

Blood profile of West African dwarf goats fed diets containing varying levels of Siam weed (*Chromolaena odorata*) leaf meal

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Target Audience; Animal scientists, plant scientists, feed millers, livestock and ruminant farmers.

Abstract

An 86-day feeding trial was conducted to determine the effect of Siam weed leaf meal (SWLM) containing diets on the blood profile of West African dwarf (WAD) goats. Sixteen WAD bucks of about 8–10 months of age averaging 7.35kg in weight were randomly allotted to four experimental diets (T_1 , T_2 , T_3 and T_4) containing 0%, 5%, 10% and 15% inclusion levels of SWLM in a completely randomized design. The bucks were fed the experimental diets on 3.0% body weight per day basis in the morning (8.00 hours) and later at 15.00 hours, were fed 1 kg wilted *Panicum maximum* as basal diet. Results showed that packed cell volume, haemoglobin, red blood cells and mean cell haemoglobin concentration were significantly ($p < 0.05$) higher in the 5% inclusion of SWLM. Mean cell volume and mean cell haemoglobin were significantly ($p < 0.05$) higher in T_2 and T_3 . White blood cells increased significantly ($p < 0.05$) from T_1 to T_4 . Total protein was significantly ($p < 0.05$) higher in T_2 and T_3 . Albumin and glucose were higher ($p < 0.05$) in T_1 and T_2 . Globulin and high-density lipoprotein were significantly ($p < 0.05$) high in T_4 (15% SWLM). T_2 showed significantly ($p < 0.05$) higher creatinine value. Cholesterol, triglyceride and low-density lipoprotein were significantly higher in T_1 . In conclusion, the inclusion of Siam weed leaf meal in the diets of West African dwarf goats had no deleterious effects on the blood profile of WAD goats and hence could be included in goat diets up to 15%, since all the blood parameters measured fall within the reference values for goats.

Keywords: Bucks, *Chromolaena odorata*, haematology, serum biochemistry, dry season supplements, grophytobiotics.

Description of Problem

Most developing countries are marked by inadequate animal protein intake. Animal protein is one of the most important components of the human diet and its consumption varies from country to country (1). (2) noted that animal protein ranks better than plant protein due to its higher essential amino acid profile needed by man for survival and healthy living. Rapid human population growth coupled with low animal protein intake constitutes a major nutritional problem facing developing countries like Nigeria. (3) reported that an average Nigerian consumes only about 10g per day

of the minimum daily intake of 35g of animal protein. This may be partly attributed to the increasing population and poor productivity of livestock in Nigeria. However, (4) blamed poor animal protein intake on the high cost of conventional supplements and seasonal variation in the country, which affects the availability, quantity and quality of ruminant diets, especially during the dry season. (5) proposed adding low-cost phyto-genic feed additives to dry season supplements as a potential remedy for poor ruminant performance. Phyto-genic compounds have recently received a lot of interest in animal

nutrition due to their growth-promoting and therapeutic properties (6). (7) reported improved performance to WAD goats fed phytogenic feed additive supplementation. Siam weed (*Chromolaena odorata*) leaf meal is one such phytogenic feed additive, due to its reported high therapeutic properties.

Siam weed is a perennial shrub that belongs to the *Aster* family. It is a very successful plant that has spread throughout several tropical ecoregions and can withstand extended periods of drought, which are common in many tropical regions. It has an unmatched capacity to begin active development when the rains start (1). Siam weed is a well-known plant in preventing blood loss from wounds due to its astringent effects on blood vessels. It is frequently used to clean and treat open wounds due to its anti-microbial qualities (8). According to (8) and (9), it provides efficient treatment for colitis, diarrhoea, toothache, diabetes, malaria fever, and skin conditions. (10) and (11) reported a high in minerals, protein, oxy carotenoids, and energy in Siam weed leaves. Earlier studies by (10), (12), and (13), stated that Siam weed contains anti-nutritional factors like saponins, phytates, tannins, and cyanogenic glycosides. (13) stated that phytic acid binds calcium, zinc, iron, and other minerals, decreasing their availability in the body. Through intraluminal physicochemical interaction, saponins decrease the absorption of several nutrients, such as glucose and cholesterol (14). However, (15) reported that several processing techniques, such as cooking, toasting, milling and drying, reduce the anti-nutrient levels of feeds, thus the need for processing the leaves to meal, through shade-drying followed by hammer milling. Siam weed leaf meal nutrient composition and feeding value for laying birds (12; 16), broilers (11; 14), and rabbits (17) have been documented, but not much has been reported

on the use of SWLM as a feed ingredient for goats, especially as a component of WAD goat diet and its effect on blood indices. This study therefore aimed to determine the effect of Siam weed leaf meal on the heamatology and serum biochemistry of WAD goats fed Siam weed leaf meal containing diets.

Materials and Methods

The experiment was carried out at the Sheep and goat unit of Animal Production Technology, Federal College of Agriculture, Ishiagu Ebonyi State, Nigeria. The College is located about three kilometres away from Ishiagu's main town. The College is situated at latitude 5.5⁰N and longitude 7.31⁰E, with an average rainfall of 1653 mm and prevailing temperature of 28.50 C and relative humidity of about 80%.

Fresh leaves of Siam weed plants without flowers were harvested within the College environs. Thereafter, the leaves were shade-dried for 5 days until they became crispy while retaining the greenish colouration. The dry leaves were milled using a hammer mill to produce leaf meal before they were incorporated into the diets. Four experimental diets (T₁, T₂, T₃, and T₄) were formulated such that Siam weed leaf meal was included at the levels of 0%, 5%, 10% and 15% for T₁, T₂, T₃, and T₄ respectively as presented in Table 1.

Sixteen WAD bucks weighing 7.35 kg and aged 8 to 10 months were sourced from Omege Echara, Ikwo L.G.A., Ebonyi State. The goats were quarantined for 21 days before the study. Before the trial, the goats were subcutaneously administered Ivermectin (1 ml/10 kg body weight and Albendazole (0.1 mg/kg BW given orally) to treat external and internal parasites. The goats were vaccinated against Peste' Petit de' Ruminante' (PPR) with PPR vaccine at a dosage of 1 ml per 10 kg of body weight. For a preliminary period of 21 days, each animal

was fed the experimental diet (control diet) on 3% of their body weight in the morning (8.00 hours) and 1 kg *Panicum maximum* as basal in the evening (15.00 hours). This was done to increase the appetite of each goat for the concentrate feeding.

The sixteen bucks were balanced for weights and divided into four groups of four animals each. The groups were randomly assigned the four experimental diets (T₁, T₂, T₃, and T₄) in a completely randomized

design (CRD). The bucks were housed individually in well-ventilated concrete-floored pens equipped with feeders and drinkers. Each animal received a designated treatment diet in the morning (08:00 hours) for 86 days. Feed offered was based on 3.0% body weight per day basis in addition to 1kg wilted *Panicum maximum* fed at 15:00 hours while fresh drinkable water was provided *ad libitum*.

Table 1: Composition of the experimental diets containing varying inclusion level of Siam weed leaf meal

Ingredients	T ₁ (%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)
Cassava root seivate	20.00	20.00	20.00	20.00
Cassava peel	30.00	30.00	30.00	30.00
Siam weed leaf meal	0.00	5.00	10.00	15.00
Brewers dried grain	25.00	20.00	15.00	10.00
Palm kernel cake	14.00	14.00	14.00	14.00
Soybean meal	7.00	7.00	7.00	7.00
Salt	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00
Premix	1.00	1.00	1.00	1.00
Total	100	100	100	100

Blood samples (10 ml) were drawn from each goat through the jugular vein on the 86th day of the feeding trial. The blood samples were divided into two lots and used for determination of the biochemical and haematological components as described by (18). The first lot (5ml) was collected in labelled sterile bottles containing 1mg/ml of ethylene diamine tetraacetate (EDTA). This was used to determine the haematological components (packed cell volume, haemoglobin, red blood cell and white blood cell, Mean cells haemoglobin (MCH), mean cell volume (MCV) and mean cell haemoglobin concentrations (MCHC). The second lot (5 ml) was collected over anti-coagulant-free sample bottles and allowed to clot at room temperature while the serum was separated by centrifuging within 3 hours of collection. This was used to determine the

biochemical components (total protein, albumin, globulin, urea, creatinine, total bilirubin, cholesterol, high-density lipoprotein, low-density lipoprotein, triglyceride, alkaline phosphatase, aspartate aminotransferase, alanine aminotransferase and serum minerals) of blood.

Triplicate samples of the experimental diets and Siam weed leaf meal were analysed for dry matter (DM), crude protein (CP), crude fibre (CF), ash, ether extract (EE) and nitrogen-free extract (NFE) according to the methods of (19). The neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL) fractions were determined using (20) methods.

The gross energy was calculated using the formula

$$T = 5.72Z1 + 9.50Z2 + 4.79Z3 + 4.03Z4 \pm 0.9\%; \text{ according to (21).}$$

Where;

T = Gross energy; Z1=Crude protein; Z2=Crude fat; Z3=Crude fibre; Z4=Nitrogen free extract.

Data obtained were analysed using analysis of variance (ANOVA) as described by (22). Significant means were separated using the Duncan Multiple New Range Test at $p < 0.05$.

Results and Discussion

The proximate and phytochemical compositions of the Siam weed leaf meal are presented in Table 2. The proximate analysis of SWLM revealed a high dry matter value of 92.24%, which was lower than 95.70% by (11) and higher than 89.51% reported by (17). The crude protein values of 20.36% obtained in this present study compared well with 21.70%, 22.80% and 20.52% reported by (14), (22) and (13) respectively, but higher than the values of 15.27% reported by (13) for SWLM. However, the CP value of 20.36% reported for SWLM in this present study is an indication that SWLM is rich in protein and may serve as a protein substitute for ruminants. The crude fibre value of 14.38% compared favourably with 13.72% reported by (17) but higher than 5.58% reported by (14) and lower than 20.10% by (16) for same leaf meal. The moderate CF makes this leaf meal a potential feedstuff for ruminants. The high ash content of SWLM in the current study is an indication of a high mineral profile in Siam weed leaf meal. This value was compared favourably with the ash value of 9.50, 11.50 and 9.64% reported for the same leaf meal by (16), (22) and (17), respectively. The results revealed that Siam weed leaf meal is moderately high in tannins, saponins, phytates, alkaloids and flavonoids. Tannins are regarded as nutritionally unfavourable because they precipitate proteins, obstruct digestive enzymes, and influence how well vitamins and minerals are utilized. A small amount of the proper

kind of tannins may be advantageous to health (23). Tannins are known to affect feed intake, growth rate, feed efficiency, and protein digestibility (24). Intestinal digestion and microbial enzyme activity such as cellulose synthesis could be inhibited by an excessive tannin concentration in the diet (25). The concentration of tannins in this study is higher than 0.37% and 0.002% by (13) and (26) respectively, but lower than 2.57% and 41.0 mg/g by (27) and (28) respectively for same leaf meal. Saponins are surface-active agents (surfactants) with a potentially bitter taste that can produce intense foaming activity in aqueous solutions. Traditionally, animal nutritionists have seen saponins as harmful constituents (29). Dietary saponins have biological effects on the digestive tract because the body poorly absorbs them (30). According to (31), saponins decrease protein digestibility most likely by forming barely digested saponin-protein complexes. However, the saponin value of 0.79% herein compared with 0.60% by (26) but lower than 1.98 and 1.99% reported by (13) and (27) respectively. Animal performance is decreased by phytates in part due to decreased digestibility and increased endogenous release of nutrients like minerals and amino acids (32). The concentration of phytates (1.98%) in this study is lower than 2.09% by (26), but higher than 0.54% by (13) and relatively compared with 1.33% by (27) for same leaf meal. Alkaloids on animals have a very diverse range of effects at the cellular level (33). While the majority of alkaloids interact with chemical agents that are found in the nervous system, others have an impact on the transport of proteins or the actions of different enzymes. In this present study however, the alkaloid value of 1.02% was slightly compared with 1.26% by (27) but lower than 1.66% and 12.2 mg/g reported by (26) and (28) respectively for same leaf

meal. Flavonoids have potent antibacterial and antioxidant properties as well as favourable effects on the immune system. Flavonoids can enhance the quality of animal products and promote the growth and development of animals (34). The concentration of flavonoid (2.04%) in this study is lower than 6.30% and 7.7mg/g by (26) and (28) respectively but higher than 1.08% by (27) for same leaf meal.

The chemical composition of the experimental diets are presented in Table 3. Dry matter, CF, EE ash, NFE, GE, NDF, ADF and ADL showed significant ($p < 0.05$) differences across the groups. The DM content of T₂ was significantly ($p < 0.05$)

higher than T₁ and T₄, but similar to T₃. The high DM composition of the diets showed that the diets were rich in different nutrients since DM is a representation of nutrients in a feed sample except water. The CP compositions of the diets though similar ($p > 0.05$) across the treatments are well above the minimum protein requirement of 6 – 8 g/100g for ruminants recommended by (35). The CF composition of T₁ was significantly ($p < 0.05$) lower than T₃ and T₄ but similar ($p > 0.05$) to T₂. However, apart from T₁ (11.83%), the other treatments were above the 12% minimum crude fibre requirement for goats as recommended by (36) for optimal rumen function.

Table 2: Chemical and phytochemical composition of Siam weed leaf meal

Parameters (%)	Siam weed leaf meal
Dry matter	92.24
Crude protein	20.36
Crude fibre	14.38
Ether extract	4.47
Ash	10.56
Nitrogen free extract	42.46
Gross energy (g/kcal)	488.92
Neutral detergent fibre	34.67
Acid detergent fibre	19.18
Acid detergent lignin	6.85
Tannin	0.65
Saponin	0.79
Phytate	1.98
Alkaloid	1.02
Flavonoid	2.04

Table 3: Chemical composition of the experimental diets

Parameters (%)	T ₁ (%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)	SEM
Dry matter	92.00 ^b	93.62 ^a	91.57 ^{ab}	90.00 ^b	0.50
Crude protein	14.30	15.53	15.65	14.81	0.39
Crude fibre	11.83 ^b	12.57 ^{ab}	13.32 ^a	13.43 ^a	0.20
Ether extract	3.94 ^{ab}	4.35 ^a	3.72 ^b	3.49 ^b	0.11
Ash	6.57 ^c	11.66 ^b	12.96 ^{ab}	13.71 ^a	0.86
Nitrogen free extract	57.85 ^a	49.49 ^{ab}	45.64 ^{ab}	44.43 ^b	1.95
Gross energy (kcal/g)	520.86 ^a	479.93 ^b	462.71 ^b	435.14 ^c	3.15
Neutral detergent fibre	26.30 ^b	27.39 ^b	29.43 ^a	30.87 ^a	0.56
Acid detergent fibre	19.24 ^b	19.59 ^b	22.08 ^a	22.93 ^a	0.51
Acid detergent lignin	10.13 ^b	9.94 ^b	11.11 ^{ab}	12.54 ^a	0.39

^{a-c} means with different superscripts along the same row are significantly ($p < 0.05$) different

The ether extract showed a significant ($p < 0.05$) difference with T_2 showing higher ($p < 0.05$) values than T_3 and T_4 . The ash values were higher ($p < 0.05$) in T_2 , T_3 and T_4 . The high ash contents of the experimental diets especially the treatment groups (T_2 , T_3 and T_4) are an indication of the high mineral profile of the diets. The higher ($p < 0.05$) ash reported in the treatment groups may be attributed to the Siam weed leaf meal. The high ash values of the treatment groups reported in this study were in agreement with earlier reports (14). The gross energy was significantly ($p < 0.05$) influenced with T_1 having the highest ($p < 0.05$) value. The lower energy value reported for the SWLM-containing diets may be attributed to the inclusion of SWLM in the diets, as grains tend to have higher energy values than leaf meals. NDF, ADF and ADL were all lower ($p < 0.05$) in T_1 as compared with T_4 . (37) in an earlier study noted that low to moderate fibre fraction contents in a diet may indicate high nutritive worth since fibre plays an important role in voluntary intake and digestibility. The NDF values reported in the study were above 20% on a DM basis as (38) observed that ruminant diets should contain at least 20% NDF on a DM basis to maintain optimal roughage digestion. The low to moderate ADL 9.94 to 12.54% reported in this study may imply that the quality of the experimental diets were not compromised by the inclusion of SWLM.

The haematological indices of West African dwarf goat-fed Siam weed leaf meal are presented in Table 4. All the parameters examined were significantly ($p < 0.05$) influenced by the diets. Packed cell volume (PCV), haemoglobin (Hb), red blood cell (RBC) and mean cell haemoglobin concentration (MCHC) were significant ($p < 0.05$) high in T_2 in comparison to other treatments. The PCV obtained in the present study (24.66 - 32.24%) compared well with

25.75 - 34% and 24.50 - 35.62% reported by (39) and (37) respectively for WAD goats fed varying leaf meals. Nevertheless, the PCV range obtained herein fell within the normal physiological of 21- 35 % (40) for WAD goats, thus indicating that the diets were nourishing and may contain tolerable or no anti-nutritional factor. The Hb range observed in this study fell within the physiological range of 7-15 g/dl reported by Daramola (40) for WAD goats. The within the normal clinical range of Hb obtained herein is an indication that the diets were capable of supporting higher oxygen-carrying capacity in the blood of the goats. Furthermore, the Hb concentration of the WAD goats may indicate that the dietary proteins were of high quality; a view corroborated with (39). The RBC counts reported in this study were within the range of 8 - 18g/gl reported by (41) and 7 - 21 ($\times 10^6/\mu\text{L}$) by (42) for apparently healthy goats and WAD goats respectively. However, the within-normal physiological range for apparently healthy WAD goats obtained in this study showed that the diets supported the good health status of the goats, and hence the animals were not likely to suffer anaemia-related diseases. The MCV, MCH and MCHC values reported for the WAD bucks in this study (18.09 - 19.60 fl, 31.04 - 34.17pg and 5.76 - 7.32 pg) fell within the normal range of 16 - 25 fl, 30 - 36 g/dl and 5.2 - 8.0 pg respectively reported for bucks by (43). The within-normal physiological range for the red blood cell differentials recorded in this study gave a clear indication of the absence of anaemia among the experimental bucks. However, the lower values of PCV, Hb and RBC values reported for the bucks on T_4 (15% SWLM inclusion level) may indicate that the possibility of anaemia-related diseases if the feeding is prolonged or higher dietary levels of Siam weed leaf meal are fed to WAD

goats. White blood cells (WBC) or leucocytes are the mobile unit of the body's protecting system that can also act as speedy and effective defence mechanisms against infectious agents in organisms. From the results of the study, it is therefore likely that the higher WBC values observed among the animals on T₃ and T₄ may indicate a response to probable risk to the animals' immune systems. This may be an affirmation that the shade drying followed by milling did not completely remove the anti-nutrients in the leaf meal. Consequently, no deadly conditions were observed among the animals in all the treatment groups during the feeding trial, since their WBC values fell within the reference range of 4 – 13 x 10³ /μL for healthy goats reported by (43).

The serum biochemistry of West African dwarf goats fed Siam weed leaf meal are presented in Table 5. Total protein, albumin and globulin were significantly (p<0.05) influenced. Goats fed T₂, and T₃ had higher total protein of 68.79g/l, and 68.60g/l respectively while lower values of 65.93 g/l, and 66.62g/l were recorded for goats fed T₄ and T₁ respectively. Albumin value decreased significantly (p<0.05) in T₄ and T₃ with WAD goat-fed T₁ and T₂ having higher values. Globulin value recorded a

progressive increase (p<0.05) with increasing levels of Siam weed leaf meal in the diets. T₁ had the lowest value of 29.89g/dl while recorded the highest value of 38.56 g/l was recorded in T₄. The total protein value of 65.93 – 68.79 g/l obtained herein fell within the reference range of 64.0-70.0 g/l reported by (44) for goats. The albumin value range of 27.37-36.79g/l obtained in this study also fell within the reference range of 27.0-39.0g/l reported by (44) for goats. These observations may be an indication of normal systemic protein utilization of the liver. The globulin range of 29.89-38.56g/l obtained herein fell within the reference range of 27.0-41.0g/l reported by (44) for goats. Globulin level generally shows the immune responses and is mostly a reliable source for the production of antibodies (45). The observation of globulin herein is an indication of high immunity among the experimental goats. In an earlier study, (46) noted that total protein, albumin and globulin are generally responsible for protein uptake. Serum glucose decreased significantly in T₃ and T₄. However, the result of this study (2.91-3.20mmol/l) fell within the normal physiological range of 2.78-4.16mmol/l for apparently healthy goats by (44).

Table 4: Haematological indices of West African dwarf goat fed Siam weed leaf meal

Parameters	Physiological range	T ₁ (%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)	SEM
PCV (%)	22 - 38 (%)	29.20 ^b	32.24 ^a	28.65 ^b	24.66 ^c	0.84
Haemoglobin (g/dl)	8 - 12 g/dl	9.51 ^b	10.33 ^a	9.67 ^b	8.23 ^c	0.23
RBC (x10 ⁶ /μl)	8-18(x10 ⁶ /μL)	12.47 ^c	15.37 ^a	13.86 ^b	10.72 ^d	0.53
Mean cell volume (fl)	16 - 25 (fl)	18.27 ^b	19.60 ^a	19.46 ^a	18.09 ^b	0.55
MCHC (%)	30-36 ((g/dl)	31.91 ^b	34.12 ^a	34.17 ^a	31.04 ^b	0.46
MCH (pg)	5.2 - 8 (pg)	5.76 ^c	7.32 ^a	6.27 ^b	6.04 ^{bc}	0.18
WBC (x10 ³ /μl)	4-13(x10 ³ /μL)	5.24 ^d	7.59 ^c	9.71 ^b	11.65 ^a	0.72

^{a-d} means with different superscripts along the same row are significantly (p<0.05) different;

PCV = Packed cell volume; RBC = Red blood cells; MCH = Mean cell haemoglobin; MCHC = Mean cell haemoglobin concentration; WBC = White blood cells

Table 5: Serum biochemistry of West African dwarf goats fed Siam weed leaf meal

Parameters	Physiological range	T ₁ (%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)	SEM
Total Protein (g/l)	60 - 79 (g/l)	66.62 ^b	68.79 ^a	68.60 ^a	65.93 ^b	0.40
Albumin (g/l)	27 - 39 (g/l)	36.79 ^a	35.35 ^a	31.60 ^b	27.37 ^c	1.11
Globulin (g/l)	27 - 41(g/l)	29.89 ^d	33.44 ^c	37.00 ^b	38.56 ^a	1.01
Glucose (mmol/l)	2.78-4.16 (mmol/l)	3.16 ^a	3.20 ^a	2.91 ^b	2.93 ^b	0.09
Creatinine (µmol/l)	88.4-159 (µmol/l)	90.18 ^c	94.66 ^a	92.01 ^b	90.31 ^{bc}	0.59
Urea (mg/dl)	10-20 (mg/dl)	13.26	12.81	12.21	12.08	0.21
TB (µmol/l)	0-1.71 (µmol/l)	0.89	0.80	0.69	0.89	0.07
Cholesterol (mg/dl)	40.1-127.3 (mg/dl)	163.20 ^a	159.61 ^b	146.50 ^c	140.11 ^d	2.89
Triglyceride (mg/dl)	4-23 (mg/dl)	16.12 ^a	12.38 ^b	9.50 ^c	7.71 ^c	0.85
LDL (mg/dl)		15.00 ^a	12.98 ^b	12.52 ^b	12.60 ^b	0.42
HDL (mg/dl)		25.00 ^c	29.92 ^c	37.58 ^b	41.30 ^a	0.94
ALT (U/L)	15.3-52.3 (U/L)	22.50	16.50	22.50	24.50	1.36
AST (U/L)	12-38 (U/L)	41.20	42.75	36.90	50.50	4.75
ALP (U/L)	61.3-283.3 (U/L)	66.62	70.58	73.89	73.82	1.47

^{a-d} means with different superscripts along the same row are significantly (p<0.05) different; TB = Total bilirubin; ALT = Alanine amino transferase; AST = Aspartate amino transferase; ALP = Alanine amino phosphatase; LDL = Low density lipoprotein; HDL = High density lipoprotein

This may indicate no symptoms of abnormal glucose levels in the blood, which include diabetes, liver dysfunction, weakness, weight loss and blurred vision. Also, the lower glucose levels reported for the treatment groups may indicate that increasing Siam weed leaf meal resulted in decreasing energy (in the form of glucose) levels in the blood serum. The values of 90.18-94.66 µmol/l observed in this present study for creatinine were significantly (p<0.05) influenced and fell within the physiological range of 88.4-159 µmol/l reported by (44) for apparently healthy goats. This could indicate that there was no catabolism or loss of muscle tissue and that the animals were not surviving at the expense of their body reserve. This may further indicate that the dietary proteins were well utilized by the goats and the shade drying followed by the harmer milling of Siam weed did not interfere with nutrient utilization since creatinine is used as an index for renal function. Similar to the results of this study, (5) reported total bilirubin values of 0.45-0.80 µmol/l for WAD goats fed *Moringa oleifera* leaf meal containing diets. The values reported herein

fell within the range of 0-1.7 µmol/l by (44) for clinically healthy goats, indicating that the diets were not damaging to the liver as bilirubin is regarded as a pointer of liver function. Cholesterol, triglyceride and low-density lipoprotein (LDL) levels decreased progressively with increasing levels of Siam weed leaf meal. Cholesterol, triglyceride and LDL levels were significantly higher (p<0.05) in T₁ (163.70mg/dl), (16.12mg/dl) and (15mg/dl) respectively compared to other treatments. The values of the cholesterol and triglyceride herein are within the normal range of 80-130 mg/dl and 4-23 mg/dl respectively reported by (44) and (47) for clinically healthy goats. This is in agreement with the findings of (11) and (49) who reported significantly lower cholesterol values to broilers fed Siam weed leaf meal and Siam weed leaf extracts respectively. The function of the heart and the presence of cardiovascular disease are evaluated using cholesterol and triglyceride readings, which are typically positively associated. High-density lipoprotein (HDL) obtained for WAD goats in this study is lower than the values reported by (50) for filial Etawah

goat-fed concentrate-rich omega-3 supplements. The HDL was significantly ($p < 0.05$) higher in T₄ in comparison with other treatments. In general, HDL is a mixture of protein and fat that circulates in the bloodstream and transports cholesterol from body tissues to the liver and bile. Because HDL is commonly thought of as a healthy cholesterol, animals with high levels of HDL may not develop coronary heart disease (50). LDL, on the other hand, is a lipoprotein that transports cholesterol from the liver to the body tissues and is hence referred to as bad cholesterol. The LDL on the other hand was significantly ($p < 0.05$) higher in T₁ in comparison with other treatments. The differences may be traced to different inclusion levels of Siam weed leaf meal in the diets of the WAD goats. In earlier studies, (51), (52) and (53) reported the anti-adipogenic, hypocholesterolemic, anti-diabetic, hypoglycemic, antioxidant and hypolipidemic of Siam weed (*Chromolaena odorata*) leaves.

Conclusion and Applications

This study showed:

1. That the nutrient and phytochemical compositions of Siam weed (*Chromolaena odorata*) leaf meals supported the blood profile of WAD goats at 0 - 15% inclusion levels.
2. Feeding WAD goats diets containing SWLM up to 15% level has no deleterious effects on the health of the goats and this has been elicited in goats as evidenced by within the physiological range for all the haematological and serum biochemical indices studied.

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