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HAEMATO-SEROLOGICAL INDICES OF WEST AFRICAN DWARF GOATS FED BOILED WILD AERIEL YAM (*DIOSCOREA BULBIFERA*) MEAL-BASED DIETS

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Abstract

An animal's blood profile reflects its overall health condition. This study evaluated the haematological and serum biochemical effects of feeding West African dwarf (WAD) goats diets containing boiled wild Dioscorea bulbifera meal at 0% (control, T_1), 10% (T_2), 20% (T_3), and 30% (T_4) inclusion levels, alongside rice bran, brewers dried grains, palm kernel cake, bone meal, and salt. Sixteen goats were assigned to four treatments in a completely randomised design with four replicates each. After eight weeks, blood samples from two goats per treatment were analysed for haematological and serum biochemical parameters. Results showed significant differences ($p<0.05$) in packed cell volume, haemoglobin, neutrophils, lymphocytes, total protein, albumin and ALP across treatments, but no significant differences ($p>0.05$) in red blood cells, white blood cells and globulin. Although some of the parameters exhibited significant ($p<0.05$) differences in their values among the treatment groups, data obtained for all the parameters were within the normal ranges for healthy WAD goats, indicating that boiled wild Dioscorea bulbifera at 10–30% inclusion had no adverse effects on blood profiles, thus being a safe non-conventional feedstuff for West African dwarf goats. Further research involving inclusion level above 30% is therefore suggested to ascertain the safe level of wild aerial yam as a nonconventional feedstuff to WAD goats.

Keywords: Haematology, Serum biochemistry, *Dioscorea bulbifera*, West African dwarf goat.

Description of Problem

Nutrition plays a pivotal role in livestock productivity and health, accounting for 60–70% of total costs in intensive animal production (Abiola *et al*., 2012). In Nigeria's savanna grasslands, ruminant feed resources face issues like inconsistent quality, seasonal scarcity, and poor management, especially during the dry season when pasture nutritive value drops, leading to weight loss in livestock (Gabriel et al., 2018; Udo *et al*., 2024a; Sowande *et al*., 2008).

This scarcity significantly hampers goat productivity in tropical regions, where goats, reliant on native grasses, legumes, and browse plants, are a crucial income source for farmers. To address seasonal forage shortages, researchers are investigating alternative feed sources such as wild aerial yam (*Dioscorea bulbifera*), known locally as Ukad ekpo in Efik (Udo *et al*., 2024b).

Wild aerial yams, which are abundant and nutritiously is often wasted as it is not consumed by humans (Babayemi *et al*., 2003). It is rich in nutrients, minerals, phytochemicals, and diosgenin, a steroid saponin with therapeutic benefits for conditions like arthritis and inflammation (Sowande *et al*., 2008). Udo *et al*. (2024b) reported that boiled *Dioscorea bulbifera* meal contains 11.63% crude protein, 4.10% crude fibre and 66.53 nitrogen-free extract. Thus, it could help alleviate dry-season feed shortages by supplying essential nutrients to ruminants.

Haematological and serum biochemical analyses are essential for evaluating animal health, monitoring physiological and pathological conditions, and assessing the safety and efficacy of new feed components (Etim *et al*., 2013). These parameters indicate how animals respond to dietary changes and help detect potential feed toxicity (Ramprabhu *et al*., 2010). However, there is limited data on the blood profile responses of WAD goats to these alternative feeds, thus encouraging the need for further studies to confirm their safety and effectiveness

in enhancing livestock productivity during feed-scarcity periods.

MATERIALS AND METHODS

Experimental Site

The research was carried out at the Goat Unit of the Teaching and Research Farm of the Department of Animal Science, Akwa Ibom State University, Obio Akpa campus, Oruk Anam Local Government Area of Akwa Ibom State, Nigeria. Obio Akpa is located between latitudes 4º30ºN and 5º00N and longitudes 70º30ºE and 80º00E (AKSG, 2022).

Experimental Layout

Sixteen West African Dwarf goats, aged 9–10 months, were sourced from local farmers near the University in Akwa Ibom State and managed intensively. Their pens were washed, fumigated, and the cement floor was covered with wood shavings, and set up 14 days prior to commencement of the quarantine period. The goats underwent a 14-day quarantine period when they received vaccinations for PPR, and were treated for internal parasites with Albendazole. Initial weights were balanced across groups, and each goat was housed individually with water and feeding troughs. Four treatment groups of four goats were randomly assigned one of four experimental diets, with each goat serving as a replicate in a completely randomised design (CRD). Each goat received 1 kg of the formulated diet daily in the morning and 2 kg of guinea grass in the afternoon for 56 days.

Blood Collection

Blood samples were obtained from each goat via jugular vein puncture (Frandson, 1986) at the end of the experiment to evaluate haematological (red blood cell, packed cell volume, haemoglobin, white blood cell) and biochemical parameters. Samples were collected into two types of bottles: one containing ethylene diamine-tetra-acetate (EDTA) as an anticoagulant for haematological analysis, and another without an anticoagulant to harvest serum for biochemical analysis.

Statistical Analysis

The collected data were analysed using Analysis of Variance (ANOVA) with SPSS software (2021). Significant differences among means were identified using Duncan's New Multiple Range Test (Duncan, 1955).

Result and Discussion

Table 1 shows the result of the haematological assessment of West African Dwarf goats fed diets with 0% (T1, control), 10% (T2), 20% (T3), and 30% (T4) boiled wild *Dioscorea bulbifera* meal. Red blood cell counts (9.16, 8.05, 8.27, 9.17 $x10^6/mm^3$ for T1–T4) and white blood cell counts (8.50, 8.56, 8.58, 8.60 $x10^3/mm^3$) showed no significant differences ($p>0.05$) and fell within normal ranges (8.0–18.0 and 4.0–13.0, respectively; Radostitis et al., 2000), indicating no adverse effects on blood health, thus proving that Boiled *Dioscorea bulbifera* meal had no dietary toxicity Packed cell volume (23.67%, 29.33%, 28.67%, 23.67%), haemoglobin (8.97, 11.50, 11.47, 9.00 g/dl), showed significant differences ($p<0.05$) but remained within normal ranges (22–38%, 10–19 g/dl, 16–35 fl, 6.0–14 pg, 30–43 g/dl; Radostitis *et al*., 2000), suggesting normal bone marrow function and no hypochromic or macrocytic anaemia. Neutrophils (46.00–48.66%), lymphocytes (42.00–45.00%), eosinophils (5.33–5.66%), and basophils (2.00–3.33%) showed no significant differences ($p>0.05$) and were within normal ranges, indicating no infection or immune issues (Etim *et al*., 2013). Boiling the *Dioscorea bulbifera* meal may have reduced the anti-nutritional factors, making the nutrients more available, minimizing adverse effects on blood health Total protein levels (6.72, 6.94, 6.96, 7.73 g/dl for T1–T4, differed significantly ($p<0.05$), with T4 highest (7.73 g/dl) and T1 lowest, yet all values fell within the normal range (3.0-8.0g/dl; Karan et al., 2012), indicating good protein utilisation. The albumin content reduced (2.75-3.42 mg/dl) with increased level of *Dioscorea bulbifera* meal and showed significant differences ($p>0.05$), but was within normal ranges (2.55–3.23 mg/dl; Etim *et al*., 2013). A gradual increase was observed in Globulin values as the inclusion increased in the diets, suggesting an increase in immune defence. Ramprabhu *et al.* (2010) observed that the higher the value of globulin, the greater the ability to fight infection because globulin is known to fight infection. Alkaline phosphatase (65.33–71.33 U/L) varied significantly ($p<0.05$) but remained

within normal ranges for healthy WAD goats, indicating no liver issues. This proved that the diets were of better quality and supported the physiological function of the goats fed, hence their better performance. Low ALP may impair bone mineralisation, leading to weak bones or growth issues in young goats (Radostitis *et al.*, 2000). The results confirm that boiled wild *Dioscorea bulbifera* at 10–30% inclusion poses no health risks to WAD goats.

Table 1: HAEMATO-SEROLOGICAL INDICES OF WEST AFRICAN DWARF GOATS

Parameters	$T_{1(control)}$	$T_{2(10\%)}$	$T_{3(20\%)}$	$T_{4(30\%)}$	SEM	Normal Range*
RBC($x10^6/mm^3$)	9.20	9.22	9.27	9.27	0.23	8.0 – 18.00
PCV (%)	23.67^b	29.33^a	28.67^a	23.67^b	0.87	22 – 38
Hb (g/dl)	8.97^c	11.50^a	11.47^a	10.00^b	0.37	10 – 19
WBC($x10^3/mm^3$)	8.55	8.56	8.58	8.60	0.24	4.0 – 13
NEU (%)	37.33^a	34.33^b	33.33^b	32.66^b	0.61	35 -50
LYM (%)	37.00^b	38.66^{ab}	39.66^a	39.00^a	0.46	20- 46
TP (g/dl)	6.72^c	6.94^b	6.96^b	7.73^a	0.37	3.0 – 8.0
Albu(gdl)	3.42^a	3.23^b	2.87^c	2.75^c	0.13	2.0 – 3.5
Globu(g/dL)	2.0	2.25	2.35	3.00	0.31	2.0–3.5 g/dL
ALP (u/l)	67.00^b	65.33^b	71.33^a	65.66^b	0.92	44 – 86 u/l

^{abc} means with different superscript on the same row are significantly different (P<0.05). SEM= standard error of means, RBC=Red blood cells, PCV= Packed cell volume, Hb= Haemoglobin, WBC= White blood cells, NEU= Neutrophils, LYM= Lymphocytes, TP=Total protein, Albu= Albumin, Globu=Globulin, ALP = Alkaline phosphate. *Radostitis *et al.,* (2000)

Conclusion and Application

From the foregoing, it could therefore be concluded that feeding WAD goat with boiled wild *Dioscorea bulbifera* based diets would not have any deleterious effect on their health status, especially during the off-season of the grass.

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