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Effect of FSH+LH (Pergonal®) Treatment and Concentrate Supplementation on Haematology, Immune Status and Serum Metabolites of West African Dwarf Goats

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Abstract: A study was conducted to evaluate the physiological responses of 16 West African Dwarf goats to treatment of FSH+LH (Pergonal®) and concentrate supplementation on haematology, immune status and serum metabolites. The following treatment groups were used: T_1 (GC) = Basal feed+concentrate, T_2 (GO) = Basal feed no concentrate, T_3 (GCP) = Basal feed+pergonal+Concentrate. The results showed that the haematological values (Hb, RBC, WBC) did not differ significantly ($p>0.05$) between T_3 (GC), T_2 (GCP) and T_4 (GOP) treatment groups, but differed significantly ($p<0.05$) from T_2 (GO). However, the (PCV) did not show any significant difference ($p>0.05$) between the treatment groups. The haematological indices (MCV, MCH, MCHC) were similar ($p>0.05$) between treatments T_1 (GC), T_3 (GCP) and T_4 (GOP), but differed significantly ($p<0.05$) from T_2 (GO). The immune system (Neutrophil and lymphocytes) were similar ($p>0.05$) between treatments T_1 (GC), T_3 (CP) and T_4 (GOP), but were significantly different ($p<0.05$) from treatment T_2. The serum metabolites (Total serum protein, urea, albumin, globulin, cholesterol, creatinine) were not significantly different ($p>0.05$) between T_1 (GC), T_3 (GCP) and T_4 (GCP), but differed significantly ($p<0.05$) from T_2 The serum calcium was similar ($p>0.05$) between T_3 and T_4. However, they differed significantly ($p<0.05$) from T_1 and T_2. The parameters evaluated in this study fell within the range of values variously reported in the literature. The results of this study suggest that the hormonal treatment with or without concentrate supplementation enhanced the physiological and nutritional status of the goats.

Key words: Pergonal, haemastology, immune status, serum metabolites, goats

INTRODUCTION

The West African dwarf goats have small body size, poor growth and low reproductive performance. These characteristics make them an undesirable stock in a competitive economic situation (Iheukwumere *et al*., 2004). However, the West African dwarf goats hold some potentials if their reproductive performances can be improved. Improvement in reproductive performance of the West African dwarf goat is crucial to the socio-economic status of Nigerian rural dwellers. Natural hormones or their analogues are some of the ways of improving the reproductive performance of farm animals. Several commercial preparations of gonadotropins have been used in super-ovulatory protocols. Superovulation involves the use of Follicle Stimulating Hormone (FSH+LH), Pregnant Mare Serum Gonadotrophin (PMSG), synthetic prostaglandin e.g. cloprostenol (Nowshari *et al*., 1995; Pereira and Holtz, 1996; Senthilkumar *et al*., 1988). Herbert *et al.* (2000) indicated that these preparations are very expensive, require cold chain storage and often deteriorate because of inadequate storage and handling. There is, therefore, the need to examine some generic preparations that could induce the desired action in the animal but at the same time are cheap, readily available and easily managed under our conditions.

Human menopausal gonadotrophin (Pergonal®) is one of such preparations that induce ovulation in domestic animals. Pergonal is a lyophilized gonadotrophin and a preparation of Follicle Stimulating Hormone (FSH) in a ratio 1:1 (Dixon and Hopkins, 1996). LH and FSH present in Pergonal play vital role in multiple ovulations. Although, there are research findings on the superovulatory. Response of West African dwarf goats administered with FSH+LH (Pergonal®) (Iheukwumere *et al*., 2004; Herbert *et al*., 2000). It has not been determined if the administration of hormone preparation and concentrate supplementation would induce any side effects on the blood parameters of treated animals.

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This study was carried out to investigate the effects of Pergonal administration on the haematology, immune status and serum metabolites of West African dwarf goats.

MATERIALS AND METHODS

This study was carried out at the livestock Teaching and Research Farm of the Federal University of Technology, Owerri, Nigeria. The study took place during the dry season of the year between January and April.

Sixteen sexually mature and clinically sound parous 2-3 year old does of the West African Dwarf (WAD) breed were used in this trial. The 16 does were randomly divided into 4 treatment groups of 4 animals in each group. Each group was further replicated 2 times with 2 animals per replicate. Each animal in the replicates was randomly assigned to the following treatments: T_1 = Basal feed+concentrate (GC), T_2 = Basal feed without concentrate (GO); T_3 = Basal feed + Concentrate + Pergonal (GCP) and T_4 = Basal feed + Pergonal without concentrate (GOP).

The fresh fodder formed the basal diet and hence the control treatment. The concentrate supplement consisted of 0.5 kg of pelleted chicken growers mash and 0.5 kg wheat offal mixed together giving a total of 1.0 kg of concentrate was fed to the does receiving the concentrate feed. The animals were fed twice a day in the morning and evening. Salt licks were made available to the animals as mineral supplement. Water was liberally provided.

Administration of the hormone: Pergonal® otherwise known as pluset, a gonadotrophin preparation lyophilized in vials is a mixture of pituitary gonadotrophin consisting of Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH) in a ratio of 1:1 (Dixon and Hopkins, 1996) was used. Each vial contains the hormones as 75 IU FSH+75 IU LH. The does on T_3 (GCP) and T_4 (GOP) received the same level of hormonal treatment, thus 1st day 27.0 IU FSH+27.0 IU LH. 2nd day 17.50 IU FSH+17.50 IU LH, 3rd day 13.50 IU FSH+13.50 IU LH.

All hormonal treatments were administered intramuscularly on the hind leg of each doe using a 1 mL syringe with 0.02 mL graduation.

Blood collection and haematological analysis: The does were bled between 9.00 am and 10.30 am twice weekly from the jugular vein for 2 weeks. Two milliliters of each blood sample was poured into Ethylene Diamine Tetra Acetic Acid (EDTA) treated Bijou bottles for haematological evaluation. The remaining 5 mL of each blood sample were allowed to coagulate to produce sera for serum metabolites evaluation. Serum samples were analyzed within 2 h of their collection.

Erythrocyte (RBC) and leucocyte (WBC) counts were determined as described by Tuffery (1995). Packed cell volume and haemoglobin concentration were measured by the microhaematocrit and cyanmethaemoglobin methods. The red cell indices-Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculatedas described (Lazzaro, 2003). The immune system (neutrophil and lymphocyte counts) were determined as described by Tuffery (1995).

Serum metabolites evaluation: The Total Serum Protein (TSP) was determined as described by Kohn and Allen (1995); while albumin was determined by using Bromocresol Green (BCG) method as described by Peters *et al.* (1982). Cholesterol (determined from fresh blood) and other serum metabolites assay such as creatinine and urea concentrations were done following the methods described by Baker and Silverton (1985). The standard flame photometry using Gallenkamp analysis was used to determine calcium ions as described by the methods of Baker and Silverton (1985).

Data analysis: All the data collected from this study were subjected to analysis of variance Steel and Torrie (1980), when means showed significant differences, they were separated by the Duncan's New Multiple Range Test as described by Obi (1990).

Table 1: Effect of FSH+LH (Pergonal) and concentrate supplementation on haematological parameters and immune system of West African Dwarf goats

	Treatments			
Parameters	T_1	T_2	T_3	T_4
PCV (%)	25.24±1.45	20.35±1.01	28.00±1.0	27.54±1.51
Hb (g dL^{-1})	0.10±0.51^a	7.25±0.18^b	11.15±0.20^a	10.20±0.58^a
RBC ($\times 10^6$ mL^{-1})	17.75±1.40^a	13.24±1.02^b	18.54±1.65^a	17.00±1.34^a
WBC ($\times 10^3$ mL^{-1})	7.45±0.13^b	12.25±1.54^a	8.10±0.32^b	9.15±0.17^b
MCV (fl)	21.56±1.51	18.95±1.63	24.03±1.56	23.20±1.73
MCHC (g dL^{-1})	36.40±1.68^a	30.00±1.41^b	37.16±1.95^b	35.25±1.70^b
Neutrophil (%)	22.00±0.65^b	23.00±0.56^a	22.00±0.62^b	22.00±58^b
Lymphocytes (%)	72.00±1.65^b	78.00±1.84^a	74.00±1.65^b	74.00±1.63^b

a' b: Means within rows having different superscripts are significantly different ($p<0.05$)

RESULTS AND DISCUSSION

The results of the haematological and immune system values of West African does following treatments with T_1 (GC), T_2 (GO); T_3 (GCP) and T_4 (GOP) are shown in Table 1. There were no significant differences($p>0.05$) between the groups in packed cell volume. PCV values ranged from 25.24±1.45% in T_1 to 28.0±1.0% in T_3 treatments Higher PCV values of 28.0±1.0% was observed in goats fed on T_3 (GCP) diets. This value was higher than 23.10±0.75% reported by Iheukwumere (2006) and lower than the value 31.00±3.76% reported by Tambuwal *et al.* (2002) in Red Sokoto goats. The marked differences in PCV values may be attributed to breed variations (Aba-Adulugba and Joshua, 1996); nutritional and physiological status of the animal (Esonu *et al.*, 2001). Plasma haemoglobin concentration showed no significant differences ($p>0.05$) between goats fed on T_1 (GC), 9.10±0.51, T_3 (GCP) 11.15±0.20 and T_4 (GOP) 10.20±0.58 g dL^{-1}, however, they differed significantly ($p<0.05$) from T_2 (GO) 7.20±0.1 g dL^{-1}. Higher haemoglobin 11.15±0.2 g dL^{-1} was observed in goats fed on T_3 (GCP) diets. This value was lower than the value 13.2±2.3 g dL^{-1} reported by Taiwo and Ogunsami (2003) for WAD goats. However, the value was close to the average value 10.07±9.26 g dL^{-1} reported by Iheukwumere *et al.* (2005) in West African dwarf goats. Haemoglobin concentration in the blood has been associated with availability of nutrients in the animal body (Esonu *et al.*, 2001). It is possible that the gonadotrophin and concentrate supplementation increased metabolism and efficient of nutrients. Erythrocyte counts (RBC) ranged from T_4 (GOP) 17.0±1.34×10^6 μL^{-1} to T_3 (GCP) 18.54±0.65×10^6 μL^{-1} and were similar ($p>0.05$) to T_1 (GC) 17.75±1.40×10^6 μL^{-1} however, they differed significantly ($p<0.05$) from T_2 (GO) 13.24±1.02×10^6 μL^{-1} in RBC count. The white blood cell counts were similar between the treatment groups T_1 (GC) 7.45±0.13, T_3 (GCP) 8.10±0.32 and T_4 (GOP) 9.15±0.17×10^3 μL^{-1}, however, they differed significantly ($p<0.05$) from T_2(GO) 12.25×10^3 μL^{-1} in white blood cell counts. Higher white blood cell counts were observed in goats fed on T_2 (GO) 12.25±1.54×10^3 μL^{-1}. However, the values obtained in this study were higher than the value 7.29±0.56×10^3 μL^{-1} reported by Iheukwumere (2006) in West African Dwarf goats, but falls within the range 4.0-13.7×10^3 μL^{-1} reported by Lazzaro (2003) for goats.

Mean Corpuscular Volume (MCV) was similar ($p>0.05$) among the T_1 (GC) 21.56±1.51 fL, T_3(GCP) 24.03±1.56 fL and T_4 (GOP) 23.20±1.73 fL but they differed significantly ($p<0.05$) from T_2 (GO) 18.95±1.65 fL in which showed the least value in MCV. MCV values obtained in this study ranged from T_2 (GO) 19.95±1.63 to T_3 (GCP) 24.03±1.56 fL.

This value was lower than 37.50±1.50 fL reported by Aba-Adulugba and Joshua (1990). MCV is an indication of the average volume of a red blood cell (Lazzaro, 2003). It is unclear how the treatment may have altered this parameter in the blood of the animals. There were significant differences ($p<0.05$) in Mean Corpuscular Haemoglobin Concentration (MCHC). MCHC was lowest in T_2 (GO) 30.0±1.41 g dL^{-1}, but differed significantly ($p<0.05$) from T_1 (GC) 36.40±1.68, T_3 (GCP) 37.16±0.95 and T_4 (GOP) 35.25±1.73 g dL^{-1}. The highest MCHC value of 37.16±1.95 g dL^{-1} was observed in goats fed on T_3 (GCP) diets. This value was higher than 32.30±0.5 g dL^{-1} reported by Tambuwal *et al.* (2002) in Red Sokoto goats but similar to values of 36.60±2.30 g dL^{-1} reported by Iheukwumere *et al.* (2006) in West African Dwarf goats. There were significant differences ($p<0.05$) between treatment groups in Neutrophil values. Goals fed on T_1 (GC) 22.00±0.65% and T_3 (GCP) 22.00±0.62% and T_4 (GOP) 22.00±0.58% were similar ($p>0.05$), but they differed significantly ($p>0.05$) from T_2 (GO) 22.00±0.56% in neutrophil values. The lymphocyte values were significantly different ($p<0.05$) between the treatment groups. The goats fed on T_1 (GC) 72.00±1.65%, T_3 (GCP) 74.00±1.65% and T_4 (GOP) 74.00±1.65% and T_4 (GOP) 74.00±1.63%, however, they differed significantly ($p<0.05$) from goats fed on T_2 (GO) 78.00±1.84% in lymphocyte values. The higher values of neutrophil observed in T_2 (GO) 23.00±0.56% was within the range 15.6-43.9% reported by Mitruka and Rawnsley (1977) and the higher lymphocyte observed in goats fed on T_2 (GO) 78.00±1.843% falls within the range 43.9-81.2% reported by Iheukwumere *et al.* (2005). Immune status is a function of leucocytes, neutrophils and lymphocytes. Lymphocytes are known to play key roles in immune defence system. in both man and animals. The similarity observed in neutrophils and lymphocyte values of goats fed on the hormone concentrate supplementation and without concentrate was an indication that the feeding pattern was not detrimental to the functioning of the immune system. This observation agrees with the reports of Butchar and Miles (2004) that most of immunological abnormalities observed in malnutrition are usually corrected after nutritional rehabilitation.

The results on the effects of FSH+LH concentrate supplementation on serum metabolites of West African Dwarf goats are shown in Table 2. There were no significant differences ($p>0.05$) in total serum protein between goats fed on T_1 (C) 7.85±0.28, T_3 (GCP) 8.95±0.15 and T_4 (GOP) 8.45±0.18 g dL^{-1}, but they differed significantly ($p<0.05$) from T_2 (GO) 5.16±0.13 g dL^{-1} in

Table 2: Effects of FSH±LH (Pergonal) and concentrate supplementation on serum metabolites of WAD goats

	Treatments			
Parameters	T_1	T_2	T_3	T_4
Total protein (g dL^{-1})	7.85±0.28^a	5.15±0.13^b	8.85±0.15^a	8.15±0.18^a
Urea (mg dL^{-1})	6.30±0.32	6.01±0.13	6.50±0.06	6.34±0.14
Albumin (g dL^{-1})	4.25±0.11^a	3.15±0.18^b	4.15±0.11^a	4.07±0.15^a
Globulin (g L^{-1})	11.50±0.54^a	8.75±0.44^b	10.53±0.46^a	10.35±0.51^a
Cholesterol (g dL^{-1})	2.10±0.05^a	1.48±0.06^b	2.35±0.14^a	2.25±0.16^a
Creatinine (g dL^{-1})	5.75±0.72^a	4.72±0.74^b	5.25±0.68^a	5.48±0.70^a
Calcium (mmol $L0^{-1}$)	2.10±0.07^b	2.30±0.04^a	2.25±0.06^{ab}	2.25±00.08^{ab}

a' b: Mean within row having different superscripts are significantly different ($p<0.05$)

total serum protein. Lower Total Serum Protein (TSP) was observed in goats fed on T_2 (GO). It has been observed that serum protein content depends on both the quantity and quality of protein supplied in the diet (Iyayi and Tewe, 1998). There were no significant differences ($p>0.05$) in serum urea values. The results show that goats fed on T_3 (GCP) 6.50±0.06 and T_4 (GOP) 6.34±0.14 mg dL^{-1} did not differ significantly ($p>0.05$) from the other treatment groups. It has been observed that serum urea content depends on the quantity and quality of protein supplied in the diet (Iyayi and Tewe, 1998). The highest serum albumin was observed in goats fed on T_1 (GC) (4.25±0.11 g dL^{-1}), while the lowest value of 3.15±0.18 g dL^{-1} was observed in goats fed on T_2 (GC) diets. Goats fed on T_1 (GC), T_3 (GCP) and (T+4+ GOP) were similar in albumin levels of the serum. However, goats on T_2 (GO) 3.15±0.18 g dL^{-1} recorded lower albumin levels. This level was however, higher than the value (2.32±0.37 g dL^{-1}) reported by Tambuwal *et al.* (2002) in Red Sokoto goats.

Goats fed on T_2 (GO) 8.75±0.44 g L^{-1} recorded the lowest value in serum globulin. The highest value (11.50±0.54 g L^{-1}) in serum globulin was obtained in goats fed on T_1 (GC). Goats fed on T_1 (GC), T_3 (GCP) and T_4 (GOP) were similar ($p>0.05$) in serum globulin levels. The lowest value 8.75±0.44 g L^{-1} was observed in goats fed on T_2 (GO) diets. This value was lower than the value 22.07±0.37 g L^{-1} reported by Arello and Mays (1998) in goats. Low albumin suggests poor clotting ability of the blood and hence poor prevention of hemorrhage (Robert *et al.*, 2000). A decrease in serum globulin is an indication of reduction in the disease fighting ability of the body system and this could result to mortality (Iheukwumere *et al.*, 2005). There were no significant difference ($p>0.05$) between goats fed on T_1 (GC) 2.10±0.65 (g dL^{-1}), T_3 (GCP) 2.35±0.14 and T_4 (GOP) 2.25±0.16 g dL^{-1} in cholesterol level of the serum, they differed significantly ($p<0.05$) from goats fed on T_2 (GO) 1.48±0.06 g dL^{-1} in cholesterol levels of the serum. The lower value of serum cholesterol observed in this study (1.48±0.06 g dL^{-1}) was lower than 2.35±0.05 g dL^{-1} reported by Iheukwumere (2004). Cholesterol in the serum has been associated with the quantity and quality of protein supplied in the diet (Esonu *et al.*, 2001). The serum creatinine levels followed the same pattern as in the serum cholesterol. Higher serum creatinine was observed in goats fed on T_1 (GC) 5.75±0.72 g dL^{-1}. Muscle wasting has been shown to be the source of excess creatinine in the blood of animals and is normally due to creatinine phosphate catabolism during this process (Bell and Patterson, 1992).

The serum calcium was similar ($p>0.05$) between T_3 (GCP), 2.25±0.06 and T_4 (GOP) 25.25±0.16 and T_4 (mmol L^{-1}), however, they differed significantly ($p<0.05$) from T_1 (GC) 2.10±0.07 and T_2 (GO), 2.30±0.04 mmol L^{-1}. Higher serum calcium level observed in T_2 2.30±0.04 (mmol L^{-1}) was higher than the value 2.00±0.06 mmol L^{-1} reported by Iheukwumere *et al.* (2004) in West African dwarf goats. The similarity observed in goats fed on T_3 (GCP) and T_4 (GOP) indicates probable electrolyte balance in the animal body caused by gonadotrophin administration. This observation is in agreement with the reports of Iheukwumere *et al.* (2004) in goats.

CONCLUSION

From the results of this study, it can be concluded that although the main intention for the administration of FSH+LH (Pergonal) and concentrate supplementation to cyclic WAD does was to stimulate superovulation, the action led to changes in haematological, immune status and serum metabolites of the animals. Even though most of the values obtained, fell within normal ranges for adult WAD does, there is need to continuously monitor the blood profiles of WAD does under superovulatory treatment using Pergonal supplemented with concentrate diets.

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