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Haematology of pregnant West African dwarf ewes fed siam weed-based rations

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Target Audience: Animal Scientists, Livestock Farmers, Physiologists

Abstract

There is relatively scanty information on normal blood values for sheep in Nigeria as regards the nature and the level of forage inclusion in the diets. The study was set up to assess the effects of siam weed on blood chemistry of pregnant West African Dwarf (WAD) sheep. Sixteen WAD sheep that have lambed once were allocated in a completely randomized design to four diets with different levels of siam weed leaf meal (SWLM) diets inclusion: 0 % (Diet A), 15 % (Diet B), 30 % (Diet C) and 45 % (Diet D). Variations in haematological parameters due to treatments were inconsistently significant except for Erythrocyte/ red blood cell (RBC). The Leukocyte/ white blood cell ($mm^3 \times 10^3$) varied from 5.64 (diet B) to 8.81 (diet A) in the last trimester. The lowest packed cell volume (28 %) was obtained for sheep on 30 % siam weed leaf meal (SWLM). Erythrocyte values were low ranging between 5.71 and 6.37. White blood cell was normal and ranged from 5.64 in 15 % to 8.81 in 0 % SWLM. The values for packed cell volume slightly increased in animals on diets 0 % and 45 % SWLM at the end of pregnancy while those of 15 % and 30 % remained normal. Mean corpuscular volume (ranged 47.50 – 53.25) was beyond the normal range at late pregnancy. The results showed that pregnant sheep could tolerate the siam weed leaf meal at levels between 15 and 45 % dietary inclusion without a significant alteration of the blood constituents.

Key words: Haematology, pregnancy, sheep, Siam weed leaf meal.

Description of problem

Blood acts as a transport medium carrying its constituents to various organs of the body. It absorbs nutrients into the plasma through the intestinal circulation and waste products of metabolism are filtered off into the urine through the kidneys. In addition, certain blood cells provide a defense mechanism against invasion of the body by pathogenic agents. Payne et al (15) established that poor growth may be brought about by limitation in dietary intake of a particular nutrient and the latter may affect the blood chemistry. On this note, it is paramount to always examine the functionality of blood at intervals, more so when a relatively new diet such as siam weed, is introduced to ruminants.

One major problem of forage legumes for livestock in the tropics is the presence of secondary metabolites, which could result in physiological, metabolic and anatomical disorders. Siam weed (*Chromolaena odorata*) is a shrub weed found almost in every part of Nigeria. Siam weed was earlier discovered and introduced as a possible fodder crop in Nigeria (18) but also later incorporated into poultry diets as a source of carotene and plant protein (11). Although siam weed is relatively low in crude fiber, it could be better utilized by herbivores. However, the plant was said to contain nitrates resulting in the death of cattle following the ingestion of the leaves in

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certain parts of the Philippines (9). It is often difficult to assess the correct health status of an animal without recourse to an examination of its blood (8). This is because the composition of blood in different animal species is reasonably constant and falls within the normal range that can be prescribed for any particular breed (6). The usefulness of normal haematological values in assessing the health status of ruminants has been established (13, 12) as anaemia in ruminants is not a primary disease symptom but some defects in feeding or parasitic infestation.

There are relatively few reports on normal blood values for sheep in Nigeria and baseline data on normal haematological values of Nigerian sheep breeds ought to be compiled. Payne *et al.*, (16) reported the existence of variations in the haematological values of different goat breeds in India. Variations also existed between Indian goat breeds and those of European and American origin. The spleen of sheep for example, stores about 500-800 ml of concentrated red blood cells (3). Under stressful condition, this can be released into the circulation, giving rise to variations in haematological values. Tewe et al (12) reported that the purpose of investigating blood composition is to have a way to distinguish normal states of stress. The present study was carried out to observe the changes in haematological values with advancing pregnancy in West African Dwarf (WAD) sheep when fed siam weed-based rations.

Table 1 Ingredient compositions of the siam-based diets fed the pregnant animals

	Rations			
Ingredients (%)	A	B	C	D
Wheat bran	45.0	30.0	15.0	0.00
Siam weed leaf meal	0.0	15.0	30.0	45.0
Cassava peel flour	32.0	32.0	32.0	32.0
Palm kernel cake	10.0	10.0	10.0	10.0
Groundnut cake	10.0	10.0	10.0	10.0
Mineral supplement	3.0	3.0	3.0	3.0

Table 2 Chemical compositions of siam weed-based rations fed WAD sheep

Constituents (%)	Diets			
	A	B	C	D
Dry matter	90.48	90.51	92.11	92.06
Crude protein	16.20	16.63	17.10	17.50
Crude fiber	13.50	14.00	14.95	16.00
Ether extract	4.70	5.37	6.15	6.89
Ash	5.30	6.20	6.96	8.69
Nitrogen free extract	60.30	57.80	54.84	50.92

Materials and methods

Management of animals

Sixteen (16) West African dwarf ewes, aged 3 - 4 years and weighing 23 – 27 kg were selected from the flock of sheep bred at the Teaching and Research farm, University of Ibadan. Under semi-intensive management, the sheep were daily grazed in *Panicum maximum* (var Nshisii) paddocks, then housed at night and given concentrate supplementation with dry cassava peelings. The flock was routinely dewormed with banmith and albendazole and later dipped against ticks and fleas using di-asuntol. The animals were also treated with antibiotics at the onset of the rains and vaccinated against *peste de petit ruminantes* (PPR). Every 2-years, the animals were treated with Berenil against blood parasite infestation. They were constantly provided with mineral licks and identified with neck tags. The ewes were randomized into four groups with four animals assigned to each of four experimental rations (Table) comprising siam weed leaf meal (SWLM) based diets A (0 % SWLM), B (15 % SWLM), C (30 % SWLM) and D (45 % SWLM).

Blood collection

The first blood sample was collected from the animals six months after they were placed on the dietary treatments. Thereafter, it was collected once a month from each animal at 0800 hr by jugular vein-puncture into bijou bottles containing ethylene- diamine- tetra-acetic acid (EDTA) at 1.5 mg/ml of blood as anticoagulant. The first sample was collected three days prior to mating. Each subsequent sample was taken at the same time each month till parturition.

Total red blood cell (RBC) and white blood cell (WBC) counts were determined. The packed cell volume (PVC) was determined by microhaematocrit method. Haemoglobin (Hb) values were estimated by the alkali- haematin method according to Schalm (19). Values of RBC were determined by the microscopic method in a counting chamber after dilution with Hayem's solution. Estimation of WBC was done in the improved Neubauer haemocytometer chamber using 2 % acetic acid as diluent. The mean corpuscular value (MCV) and mean corpuscular haemoglobin concentration (MCHC) were calculated mathematically from values of PCV, Hb and RBC as described (19).

Chemical composition and statistical analysis

Crude protein, crude fibre, ether extract and ash of the Siam weed-based diets were determined as described (1). Data were subjected to analysis of variance (20). Statistical significance between means was determined according to Duncan (4) multiple range F-test.

Results and Discussion

Haematological values for WAD ewes fed Siam weed-based rations during pregnancy are shown in Tables 3 – 8. Variations observed in haematological indices due to treatments were significant ($P<.05$) except for RBC values in the 5th month. PCV values at the 1st, 3rd and 4th months, Hb values in the 1st and 5th month, MCV values at the start and 5th months and WBC values

Table 3: Red blood cell ($mm^3 \times 10^6$) of WAD ewes fed Siam weed-based rations during pregnancy

Month of pregnancy	Diets			
	A	B	C	D
0	5.27 ± 0.61^{ab}	6.21 ± 1.25^{b}	4.96 ± 0.44^{a}	4.36 ± 0.24^{a}
1	5.69 ± 0.33^{a}	7.24 ± 1.59^{b}	6.39 ± 0.94^{ab}	5.32 ± 0.30^{a}
2	4.72 ± 0.44^{ab}	5.99 ± 1.45^{b}	4.29 ± 0.59^{a}	4.85 ± 0.41^{ab}
3	7.40 ± 1.14^{b}	7.21 ± 0.85^{b}	6.65 ± 0.34^{ab}	5.03 ± 0.50^{a}
4	7.01 ± 0.34^{ab}	6.65 ± 1.48^{ab}	5.80 ± 1.18^{a}	7.65 ± 0.41^{b}
5	6.37 ± 0.86	5.71 ± 0.90	5.96 ± 1.57	6.23 ± 0.84

^{a,b} Means on the same row with different superscripts are significantly different (P<.05)

Table 4 White blood cell ($mm^3 \times 10^3$) of WAD ewes fed Siam weed-based rations during pregnancy

Month of pregnancy	Diets			
	A	B	C	D
0	6.91 ± 1.55^{ab}	7.91± 1.19^{a}	7.16 ± 0.78^{ab}	5.46 ± 1.04^{a}
1	10.89 ± 2.79^{b}	7.10 ± 1.73^{a}	9.15 ± 1.22^{ab}	8.14 ± 1.14^{ab}
2	8.65 ± 1.43	8.84 ± 2.94	7.44 ± 0.59	7.32 ± 0.94
3	8.99 ± 1.37^{a}	11.71 ± 1.98^{b}	9.25 ± 1.41^{a}	7.24 ± 1.50^{a}
4	5.99 ± 1.82^{a}	10.24 ± 2.53^{b}	10.75 ± 0.71^{b}	6.75 ± 1.56^{a}
5	8.81 ± 0.70^{b}	5.64 ± 1.27^{a}	6.33 ± 0.34^{ab}	7.40 ± 1.35^{ab}

^{a,b} Means on the same row with different superscripts are significantly different (P<.05)

Table 5 Pack cell volume (%) of WAD ewes fed Siam weed-based rations during pregnancy

Month of pregnancy	Diets			
	A	B	C	D
0	29.00 ± 1.41	30.25 ± 2.06	28.25 ± 2.06	25.00 ± 1.41
1	33.75 ± 2.36^{b}	33.00 ± 2.83^{b}	29.25 ± 0.50^{a}	30.75 ± 3.10^{ab}
2	28.75 ± 2.36^{b}	29.75 ± 1.26^{b}	23.25 ± 1.26^{a}	27.25 ± 3.62^{b}
3	33.25 ± 2.63	30.75 ± 2.87	30.25 ± 2.06	33.25 ± 2.63
4	32.25 ± 4.64	30.75 ± 2.50	29.00 ± 5.35	30.25 ± 5.56
5	33.25 ± 1.26^{b}	29.25 ± 1.26^{ab}	28.00 ± 5.66^{a}	31.00 ± 2.16^{ab}

^{a,b} Means on the same row with different superscripts are significantly different (P<.05)

Table 6 Haemoglobin (mg/100 ml) of WAD ewes fed Siam weed-based rations during pregnancy

Month pregnancy	Diets			
	A	B	C	D
0	6.50 ± 0.37[a]	7.55 ± 0.39[b]	7.35 ± 0.62[ab]	6.51 ± 0.78[a]
1	7.93 ± 0.50	8.60 ± 0.33	8.53 ± 1.06	8.90 ± 0.42
2	8.88 ± 0.67[ab]	10.23 ± 0.70[b]	8.43 ± 1.41[a]	9.08 ± 0.87[ab]
3	13.60 ± 1.77[b]	10.33 ± 1.75[a]	12.88 ± 0.82[b]	14.23 ± 0.61[b]
4	11.88 ± 0.33[b]	9.13 ± 2.89[ab]	7.68 ± 2.64[a]	10.40 ± 3.24[ab]
5	10.20 ± 0.59	9.83 ± 0.33	9.08 ± 1.81	10.33 ± 0.77

[a,b] Means on the same row with different superscripts are significantly different (P<.05)

Table 7 Corpuscles (m^3) of WAD ewes fed Siam weed-based rations during pregnancy

Month pregnancy	Diets			
	A	B	C	D
0	55.25 ± 4.50	49.75 ± 8.34	56.75 ± 3.59	57.25 ± 2.50
1	59.25 ± 1.50[b]	46.75 ± 10.15[a]	46.00 ± 7.96[a]	57.25 ± 2.22[b]
2	60.50 ± 1.29[b]	50.75 ± 9.29[a]	54.50 ± 5.26[ab]	56.25 ± 10.28[ab]
3	45.25 ± 6.34[a]	43.00 ± 6.53[a]	45.50 ± 4.80[a]	66.50 ± 10.28[b]
4	46.00 ± 4.32[ab]	47.50 ± 7.05[b]	50.00 ± 1.41[b]	39.25 ± 5.32[a]
5	53.25 ± 10.24	51.75 ± 5.12	47.50 ± 3.32	50.25 ± 3.30

[a,b] Means on the same row with different superscripts are significantly different (P<.05)

in the 2nd month of experimentation were not significantly different. Variations observed due to treatments did not follow any definite observable trends. This could be due to the fact that under a wide range of feeding regimes, an animal maintains its blood picture within ranges normal for that breed in that environment. Once the feed is adequate, variations observed could indirectly be due to reactions to external changes rather than direct response to feeding regime.

Changes in haematological values with advancing pregnancy can also be seen in Tables 3 - 8. Period 0 denotes values before mating while those of 1-5 show values obtained from the 1st to the 5th month of pregnancy. Leucocytes values (mm^3 x 10^3) for all animals on all treatments remained within the normal range (4-12) from the beginning to the end of the period of experimentation. Initially they ranged from 5.46 (ration D) to 7.91 (ration B). A slight peak was observed for animals on rations B and C in the 3rd and 4th months of pregnancy coinciding with

the peak in DM intake.

Packed cell volume (PCV %) values also remained within the normal range throughout the experimental period. Initially they ranged from 25 % (ration D) to 30.25 % (ration B). The values showed slight increases at the end of pregnancy for animal on ration A and D but fell back to initial levels for animals on rations B and C. RBC values (RBC $mm^3 \times 10^3$) were below the normal values documented for sheep but agreed with values obtained elsewhere (5). Low RBC values reported may be due to the presence of a low but constant parasitic burden (10).

RBC values reached a peak in the 1st month for animals on ration B whose average DM intake was highest (Data not shown) in the preceding month. A peak was observed in the 3rd month for animals on ration C and the 4th month for animals on ration D. These peaks coincided with the highest DM intake (Data not shown). The peak for the control animals on ration A came in the 3rd month at a time of average DM intake but highest weight gain (Data not shown). This shows that the efficiency of feed utilization at this period was high and the animal was mobilizing body reserves to sustain pregnancy, which then reflected in the blood picture.

Mean corpuscular volume (MCV) (m^3) values observed for all treatments fell outside the normal range (23-48) except for animals on rations B and C in the 1st, 3rd, 4th and 5th months of pregnancy. Only in the 3rd and 4th months did animals on rations D and A respectively fall within this range. This indicates that the erythrocytes of the WAD ewes obtained in this study were observed to be macrocytic or larger than normal. Mean corpuscular haemoglobin concentration (MCHC%) values were initially below the normal range (29-35%) for sheep but with advancing pregnancy the MCHC values recorded were above the average value of 32 % for all treatments. This coincides with the decrease in MCH values and a peak in DM intake and Haemoglobin (Hb g/100 ml) values. This was to be expected since most macrocytic anemia are transitory, being commonly observed in the recovery stages in recuperating animals (2). By the end of pregnancy (5th month) MCHC values had returned to normal and Hb values which

Table 8 Corpuscles haemoglobin concentration (%) of WAD ewes fed Siam weed-based rations during pregnancy.

Month of pregnancy	Diets			
	A	B	C	D
0	22.25 ± 0.50^{a}	25.00 ± 2.16^{ab}	26.25 ± 2.87^{b}	25.75 ± 1.71^{b}
1	23.25 ± 0.50^{a}	26.00 ± 2.94^{ab}	28.50 ± 3.70^{b}	29.00 ± 2.45^{b}
2	30.50 ± 0.58^{a}	34.00 ± 0.82^{ab}	36.00 ± 4.76^{b}	33.25 ± 0.96^{ab}
3	40.50 ± 4.12^{b}	33.50 ± 5.74^{a}	42.25 ± 0.96^{b}	42.75 ± 1.89^{b}
4	37.75 ± 6.40^{b}	29.25 ± 6.85^{ab}	26.00 ± 4.69^{a}	33.75 ± 4.72^{ab}
5	30.50 ± 1.00^{a}	33.50 ± 0.58^{b}	32.25 ± 0.96^{b}	33.75 ± 1.50^{b}

^{a,b} Means on the same row with different superscripts are significantly different ($P<.05$)

were initially below the normal range of 8-16 g/100 had also returned to normal.

The observations on haematological indices show that parasitic diseases play an important role in livestock productivity in the humid tropics (21) into which zone southern Nigeria falls. Ecological conditions here also support several vectors and parasites of economic significance. This explains why a considerable proportion of animals subsist under sub-clinical infections (16). Mean corpuscular values are used to clarify anemia morphologically. This classification has little reference to the cause of the anemia but represents estimations from normal size and haemoglobin concentrations of individual erythrocytes. For example, trypanotolerant WAD sheep have a certain degree of innate genetic resistance to trypanosomiasis (7). This phenomenon confers on the animal the ability to contain to a great extent the effect of trypanosomiasis infection and continue growing and reproducing without therapy but this change will show in the blood picture.

Conclusion and applications

The positive response of the pregnant ewes to varying levels of SWLM in the rations, shown by the normal blood parameters, suggests its positive acceptance and utilization. It then implies that the livestock farmer may include the weed as feed supplement up to 45 % without distortion in the blood chemistry.

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