

Investigation into the Hematological and Liver Enzyme Changes at Different Stages of Gestation in the West African Dwarf Goat (*Capra hircus* L.)

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Abstract: An investigation into the hematological and biochemical changes at different stages of gestation was conducted using ten intact adult female West African Dwarf goats (*Capra hircus* L.). Animals were synchronized and allowed to be mated naturally by proven buck. Whole uncoagulated blood and serum samples were collected before gestation (day 0), day 50, day 100 of gestation and first day of parturition. There were no statistically significant differences ($p>0.05$) between the mean values of the packed cell volume (%), hemoglobin (g/100 mL) and mean corpuscular hemoglobin concentration (g/mL) when the values before gestation (day 0) were compared with the values at day 50, day 100 of gestation and first day of parturition. Erythrocyte values at day zero differed significantly ($p<0.05$) from the values at day 100 and at parturition while the total leukocyte count at day zero differed significantly ($p<0.05$) from the values at day 50, 100 and day of parturition. Liver enzyme assay showed no significant difference ($p>0.05$) in the values obtained for Alkaline Phosphatase (ALP), while Serum Glutamic Oxaloacetic Transaminase (SGOT) on day zero (111.50 ± 15.42 iu/L) was significantly higher ($p<0.05$) than day 50 (124.50 ± 24.30 iu/L) and day 100 (86.50 ± 18.14 iu/L); Serum Glutamic Pyruvic Transaminase (SGPT) value on day zero (17.00 ± 4.32 iu/L) was significantly lower ($p<0.05$) than the value at parturition (50.50 ± 15.78 iu/L). In conclusion, WAD goats may be susceptible to liver damage during gestation. This study will serve as baseline data for comparison in cases of nutritional deficiency, disease conditions, and studies of gestation period, being of immense value to animal breeders and veterinarians.

Key words: Hemogram, goats, liver function test, pregnancy, West African dwarf

INTRODUCTION

Goats (*Capra hircus* L.) are multipurpose animals that produce milk, skin, meat and hair. They are able to thrive as meat producers under conditions which other animals may find difficult (Oyeyemi *et al.*, 2001). Goat production in Nigeria makes a major contribution to the agrarian economy (Daramola *et al.*, 2005). They are valued mainly for their meat and milk; the skin, wool and hair also strengthen its economic basis in many parts of the world (Oyeyemi and Akusu, 2002). Goats are of great economic value in the tropics and about 80% of world's goat population is present in this region. In Nigeria, the goat population is about 23.2 million heads and remains the most abundant among the ruminants (Adigwe and Fayemi, 2005).

Benefits derived from goats are far below the expected due mainly to low productivity brought about by a number of factors, such as drought, malnutrition and diseases. For example, diseases constitute a great

impediment to small ruminant production, resulting in a mortality rate of 36.2% in the old Bendel state, Nigeria (Adejinni *et al.*, 2004). The West African Dwarf (WAD) goats are found in the region south of latitude 14°N across West Africa in the coastal area, which is humid and favors high prevalence of diseases. The eco-zone is infested with tsetse fly and the dwarf goats thrive well and reproduce with twins and triplet births in the ecological niche, thereby satisfying a part of the meat requirement in this region (Daramola *et al.*, 2005). Other factors associated with mortality include low birth weight, low milk production, bad management system, predators, diseases and accidents. Mortality is most crucial from birth to weaning. Serum biochemistry and hematological analysis have been found to be important and reliable means for assessing an animal's health status (Otesile *et al.*, 1991), and might give an indication of the degree of damage to host tissue as well as severity of infection (Otesile *et al.*, 1991). Different studies have reported the effect of pregnancy and lactation on the hemogram of WAD goats

(Makinde *et al.*, 1983), also, the effect of age and sex on the hemogram (Daramola *et al.*, 2005), but careful electronic search did not reveal any documentation of the hemogram profile at different stages of gestation in the WAD goat. This study is aimed at assessing the hemogram and some liver enzymes (namely Serum Glutamic Oxaloacetic Transaminase (SGOT), Serum Glutamic Pyruvic Transaminase (SGPT) and Alkaline Phosphatase (ALP) at different stages of gestation, especially at the stages of fetal growth. It is hoped that the results for this study will be of clinical value to veterinary practitioners.

MATERIALS AND METHODS

Animals: Ten adult (18 months and above) female goats were used for this study. Ageing was determined by teeth eruption. The animals were clinically examined and showed no reproductive inability or deformity. They were housed in the small ruminant unit of the Department of Veterinary Surgery and Reproduction of the University of Ibadan. The University of Ibadan is about 6 km to the North of Ibadan city at longitude 3°54'E and latitude 7°26'N at mean altitude of 277 m above sea level. The annual rainfall is about 1200 mm, most of which fall between April and October, and a dry season from November and March (Oyeyemi and Fayomi, 2011). The temperature of Ibadan ranges from 21°C in the rainy season to 34°C in the dry season, while the relative humidity ranges from 71% in the dry season to 88% in the rainy season (BBC Weather, 2010). They were acclimatized for 3 weeks before the commencement of the experiment, de-wormed with Levamisole hydrochloride (Levadex®, Pantex Holland) by subcutaneous injection and also vaccinated against Pestes des Petit Ruminant (PPR) with PPR vaccine (Nigerian Veterinary Research Institute, Vom, Nigeria) at a dose of 1 mL per animal through intramuscular injection. After acclimatization, the estrus cycle was synchronized with Prostaglandin F2 α (Dinoprost Tromethamine, Lytalyse®, UpJohn Ltd, UK) 5 mg/mL. Animals were allowed to graze on pasture consisting of carpet grass (*Axonopus campresous*), guinea grass (*Panicum maximum*), elephant grass (*Pennisetum purpureum*). They were given dry cassava peelings (*Mannihot esculata*) which were sundried and supplemented with concentrate containing 3.86% crude protein, 10.6% crude fiber and 227.45 cal/kg.

Blood collection: Blood samples were collected via the external jugular vein from each animal into plain universal bottles and bottles containing Ethylene Diamine Tetra-acetic Acid (EDTA) to obtain serum and uncoagulated blood for biochemical and hematological analysis respectively. Blood samples were collected

before mating, at 50 days of gestation, 100 days of gestation and first day of parturition.

Hematology and liver enzyme assay: Erythrocyte count, leukocyte count, hemoglobin, Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Hemoglobin Concentration (MCHC) were all determined according to the method described by Schalm *et al.* (1975) while liver enzymes Serum Glutamic Oxaloacetic Transaminase (SGOT), Serum Glutamic Pyruvic Transaminase (SGPT) and Alkaline Phosphatase (ALP) were determined according to the method described by Achliya *et al.* (2004).

Statistical analysis: The data obtained were presented as mean \pm standard deviation. Data obtained were subjected to Student t-test using Graph pad Prism Software version 4. Tests were carried out at 95% level of confidence ($p < 0.05$).

RESULTS

Body weight: The body weight at days 0, 50, 100 and parturition were 19.60 \pm 0.55, 23.85 \pm 0.99, 28.29 \pm 0.23 and 24.68 \pm 0.11 kg, respectively.

Hematology: There were no statistically significant differences ($p > 0.05$) between the mean values of the PCV (%), hemoglobin (g/100 mL) and MCHC (g/mL) when the values before gestation (28.00 \pm 3.65%, 7.53 \pm 3.09 g/mL, 26.37 \pm 9.76 g/dL, respectively) were compared with the values at day 50 (33.75 \pm 2.87%, 10.33 \pm 0.96 g/100 mL, 30.58 \pm 0.42 g/dL, respectively), day 100 (30.00 \pm 2.94%, 9.83 \pm 0.92 g/100 mL, 32.77 \pm 0.84 g/dL, respectively) of gestation and at the first day of parturition (31.00 \pm 1.15%, 9.90 \pm 0.23 g/100 mL, 31.95 \pm 0.44 g/dL, respectively). The erythrocyte counts ($\times 10^6/\mu\text{L}$) at day zero (5.78 \pm 3.03 $\times 10^6/\mu\text{L}$) did not differ significantly ($p > 0.05$) from day 50 (18.83 \pm 27.47 $\times 10^6/\mu\text{L}$) but differed significantly from the values at day 100 and parturition (56.25 \pm 4.97 $\times 10^6/\mu\text{L}$ and 30.00 \pm 7.07 $\times 10^6/\mu\text{L}$, respectively) (Fig. 1).

For the MCV, no significant difference ($p > 0.05$) occurred between day zero (58.14 \pm 24.55fl) and day 50 (65.71 \pm 16.17fl), but the value before pregnancy (58.14 \pm 24.55fl) was significantly higher ($p < 0.05$) than that obtained on day 100 (5.37 \pm 0.50fl) and the day of parturition (10.74 \pm 22.33fl) (Fig. 2). The total leukocyte count (/mm³) at day zero (5,700 \pm 621.83/mm³) was significantly lower ($p < 0.05$) than the values obtained on day 50 (13,850 \pm 754.98/mm³), day 100 (13,900 \pm 3039.74/mm³) and also the first day of parturition (13,750 \pm 4349.33/mm³) (Fig. 3).

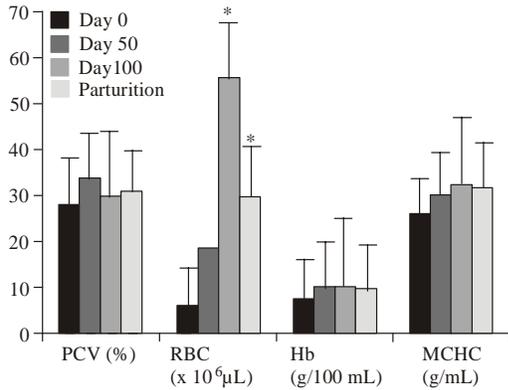


Fig. 1: n (number of animals) =10. Mean values for PCV, RBC, Hb and MCHC at different stages of gestation and at first day of parturition in WAD goats. Data represent means ± SD of group averages, *Indicates statistically significant difference compared to values at day 0, where p<0.05

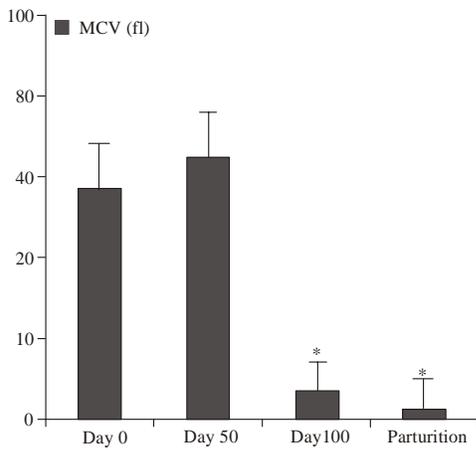


Fig. 2: n (number of animals) = 10. Mean values for MCV at different stages of gestation and at first day of parturition in WAD goats. Data represent means±SD of group averages. *Indicates statistically significant difference (higher or lower) compared to values at day 0 (p<0.05)

Liver enzyme assay: The results of the liver enzyme assay revealed that ALP showed no significant difference (p>0.05) between day zero (439.25±176.68 iu/L), day 50 (355.25±87.23iu/L), day 100 (370±126.80iu/L) and after parturition (513.00±143.42 iu/L). For SGPT, no significant difference (p>0.05) occurred between days zero (17.00±4.32 iu/L), 50 (33.50±14.82 iu/L) and 100 (37.00±22.42 iu/L), but the value obtained at day zero (17.00±4.32 iu/L) was significantly lower (p<0.05) than the value obtained on the day of parturition (50.50±15.78 iu/L). The SGOT analysis revealed that the value obtained at day zero (111.50±15.42 iu/L) was significantly lower (p<0.05) than that obtained on day 50 (124.50±24.30

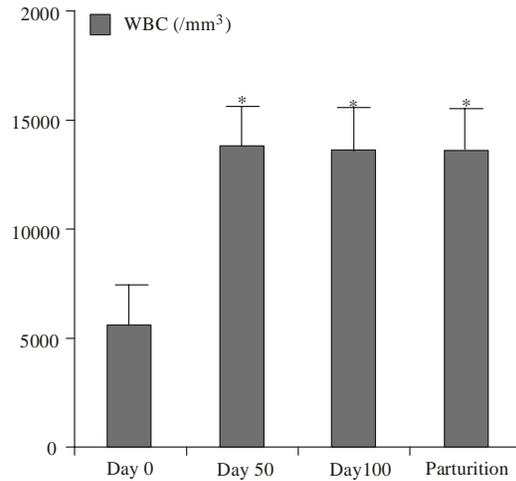


Fig. 3: n (number of animals) =10. Mean values for WBC at different stages of gestation and at first day of parturition in WAD goats. Data represent means±SD of group averages. *Indicates statistically significant difference compared to values at day 0 (p<0.05)

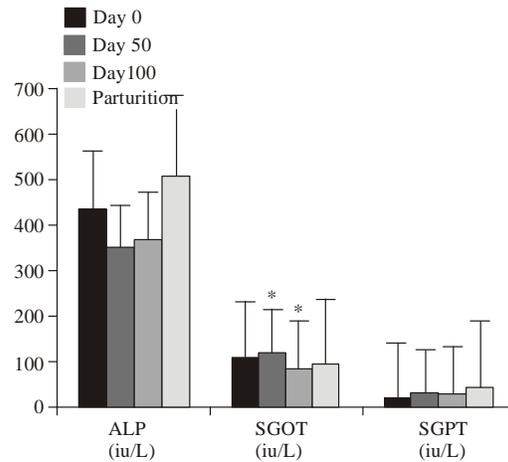


Fig. 4: n (number of animals) =10. Mean values for ALP, SGOT AND SGPT at different stages of gestation and at first day of parturition in WAD goats. Data represent means ± SD of group averages. *Indicates statistically significant difference compared to values at day 0 (p<0.05)

iu/L), but significantly higher (p<0.05) than that obtained on day 100 (86.50±18.14 iu/L), while no significant difference (p>0.05) was observed between day zero (111.50±15.42 iu/L) and the day of parturition (94.25±10.28 iu/L) (Fig. 4).

DISCUSSION

The values obtained for the body weight, PCV and Hb values are similar to those obtained by Makinde *et al.*

(1983) also in non-pregnant, pregnant and lactating West African goats, although their experiment did not consider different stages of gestation. The increase in body weight observed after the onset of gestation is to be expected and is a case seen in all mammals. This increase is primarily due to the weight of the developing fetus, and to body weight growth and storage in animals that have not attained maximum growth before getting pregnant (Durotoye and Oyewale, 2000). It can also be inferred from this study that an increase/decrease in body weight was accompanied by an increase/decrease in leukocyte count, hemoglobin and MCHC values. With the exception of the MCV value, which was lowest at parturition, all the other hematological parameters showed values that were higher during gestation and at parturition relative to the non-pregnant state. This observation is in consonance with the report of Durotoye and Oyewale (2000), who reported an increase in hematological parameters in pregnant and lactating West African Dwarf ewes relative to non-pregnant or non-lactating ewes, and rams. This increase observed may probably be due to increased erythropoiesis as reported in pregnant goats (Makinde *et al.*, 1983), sheep (Durotoye and Oyewale, 2000) and cow (Reynold, 1953). This differs greatly from what obtains in humans, where pregnancy can be accompanied by hydremia and anemia (Reynold, 1953). The increase in leukocyte count at days 50 and 100 could also be due to physiological stress induced by pregnancy. This may show that immunity is suppressed during pregnancy, since according to Jain (1993), changes in total and differential leukocyte count and erythrocyte parameters and indices are pointers to various disease processes even at subclinical levels.

The decrease in RBC, Hb and MCHC and also the increase in WBC at parturition relative to day 0 is consistent with the findings of Makinde *et al.* (1983) who reported the same in goats after withdrawal of 30% of the calculated blood volume, via the jugular vein to simulate hemorrhage. This is also consistent with similar report in the horse (Torten and Schalm, 1964). These observations are due to the movement of intestinal fluid into the vascular system to replace fluid volume lost through hemorrhage (Oyewale *et al.*, 1997). In our experiment, the blood loss was due to parturition.

The ALP values were considerably higher than those obtained by Oduye and Adadevoh (1976) in non-pregnant sheep, while the SGPT values obtained pre-partum were similar to those reported in Nigerian sheep by Oduye and Adadevoh (1976), and in WAD goats by Daramola *et al.* (2005). The increased SGPT observed post-partum could possibly be due to the parturition hemorrhage, as this has been reported to result an increase in SGPT level (Benjamin, 1978). The SGOT values obtained at days 50 and 100 were statistically significantly higher ($p < 0.05$) than the value obtained at day 0, while no statistically significant differences were observed in the SGPT values

for days 0, 50 and 100 ($p > 0.05$), but between days 0 and at parturition ($p < 0.05$). These observations may possibly indicate an increased tendency for liver damage to occur during pregnancy. This is supported by the report of Alemu *et al.* (1977), that liver damage in ruminants often result in high serum SGOT levels and only slightly raised SGPT levels. ALP and SGOT levels were observed to fluctuate till parturition, while SGPT level increased consistently till parturition.

CONCLUSION

This study highlights the hematological and liver function test changes in the three major stages (trimesters) of pregnancy. In spite of the fact that goats are a major source of meat protein to the Nigerian populace and reared in a good number of homes especially in the rural areas, they are usually reared extensively, and left to roam and graze around for fodder. This makes them susceptible to picking up toxins, leading to increased physiological stress and potential or subclinical liver damage. As much as intensive rearing is not always practicable in a developing economy, it is advisable that goats are reared semi-intensively so as to provide more viable kids, prevent economic wastage due to abortion and miscarriages and therefore sustain a viable source of food and protein for the populace.

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