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Effect of Administration of Aqueous Leaf Extract of *Aspilia africana* on Haematological Parameters of West African Dwarf Sheep (Rams)

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Abstract

Haematological parameters of West African Dwarf rams administered with aqueous *Aspilia africana* extract were examined. Twenty-four (24) West African Dwarf rams aged 6-9 months with average weight of 4.65kg were used for the study. The experiment was in a Completely Randomized Design (CRD). The rams were randomly divided into four treatment groups with six rams per treatment group and balanced for weight. Each treatment was replicated 3 times with 2 rams per replicate. Rams in treatment 1 ((T_1; control)) received 10ml of distilled water, while those in T_2, T_3 and T_4 received orally, 1000mg/kg body weight (BW), 2000mg/kg BW and 3000mg/kg BW of aqueous *Aspilia africana* extract, respectively. Rams in all the treatment were fed 2kg of forages and 500g of the same concentrate diet daily. Blood samples were collected and analysed pre-, during and post-experiment. The results obtained revealed significant differences ($P<0.05$) in most of the parameters measured during experiment and post-experiment. Dose dependent increases in values were observed for the rams administered with the extract (T_2, T_3, and T_4), in which T_4 had the highest mean values in Packed Cell Volume (36.50%), Haemoglobin (12.75g/dl), Red Blood Cell counts ($12.50x10^6/mm^3$), Mean Corpuscular Volume (29.23fl), Mean Corpuscular Haemoglobin Concentration (34.93%), Mean Corpuscular Haemoglobin (10.21pg), White Blood Cell counts ($8.50x10^9/mm^3$); lymphocytes (74.50%). Treatment 1 (control group) had the lowest mean values in Packed Cell Volume (29.50%), Haemoglobin (10.00g/dl), Red Blood Cell counts ($9.00x10^6/mm^3$), Mean Corpuscular Volume (33.25fl), Mean Corpuscular Haemoglobin Concentration (33.91%), Mean Corpuscular Haemoglobin (11.25pg), White Blood Cell counts ($6.25x10^9/mm^3$); lymphocytes (70.00%). Treatment 1 had highest mean value for neutrophils (23.00) while treatment 4 had the least (18.00). The results obtained post-experiment followed similar trend as those during experiment with T_4 recording the highest significant mean values ($P<0.05$) for all the parameters except neutrophil. The high and significant increase in haematological parameters of rams administered with aqueous *Aspilia africana* extract is an indication that it has the potential to improve blood parameters of sheep and could serve as a very useful agent in the management of anaemia in sheep. Upto 3000mg/kg BW of *A. africana* is recommended for rams.

Keywords

Anaemia, *Aspilia africana*, Haematology, Erythropoiesis

1. Introduction

Sheep are short-cycle animals and their production requires little management practices. Therefore, in order to meet the high demand for meat as a source of animal protein in the future, much of the increase in meat production would have to come from sheep (Opara *et al*., 2010).

The increasing demand and subsequent high cost of conventional animal feed ingredients in the tropics and the competition between humans and farm animals for the available food sources have created the need for sustainable feed alternatives, which will reduce the cost of animal production (Omojola and Adesehinwa, 2007). This is the reason for which many types of forages have been brought into limelight in livestock feed and production research. One of such forages is *Aspilia africana*, with the common name, African marigold plant (Burkil 1985; Etim and Oguike, 2014). *Aspilia africana* belongs to the family Asteracea. It is a perennial herb varying in height from 60 cm to 150 cm depending on rainfall. According to Burkil (1985), *Aspilia africana* is described as a semi_woody herb from a perennial woody rootstock. It has very rapid growth and grows up to 2 m high, very polymorphic with at least four varieties recognized in the Western African sub region. Varieties of *Aspilia africana* occur throughout the region on wasteland of the savanna and forested zone. The plant is a common weed of field crops in West Africa and sometimes found in fallow land especially the forest zone (Akobundu, 1987; Etim and Oguike, 2014). It has a somewhat carroty smell. It is ligneous at the base; it fruits quadrangular akenes and leaves opposite and hairy (Fig. 1). The plant is a weed grazed by cattle and sheep (Burkil, 1985; Etim and Oguike, 2014). *Aspilia africana* is a good source of nutrients and energy (Oguike and Etim, 2010; Etim and Oguike, 2014). Reports by Okwu and Josiah (2006) indicated that *Aspilia africana* is a good source of Ca, P, K, Mg, Fe and Zn.

Figure 1. *African marigold plant or wild sunflower (Aspilia africana).*

The significance of determining haematological indices of domestic animals has been well documented (Etim *et al*., 2013). Haematological examination is among methods which may contribute to the detection of some changes in health and physiological status, which may not be apparent during physical examination, but affects the fitness of the animal (Esonu *et al*., 2001; Bamishaiye *et al.,* 2009). Examination of blood provides the opportunity to clinically investigate the presence of several metabolites and other constituents in the body. It plays a vital role in the assessment of physiological, nutritional and pathological status of the animal.

There is paucity of information on blood parameters of sheep offered unconventional plants such as *Aspilia africana*. This study was therefore, conducted to investigate, as well as, provide information on haematological parameters of West African Dwarf rams administered with aqueous *Aspilia africana* extract.

2. Materials and Methods

2.1. Location and Site of the Experiment

The research was conducted in the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State Nigeria.

Obio Akpa is located between latitudes 5°17'N and 5°27'N and between longitudes 7°27'E and 7°58'E. It has an annual rainfall ranging from 3500mm – 5000mm and average monthly temperature of 25°C. Akwa Ibom State is a coastal State lying between latitudes 4°28'N and 5°3'N and between longitudes 7°27'E and 8°20'E, with a relative humidity between 60 – 90%. It is in the tropical rainforest zone of Nigeria.

2.2. Collection and Identification of *A. africana*

Fresh leaves of *A. africana* were collected from Nung Uyo Idoro village in Uyo Local Government Area of Akwa Ibom State and authenticated by Botany Department of the University of Uyo, Uyo, Akwa Ibom State.

2.3. Preparation and Administration of Extract

The leaves were sorted to remove contaminants, dead matter and sand particles. They were prepared fresh to prevent loss of bioactive ingredients which can take place during drying. The leaves were chopped into tiny pieces with chopping stick and sharp knife and ground using hand blender to produce *A. africana leaf* meal. 500g of the leaf meal was measured into conical flasks and extracted with 600ml distilled water. The mixture was filtered into 250ml conical flasks with Whatman paper no. 1. The solution was filtered while the filtrate was concentrated to a semi-solid form using a rotary evaporator at 40°C to produce gel-like aqueous *A. africana* extract. This was weighed and the solution prepared as 100mg/ml, 200mg/ml and 300mg/ml respectively.

2.4. Experimental Animals and Management

Twenty four (24) pubertal West African Dwarf rams of average weight of 4.65kg, aged 6 – 9 months from farm record and confirmed by the dentition, were sourced from four (4) Local Government Areas (Uyo, Abak, Oruk Anam and Etim Ekpo) of Akwa Ibom State and used for the study.

The flock was managed intensively. The sheep were quarantined for two (2) weeks before the commencement of the experiment. Routine medications against endo and ectoparasites as well as suitable vaccination, together with fumigation were performed during the pre-experimental period. The animals were randomly assigned to 4 treatment groups, with one (1) ram per pen. The pens were constructed with concrete halved walls and iron doors in the research farm that was well ventilated. The sheep were properly identified using plastic neck-tags.

During the period of the experiment, the animals were periodically washed (dipped) with Prectosol® against ticks and other ectoparasites. The health of the animals was properly monitored and adequate treatment was given to unhealthy animals. Routine inspection and regular cleaning were carried out.

2.5. Experimental Diet

The rams were fed 2kg of forages daily. The forages included: *Panicum maximum* (guinea grass), *Pennisetum purpureum* (elephant grass) and *Cynodon nlemfuensis* (star grass). Each animal also received 0.5kg (500g) of concentrate daily. Water was provided ad-libitum throughout the study. The quantity of forage and concentrate diet offered to the animals were weighed daily and the left-over feeds were weighed every morning using a sensitive electronic balance. Tables 1 and 2 show the composition of the concentrate diet given to the experimental animals.

Table 1. *Gross composition of concentrate.*

Ingredients	%
Maize	40.01
Soybean meal	4.31
Rice bran	41.30
Palm kernel cake	11.38
Bone meal	2.00
*Vitamin/mineral premixes	0.50
Salt	0.50
Total	100

Vitamin/mineral premixes (Growers) produced by Animal Care Product/Care Services Konsult (Nig) Ltd, Iperu Road-Ibadan Express way, Ogera Remo, Ogun State. *Vitamin Premix: Vit. A=8,000,000 I.U, Vit D_3 = 1,700,000 I.U, Vit. E = 5,000mg, Vit K_3 = 150mg, Folic acid = 200mg, niacin = 15,000mg, Vit. B_2 = 3,000mg, Vit. B_{12} = 5mg, Vit. B_1 = 1000mg, Vit. B_6 = 1000mg, biotin = 20mg. antioxidant = 125,000mg. Mineral Premix: Cobalt = 100mg, Selenium = 100mg, iodine = 100mg, Iron = 25,000mg, Manganese = 45,000mg, Copper = 3,000mg Zinc = 35, 000mg, Choline/chloride = 100,000mg.

Table 2. *Proximate Composition of Formulated Concentrate Diet.*

Parameters	Percentages
Drymatter	86.26
Crude protein	12.71
Ether Extract	7.59
Crude fibre	7.6
Ash	5.46
Nitrogen free extract	52.9
Metabolizable energy (Kcal/kg)	2529.57

2.6. Experimental Design

The experiment was in a Completely Randomized Design (CRD). The treatment consisted of administration of aqueous *A. africana* extract at 0mg/kg body weight (control), T_1), 1000mg/kg weight (T_2), 2000mg/kg body weight (T_3), 3000mg/kg (T_4). Six (6) rams were randomly assigned to each treatment and balanced for weights. Each treatment was replicated three (3) times with two (2) rams per replicate. The experimental model was as follows:

$$Yij = \mu + T_1 + Eij$$

Where:
Yij = Individual observation
μ = Overall mean
Ti = Treatment effect
Eij = Random errors, which is assumed to be independently, identically and normally distributed with zero mean and constant variance (iind) (P=0.05).

2.7. Administration of Aqueous Extract to Experimental Animals

After two weeks of quarantine and acclimatization, and eight weeks which were used for collection of pre-experimental data, the aqueous extract of *A. africana* was administered once a day orally for 64 days. Ten milliliters (10mls) syringes were used for the administration of the extract. The control group (T_1) received 10mls of distilled water while treatments 2, 3 and 4 received 10mls of each of the following 100mg/kg, 200mg/kg and 300mg/kg body weight of aqueous extract of *Aspilia africana*, respectively.

2.8. Blood Sampling for Analysis

2.8.1. Haematology

At day 1 (i.e., after the two weeks quarantine and acclimatization), day 28 of the experiment (period of administration of extract) and a day after the 64 days of extract administration. Blood samples (2ml) each were collected at 8.00am from two animals in each treatment group by jugular vein puncture. It was put into clean, sterilized bottles containing Ethylene Diamine Tetraacetic Acid (EDTA) as anti-coagulant for haematological assay. The blood was mixed thoroughly with the antigulant to prevent coagulation. Blood samples were analysed within 2 hours of collection for Packed Cell Volume (PCV) using the microhaematocrit method, haemoglobin using the sahli technique, White Blood Cell Counts (WBC) and Red Blood Cell Counts (RBC) were determined using improved Neubauer haemocytometer method as described by Jain (1986). The various red cell indices; Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Haemoglobin were calculated from RBC, HB and PCV as described by Jain (1986). Differential leucocyte counts were carried out after staining the samples using battlement method.

2.8.2. Determination of Packed Cell Volume (PCV) by Microhaematocrit Method

Plain capillary tubes were filled with blood samples up to two third (2/3) of the whole length. The vacant end of each tube wasfixed in the haematocrit and centrifuged for five minutes at a speed of 3000 revolutions per minute and the percentage of the Packed Cell Volume read from a graphic reader (Schalm *et al.*, 1975)

2.8.3. Erythrocyte (Red Blood Cell (RBC) Count

The RBC count was made using a haemocytometer. Erythrocyte diluting pipette was used to draw the blood samples to a point marked 0.5 on the pipette. The pipette was wiped free of blood and filled with blood cell diluting fluid to a point marked 101 on the pipette. This was then mixed together. About one third of the content of the pipette was discarded and the counting chamber filled. The cells were then observed under the microscope at a magnification of x40. Erythrocytes in 5 of the 25 squares in the central area of each chamber of the haemocytometer were counted, taking the 4 corner squares and central one (Schalm *et al.*, 1975; Jain, 1986; Oyeyemi and Ajani, 2014).

2.8.4. Leucocyte Count

Total white blood cell count was made in a haemocytometer using the white blood cell diluting fluid. Leucocyte diluting pipette was used to draw blood sample to a point marked 0.5 and filling up to the 11 mark using the leucocyte diluting fluid. The white blood cells in the 4 large corner squares of the haemocytometer chamber were then counted and the total multiplied by 50 (Schalm *et al*., 1975; Jain, 1986; Oyeyemi and Ajani, 2014).

2.8.5. Differential White Blood Cell Count

Thoroughly cleaned smooth slides were used. A clean slide with a small drop of blood was placed on a flat surface. Another slide was then used to make a thin smear. The slide was then allowed to air-dry and then fixed in absolute methanol for about 5 mins. Giemsa stained slides were used for leucocyte count. They were examined for different leucocyte types under oil immersion of the microscope. The different leucocytes types were then expressed as percentage of total (Reece, 1997; Oyeyemi and Ajani, 2014).

2.9. Data Analysis

Data obtained were subjected to Analysis of Variance (ANOVA) (Steel and Torrie, 1986). Significant means were separated using Fisher's Least Significant Difference (LSD) as described by Akindele (2004).

3. Results and Discussion

3.1. Haematology of West African Dwarf Rams Before Administration of *A. africana* Extract

The result of haematology of West Africa Dwarf Rams before the period of Administration of *A. africana* extract is presented in Tables 4.

Table 3. *Haematology of West African Dwarf Rams before Administration of A. africana Extract.*

Parameters	T_1	T_2	T_3	T_4	SEM
Packed Cell Volume (%)	29.00	29.50	30.00	28.00	1.26
Haemaglobin (gldl)	9.45	10.00	10.50	9.75	1.76
Red Blood Cells ($x10^6/mm^3$)	7.75	7.75	8.25	8.00	1.49
Mean Corpuscular Volume (fl)	37.92	38.09	36.40	36.28	7.38
Mean Corpuscular Haemoglobin Concentration (%)	35.56	33.91	35.00	33.00	5.63
Mean Corpuscular Haemoglobin (pg)	12.38	12.92	12.92	11.93	3.89
White Blood Cells ($x10^9/mm^3$)	6.20	6.20	6.30	5.80	1,58
Differential Count (%):					
Lymphocytes	71.00	68.50	70.00	67.00	1.15
Neutrophils	21.5	23.5	22.00	24.50	14.69
Eosinopils	1.50	2.00	2.00	1.50	1.76
Basophils	0.00	0.00	0.00	0.00	0.00
Monocytes	1.00	2.00	1.50	2.00	1.15

No significant differences (P>0.05) were observed in all the haematological parameters pre-experiment. Values obtained for all the experimental groups were within the normal physiological range for sheep as reported by Jawasreh *et al*. (2009); RAR (2009) and Etim *et al*. (2014).

3.2. Haematology of West African Dwarf Rams Administered with Aqueous *A. africana* Extract

Tables 5 outlines the result for haematology of West Africa Dwarf rams administered with aqueous *A. africana* extract.

Table 4. *Haematology of West African Dwarf Rams Administered with Aqueous A. africana Extract.*

Parameters	T_1	T_2	T_3	T_4	SEM
Packed Cell Volume (%)	29.50^{c}	31.50^{b}	36.00^{a}	36.50^{a}	1.25
Haemaglobin (gldl)	10.00^{c}	11.50^{b}	12.50^{a}	12.75^{a}	0.71
Red Blood Cells ($x10^6/mm^3$)	9.00^{b}	11.50^{a}	12.50^{a}	12.50^{a}	1.25
Mean Corpuscular Volume (fl)	33.25^{a}	27.43^{b}	28.81^{b}	29.23^{ab}	4.14
Mean Corpuscular Haemoglobin Concentration (%)	33.91^{b}	36.49^{a}	34.72^{b}	34.93^{b}	1.18
Mean Corpuscular Haemoglobin (pg)	11.25^{a}	10.00^{b}	10.00^{b}	10.21^{b}	1.19
White Blood Cells ($x10^9/mm^3$)	6.25^{b}	7.25^{ab}	8.10^{ab}	8.50^{a}	2.19
Differential Count (%):					
Lymphocytes	70.00^{c}	73.00^{b}	73.00^{b}	74.50^{b}	1.05
Neutrophils	23.00^{a}	20.50^{ab}	21.00^{ab}	18.00^{b}	3.01
Eosinopils	2.00	1.50	1.50	1.50	2.05
Basophils	0.00	0.00	0.00	0.00	0.00
Monocytes	1.00	1.50	2.00	1.50	1.15

a, b, c, means in same row with different superscripts are significantly different (P<0.05)

During the period of administration of the extract to the rams, significant differences (P<0.05) were observed in most of the parameters measured.

Packed Cell Volume (PCV) varied significantly among the various treatment groups during the period of administration of *A. africana* extract. Values observed ranged from 29.50% (T_1) to 36.50 (T_4). Packed Cell Volume in rams in the treated groups was observed to improve more rapidly than in the control group. Values obtained for PCV in all the treatment groups fell within the normal physiological ranges of 24-45%, 28-31%, 27-45%, 27.75-36.67%, 30%, 22.9-29.4%, 21-35%, 20.10-48.00% and 27.45-29.13% reported by RAR (2009) and Etim (2014) for sheep; Frandson (1986) for sheep, Jawasreh *et al*. (2009) for Awassi sheep, Jain (1993) and Kramer (2000) and Jawasreh *et al*. (2009) for sheep; Oyeyemi and Ajani (2014) for sheep; Durotoye and Oyewola (2000) for WAD rams; Abu *et al*. (1998) and Bello and Tsado (2013) for Yankasa rams, Daramola *et al*. (2005) for WAD goats and Jawasreh *et al*.(2010) for Afec Awassi sheep and Baiden and Obese (2010) for WAD sheep respectively.

Result obtained for RBC also revealed significant difference among the three treatment groups during the period of administration of extracts to the rams. Prominent increase was observed in values obtained for rams in all the treated groups compared to the control group. But values obtained in all the treatment groups were within the range of 9-15 $x10^6/mm^3$, 10.82-16.11$X10^{12}$/l and 11.42$x10^3$/ml reported by Jain (1993) and Kramer (2000) and Jawasreh *et al*. (2009), Oyeyemi and Ajani (2014); and Baiden and Obese (2010) respectively for sheep. MCV also manifested significant difference (P<0.05) among the different groups during and after the experiment and values observed were within the normal ranges of 23-48; 30-33; 28-40 and slightly higher than the range of values reported by RAR (2009) and Etim *et al.* (2014); Jain (1993) and Kramer (2000) and Jawasreh *et al*. (2009); and Oyeyemi and Ajani (2014) for sheep respectively. Significant difference (P<0.05) were also observed for values for MCHC among all the groups during the experimental period and post-experimental and values for all the groups were within the ranges reported by Jain (1993), Kramer (2000), Jawasreh *et al.* (2014) Etim *et al.* (2014) and Oyeyemi and Ajani (2014). While significant difference (P<0.05) was observed for result on MCH among all the treatment groups during the experiment, non-significant difference (P>0.05) was recorded post-experiment. And values for all the treatment groups were also within the normal ranges reported by Jain (1993) Kramer (2000), Jawasreh *et al*. (2009), Etim *et al.* (2014) and higher than values reported by Oyeyemi and Ajani (2014). While significant differences were also observed in values for lymphocytes and neutrophils during and post-experiment in all the treatment groups, the values were within the physiological ranges reported by Jain (1993) Kramer (2000), Jawesreh *et al.* (2009), Etim *et al.* (2014) and Oyeyemi and Ajani (2014) for sheep. Data obtained for eosinophils, basophils and monocytes were non-significantly different (P>0.05) among all the treatment groups.

Furthermore, it was observed that although the control group (T_1) also exhibited increase and improvement in all the haematological parameters measured as observed before and during the experiment, more prominent and dose dependent increase was recorded in the treated groups (T_2, T_3 and T_4). The high significant and dose dependent increase in PCV, RBC and Hb in T_2, T_3 and T_4 could be attributed to the aqueous *A. africana* extract administered at different doses to rams in these groups. This could have led to a more efficient erythropoiesis in the experimental animals (T_2, T_3 and T_4), through increasing the bone marrow capacity to produce red blood cells thereby increasing and improving the blood level conditions. Thus, preventing anaemia (Togun *et al.,* 2007; Chineke *et al.,* 2006; Etim, 2010 and Etim *et al.,* 2014).

WBC values were significantly different (P<0.05) among the various treatment groups during the experiment. Although, T_1 showed increased in the WBC value during the experiment compared to value obtained before the beginning of the study, significantly high values and a dose dependent increase were recorded for T_2, T_3 and T_4. Values for all the groups were within the normal physiological range as reported by Jain (1993), Kramer (2000), RAR (2009), Jawasreh *et al.* (2009), Etim *et al.* (2014a) and Oyeyemi and Ajani (2014).

Similarily, the significant and dose dependent increase in WBC values for T_2, T_3 and T_4 may be associated with the test extract. Suggesting a better ability of animals in this group to

generate antibody to fight infection and defend the blood by phagocytocis against invasion by foreign organisms. Resulting in high degree of resistance to disease (Soetan, 2013, Etim, *et al*., 2014) and enhanced adaptability to local environment and disease prevalent condition (Kabir *et al.,* 2011, Okunlola *et al*., 2012, Iwuji and Herbert 2012, Isaac *et al.,* 2013, Etim *et al.,*2014), The higher WBC count in the treated groups may explain longevity as reported by Mbanasor *et al.* (2003) and Etim (2010) for haematological prameters of rabbit does fed *A. africana* leaves and also agrees with the report by Reilly (1993) and Etim (2010) that normal range of value for WBC indicated that the animals were healthy. It is also consistent with the observation of Bello and Tsado (2013) that WBC values within the normal range is an indication that there were no microbial infections or presence of foreign body or parasite in the circulatory system of the experimental animals. The available results also agrees the report by Ameen *et al.* (2007) that when the values for lymphocytes, leucocytes and neutrophils fall within the normal ranges as observed in this study, it implies that the feeding pattern, but in this case the experimental extract did not affect the immune system. The results of this study also agree with earlier report that methanol and aqueous extract of the leaves of *A. africana* can exhibit differential anti-infective activities on both gram- positive and gram-negative bacterial species and also believe to have anti-parasitic compounds (Macfoy and cline, 1990; Adeniji and Odufowora, 2000; Okoli *et al.*, 2007 and Etim, 2010).

3.3. Haematology of West African Dwarf Rams Post-experiment

The result for haematology of West Africa Dwarf rams 24 hours after the 64 days of administration of aqueous *A. africana* extract is presented in Table 5.

Table 5. *Haematology of West African Dwarf Rams Post-experiment.*

Parameters	T_1	T_2	T_3	T_4	SEM
Packed Cell Volume (%)	31.00^{c}	35.50^{b}	43.50^{a}	45.00^{a}	1.76
Haemaglobin (gldl)	10.75^{c}	12.50^{b}	14.50^{a}	15.00^{a}	0.97
Red Blood Cells ($x10^6/mm^3$)	10.00^{a}	12.50^{b}	13.75^{a}	14.75	1.03
Mean Corpuscular Volume (fl)	31.41	28.48	31.63	30.52	4.21
Mean Corpuscular Haemoglobin Concentration (%)	34.64^{ab}	35.20^{a}	33.33^{b}	33.33^{b}	1.50
Mean Corpuscular Haemoglobin (pg)	10.97^{a}	10.03	10.54	10.17	1.95
White Blood Cells ($x10^9/mm^3$)	6.25^{b}	7.25^{ab}	8.30	9.35	2.28
Differential Count (%):					
Lymphocytes	70.00^{d}	73.00^{c}	74.00^{b}	75.00^{a}	0.94
Neutrophils	23.00^{a}	20.50^{ab}	19.00^{b}	18.50^{b}	2.86
Eosinopils	2.00	1.50	1.00	1.00	1.94
Basophils	0.00	0.00	0.00	0.00	0.00
Monocytes	1.00	1.00	1.00	1.00	1.00

a, b, c, means in same row with different superscripts are significantly different ($P<0.05$)

There were persistent significant differences ($P <0.05$) in values obtained for most of the haematological parameters measured post-experiment, except, eosinophils, basophils and monocytes. Although, the result for all the parameters measured fell within the normal physiological ranges for sheep (Jawasreh *et al.*, 2009; RAR, 2009 and Etim *et al.*, 2014a), superior values were still recorded in the treated groups (T_2, T_3 and T_4), which might be associated with the experimental extract indicating that it has the potential to improve blood indices of rams.

4. Conclusion

It was observed that *Aspilia africana* had pronounced effects on the haematological parameters of the rams administered with it. This is because rams in the treated groups had superior and highly significant values in a dose-dependent manner in the haematological parameters measured compared to those of the rams in the control group. This indicated that *A. africana* has the potential to improve haematological parameters of sheep and could serve as a very useful agent in the management of anaemia in sheep.

Furthermore, from the findings of the study, upto 3000mg/kg BW of *Aspilia africana* is recommended for rams, because rams administered with this concentration of the extract had highest significant values which were within normal physiological ranges of values for haematological parameter of rams.

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