animal 334



(e) Animal 335

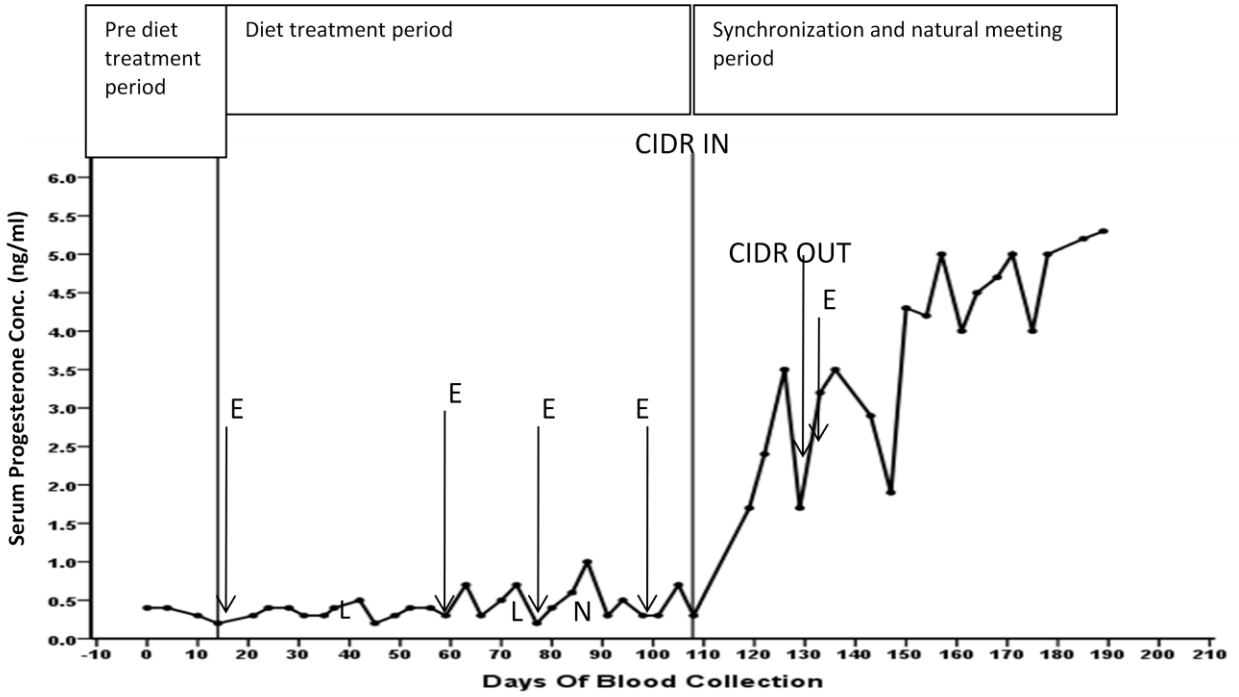


Figure 3. Serum progesterone concentration of five does (a, b, c, d and e) on low protein diet supplementation.

(E= Oestrus, CIDR IN= Insertion of CIDR, CIDR OUT= Removal of CIDR, L= Long oestrous cycle, N= Normal oestrous cycle, S= Short Oestrous cycle)

The summary of the oestrous cycle lengths is presented in (Table 3). The number of normal oestrous cycles, short oestrous cycles and long oestrous cycles did not vary significantly between treatment groups ($p > 0.05$). However, the total number of oestrous cycles differed significantly between treatment groups ($p < 0.05$) with T1 higher than T2 and T3 while T2 andT3 are similar.

Table 3. Effect of dietary protein levels on mean(X ± SEM) number of oestrous cycles lengths in WAD does

Parameters	T1	T2	T3
Normal oestrous cycles	1.8 ± 0.58	2.0 ± 0.58	1.3 ± 0.33
Short oestrous cycles	3.8 ± 0.49	3.0 ± 1.15	3.3 ± 0.33
Long oestrous cycles	0.4 ± 0.24	0.3 ± 0.33	0.3 ± 0.33

Total no. of oestrous cycles	6.0 ± 0.00[b]	5.3 ± 0.67[a]	5.0 ± 0.00 [a]

Values with different superscript on the same row are significantly different at ($p < 0.05$)

Effect of dietary protein levels on some reproductive indices in WAD does

The reproductive indices of WAD does is presented in Table 4. All animals on high protein supplementation diet conceived as confirmed by serum progesterone concentration. None of these animals return to oestrus after mating. All of these does kidded normally with three having twins. All kids in this group survived. All does on medium protein supplementation diet conceived as confirmed by serum progesterone. All does kidded normally. Two (2) does in this group had twins. However, out of the five (5) kids that were kidded in this group only two survived. Oestrus response, conception and kidding did not vary significantly among treatment groups. However, kid survival rate differed significantly between treatment groups T1 and T2; T1 and T3 but not between T2 and T3

Table 4 shows the effect of dietary protein levels on reproductive response of WAD does

Table 4. Effect of dietary protein levels on reproductive response of WAD does

Parameters	T1	T2	T3	Mean	± sem	χ^2- value	P – value	Remark
Oestrous response	5	5	5	3.67	0.667	0.727	0.695	NS
Conception	5	5	5	3.33	0.882	2.564	0.307	NS
Abortion	0	0	1	0.33	0.333	nil	nil	NIL
Kidding	5	5	3	3.00	1.155	2.667	0.264	NS
Twining	3	2	1	2.00	0.577	1.000	0.607	NS
Kids survival	8	5	4	3.67	0.186	7.818	0.020	Sig

($p<0.05$) NS = not significant, Sig. = significant

DISCUSSION

Protein supplementation has been a method used in improving animal production with many studies done on sheep and cattle but few on goats (Muktar *et al.* 2011). The current study has investigated this effect on West African Dwarf goats where three different protein levels of supplementation were used. The reproductive data obtained in the high and medium protein supplementation in the current study suggest that the calculated nutritional requirement was

adequate in meeting the estimated protein and energy requirements of 36.0 g or 6.0 % dry matter intake (DMI) and 5.50 MJ ME per day for does (Devendra and McLeroy, 1992; Peacock, 1996). The current results of the reproductive performance of this does indicate that concentrate supplement was rich enough to meet the energy (6-13 MJ/Kg DM ME: Steel, 1996) and digestible crude protein (16 – 18 %: Steel, 1996) concentrations in typical goat feed as well as the requirement of the does (Nix, 2004). Although not measured, the dry matter intake of the forage might perhaps, be less than expected because of reduction in grazing hours due to interruption by rainfall during the first month of the experiment. Steel (1996) reported that goats will stop grazing if disturbed by rain.

The oestrous cycles were classified according to Chemineaus *et al.* (1992) as short (>17 days), normal (17-25 days) or long (<25 days). When an increase in serum progesterone level above 1.0 ng/mL in two consecutive samples, was not preceded by observed oestrus behaviours it was considered to be a silent heat (Rivera *et al.* 2003). In this experiment the progesterone level on the day of oestrus was below 1.0 ng/mL which is in agreement with the findings in studies done by Bauernfeind and Holtz (1991) who reported that progesterone levels below 1.0ng/ml around oestrus suggested that in goats the coporalutea constituted the major source of the progesterone. Individual differences in progesterone levels during the luteal phase may be associated with different numbers and functional capacity of the coporalutea as indicated by Chemineau *et al.* (1992). The changes in progesterone level from day 4-19 after the onset of oestrus in West African Dwarf does are well accompanied with physiological events in goats. The average progesterone level of 0.70 ng/ml, and cyclic pattern reported in this experiment correspond with findings reported by Braun *et al.* (1988) for Nubian 0.68 ng/ml, Leyva-ocariz *et al.(*1995) for native 0.69 ng/ml and crossbred ANN(Alpine × Nubian × Native) goats 0.72 ng/ml, for Yankasa sheep 0.71ng/ml by Oyedipe *et al.* (1986).

The current study has demonstrated that animals in the three different groups showed short, normal and long oestrous cycles. Short oestrous cycles have been observed in does following parturition after prostaglandin F2α induced abortion, and following super ovulation associated with premature regression of luteal function (Camp *et al.* 1983). This premature regression of corpus luteum could be due to the distortion of hormonal imbalance along the hypothalamo-pituitary- ovarian axis. In the current study, the possible cause of distortion in oestrous cycle lengths could be due to the effect of different protein levels on the hypothalamo-pituitaty ovarian axis thereby causing hormonal imbalance that can cause prolonged, and short oestrous cycles. The current study indicates that there were fewer normal oestrous cycles in the low protein diet than either the medium or high. However, the total numbers of oestrus cycles (normal, long and short) in the three groups were not significant. This shows that the effect of plane of nutrient does not affect reproductive activity via oestrous cycle's manifestation.

In the current study one animal number 332 in the low protein supplementation group aborted twins in the third trimester. Previous studies by Vinoles (2003) reported that in females, the most prominent effect of under nutrition occur around the time of mating with carry over effects on embryo survival and twining rate. El-Hag *el al.* 1998 also reported that improved diet

has also improved lambing rate and reduced abortion rate. All does on high and medium protein supplementation did not abort and also kidded normally. The current study result agrees with these previous findings. Does in all experimental groups had twins. However, twining was better in the high protein supplementation group than the medium and low protein supplementation groups, respectively. From this work protein variation had effect on twining rate which is in agreement with the studies done by Muktar *et al.* (2011) who reported that protein supplementation improved twining rate. Sachdeva *et al.* (1973) also reported that good nutrition enhanced body weight with a resultant improvement in litter size in mature Indian goats. Kid survival was better in high protein supplementation than medium; while medium protein supplementation better than low. This could be as a result of the different protein level in the concentrate which gives a better birth weight, good milk let-down and hence better immunity against prevailing diseases that help kids' survival.

In conclusion, low protein level intake affected reproductive performance of West African Dwarf Does by lowering conception rate, twining rate, kidding and kid survival rate.

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REFERENCES

Aherne, F.X. and Kirkwood, R.N. 1985.Nutrition and sow prolificacy.*Journal of Reproduction Fertility Supplementation* 33: 134-136.

Bauernfeind, M. and Holtz, W. (1991). Progesterone and estrogen levels in serum of cycling goats measured by enzyme immune assay.*Small Ruminants Research,* 6: 95-102.

Braun, W.F. Solorzano,N.M.and C.J. Bierschiol, (1988). Characterization of caprine oestrus cycle using enzyme immunoassay for the determination of whole blood progesterone concentration. *Theriogennology.* 19:1155-1162.

Brown, B. W. (1994). A review of nutritional influence on reproduction in boars bulls and rams. *Reproduction Nutrition Development*, 34:89-114.

Camp, J.C. Wildt, D.E. Howard, P. K. Stuart, L.D. and Chakraborty, P.K. (1983).Ovarian activity during normal and abnormal length of oestrus cycle in the goat *Biological Records.,* 28: 678-681.

Chilliard, Y.Bocquier, F. and Doreau, M. (1998).Digestive and metabolic adaptations of ruminants to undernutrition, and consequences on reproduction.*Reproduction, Nutrition, Development,* 38:131–152.

Chemineaus, P., Daveau, A. Maurice, F. and Delgadillo, J.A. (1992). Seasonality of oestrus and ovulation is not modified by subjecting female Alpine goats to a tropical photoperiod. *Small Ruminant,* RES. 8: 299-312.

Dawuda, P.M. Scraramuzzi, R.J. Drew, S. B. Biggadike, H.J. Laven, R.A. Allison, R.and Collins, C.F. Wathes, D.C.(2004). The effect of a diet containing excess quickly degradable nitrogen (QDN) on reproductive and metabolic hormonal profiles of lactating dairy cows, *Animal Reproduction Science* 81,195-208.

Devendra, C. And McLeroy, G.B (1992). Goat and sheep production in the tropics.Longman Singapore Publishers, Singapore (ELBS). Pp. 37-45.

Doney, J.M. Gun, R.G. and Horak, F. (1982). Reproduction in sheep and goat, Pp. 57-80 [I.E Coop edition]. Amsterdam: Elsevier Scientific Publishing Company Draincourt M.A. Cohill L.P. and Bindon B.M. (1985). Overian follicular populations and preovulatory enlargements in Booroolaand controlMrino ewe. *Journal ofReproduction Fertility,* 73; 93.

El-Hag, F.M. Fadlalla, B. and Elmadih, M.A. (1998).Effect of strategic supplementary feeding on ewe productivity under range condition in north Kordofan, Sudan.*Small Ruminant Research;* 30; 67-71.

Lassoued, N. and Atti, N. (1996).Maitrise des techniques de Ielevage ovine en conditions difficiles. Report final du project PNM. N^{O} PS94 BIRD 6 Secretariat a la Recherche Scientifiqueet a la Technologie, Tunisia. 12: 52-55.

Lyva-Ocariz, H. Munro, C. and Stabenfeldt,G.H. (1995). Serum LH, FSH, estradiol-17 and progesterone profiles of native and crossbred goats in a tropical semiarid zone of Venezuela. Nutrient requirement of goats: Agora, dairy and meat goat in temperate and tropical countries. National academy press, Washington, DC. 13:49-58.

Luginbuhl, J.M. and Poore, M. (1998). Nutrition of meat goats' Animal Science fact, North Carolina state University. Pp. 1-3.

Martin, G.B.Rodger, J. and Blache, D. (2004).Nutritional and environmental effects on reproduction in small ruminants.*Reproduction Fertilization and Development.* 16 (94):491 – 501.

Muktar, Y.M. Aminu, I.M.and Midau, A. (2011). The effect of different supplements on birth weight and kid growth on Red Sokoto goat in Adamawa State, Nigeria.*Global Journal of Science,* Pp. 3-11.

Nix, J. (2004). Flushing does for the breeding season. *Journal of Applied Ecology.* Pp. 1092-1102.

O'Callaghan, D. and Boland, M.P. (1999). Nutritional effects on ovulation., embryo development and the establishment of pregnancy in ruminants. *Journal of Animal. Science,* 68: 299-314.

Odubote, I.K. (1994). Characterizationof the WAD goat for certain qualitative traits.*Journal of Animal production,* 21: 37-41.

Opara, M.N. Ukpong,U.M. and Okoli,I.C. (2005). Quantitative analysis of abattoir slaughtering of animal in AkwaIbom State. *Nigeria Journal of Agriculture Social Reseach*, 5; 118-125.

Oyedipe, E.O.Pathiraja, N. Edqvist, L.E. and Buvanendran,V. (1986). Onset of puberty and oestrouscycle phenomena in yankasa ewes as monitored by plasma progesterone concentrations. *Animal Reproduction Science,* 12: 195-199.

Ozoje, M.O. and Mgbere, O.O. (2002). Coat pigmentation effects in WAD goat; live weights and body dimensions.*Nigerian Journal of Animal Production,* 29; 5-10.

Partridge, G.G. (1989). Nutrition of farmed rabbits Proceedings of the Nutrition Society, 48:93-101.

Peacock, C. P. (1996). Improving Goat Production in the Tropics a manual for developing workers, Pp 8-13 Publish by Oxfam, UK and Ireland.(CTA series), London.

Rastagi, R. Srinivas, K. Supratin, D. Naidu, K. and Annd, S. (2006).Effecient gossip-based aggregation coputation POD,06 Proceedings of the twenty-fifth ACM, S, MOD-SIGART Symposium on Principles of data base system, Pp. 308-317.

Rhind, S.M. and McNeilly, A.S. (1986). Follicle population, ovulation rates and plasma profile LH, FSH and prolactin in Scottish Black face ewes in high and low levels of body condition. *Animal Reproduction Science,* 10: 105-115.

Rhind, S.M.Mcmillen, S. McKelvey, W.A.C. Rodriguez-Herrejon, F.F. and McNeilly, A.S.(1989). Effect of the body condition of ewes on the secretion of LH and FSH and pituitary response to gonadotrophin releasing hormone.*Journal of Endocrinology* 120:497-502.

Rhind, S.M.(1992). Nutrition: It effect on reproductive performance and as hormonal control in female sheep and goats in A.W. speedy (ed.) progress in sheep and goat research Elsevier, Amsterdam. pp. 25-50.

Rivera, G.M., G.A. Chaves, S.B. Fevrero and H. Morello.(2003). Seasonality of oestrus and ovulation in creole goats of Argentina.*Small Ruminant Research,* 48: 109-117.

Robinson , J.J. (1990). Nutrition in the reproduction of farm animals.*Nutritional Research Reviews,* 3: 253-276.

Satchdeva, K.K.Sengor, Q.P.S. Singh, S.N.and Lindahi, I.L. (1973). Studies on goat effect of the plane of nutrition on the reproductive performance of does.*Journal of Agricultural Science* Cambridge*,* 80: 375-379.

Smith, L.C. Olivera-Angel, M. Groome, N. P. Bhatia, B. and Price, C.A. (1991).Oocyte quality in small antral follicles in the presence or absence of a large dominant follicle. *Journal of Reproduction Fertility,* 106: 193 – 199.

Steel, M. (1996). The Tropical Agriculturist: Goats. Macmillian Education Ltd, London, Oxford (CTA series 3). Pp. 256-272.

Time, E. O. and Tor, T. (2006). The changing Rainfall pattern and its implication for flood frequency in Makurdi Northern Nigeria *Journal of Apply Science.Environmental Management.* Vol.10 (3) 97-102.

Vinoles, C. (2003). Effect of nutrition on follicle development and ovulation rate in the ewe.Doctoral Thesis.Swedish University of Agricultural sciences Uppsala.Pp.116-124.

Walkden-Brown, S.W .(2001). Reproduction in goats. *Animal Reproduction Science.* Pp 211-219.

Wosu, L.O. (2002). Veterinary hand book ISBN 978-36627-7-5 Pp. 44-43.

Xu, W.A. Kaelin, C.B. Takida, K., Akira, S. Schwartz, M.W. and Barsh, G.S. (2005). PI3K Integrate the action of insulin and leptin on hypothalamic neurons. *Journal of Clinical Investigation,* 115: 951 – 958.