

EFFECT OF AQUEOUS GMELENA (*Gmelina arborea*) LEAF EXTRACT ON THE OXIDATIVE STABILITY OF WEST AFRICAN DWARF SHEEP

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ABSTRACT

The practice use of herbal medicine in recent times cannot be overemphasized in livestock industry. Hence, a 56 day trial was conducted to investigate the effect of aqueous *Gmelina arborea* leaf extract (AGALE) on oxidative stability of West African Dwarf (WAD) sheep. Twenty (20) WAD sheep, with an average live weight of $16 \pm 0.02\text{kg}$ were randomly assigned into four treatment groups consisting of 5 animals per treatment in a completely randomized design (CRD). Fresh, clean water, cassava peel, and grasses were made available *ad libitum* during acclimatization. AGALE was administered on daily basis at varying levels such that T_1 served as the control (0 mL), while T_2 , T_3 , and T_4 received 5, 10, and 15 mL respectively. At the end of the feeding trial, three WAD sheep per treatment were randomly selected for blood samples collection to determine oxidative biomarkers. No significant ($p < 0.05$) influence was observed on all the oxidative stability parameters measured except the catalase (CAT) and glutathione (GSH) values. The CAT values observed in this study varied significantly ($p < 0.05$) across the treatment groups in which WAD sheep drenched 5mL AGALE recorded highest value (14.14 u/mL) followed by those drenched 15mL (11.27u/moL), 10mL (9.45u/moL) and 0mL (4.36u/moL) respectively. Animals administered 0 (199.38 $\mu\text{mol/L}$) and 5mL (152.33 $\mu\text{mol/L}$) AGALE recorded similar GSH values but significantly higher than those administered 10 (185.33 $\mu\text{mol/L}$) and 15 (152.33 $\mu\text{mol/L}$) mL AGALE respectively. It was concluded that 5mL AGALE inclusion level reduced oxidative stress and increased antioxidant stability in WAD sheep.

Keywords: Medicine, *Gmelina arborea*, Extract, Herbs, Phytochemicals, Browse plant

INTRODUCTION

Medicinal plants have proven effective in various applications for ruminant animals, driving renewed interest in herbal-based medicine as a source of novel antibacterial drugs. Their long history of use among certain populations, coupled with their safety for both humans and the environment, makes them a promising alternative (Banu *et al.*, 2013). One such plant is *Gmelina arborea*, a leguminous browse species commonly found in tropical regions. The aqueous leaf extract of *Gmelina arborea* (AGALE) has demonstrated potential in enhancing health parameters across different animal species. While some plant extracts offer health benefits, others may be toxic to animals due to their secondary metabolite composition. Therefore, animal trials are essential to confirm their safety when used as dietary additives. Biochemical markers, such as metabolite and enzyme concentrations in the blood, are closely linked to the physiological status of sheep. Hematological parameters can be influenced by various factors, including temperature, nutrition, reproductive status, metabolic disorders, age, sex, breed, season, and management-related stress (Piccione *et al.*, 2009). Given these considerations, this study evaluated the inclusion of AGALE in the diets of WAD sheep to determine its effects on oxidative stability.

Material and Methods: Experimental site and duration: 8-week trial was conducted at the Teaching and Research Farm, Federal College of Animal Health and Production Technology, Moor Plantation, Apata, Ibadan.

Experimental animals, diet and design: A total number of twenty (20) West African Dwarf (WAD) Sheep aged 7 to 8 months weighing $16 \pm 0.02\text{kg}$ were purchased from Akinyele market in Ibadan, Oyo state. Prior to the arrival of the animals, the pens were thoroughly washed and disinfected with Povidone-iodine. The WAD sheep were confined in individual pen and quarantined for a period of two (2) weeks until they were stabilized. Fresh cool clean water, cassava peel and grasses (Table 1) were made available *ad libitum*. During acclimatization, WAD sheep were given prophylactic treatments consisting of intramuscular injection of oxytetracycline (long acting) and vitamin B complex to ensure good body condition of the animals. After adaptation period, the 20 WAD sheep were randomly allotted into four treatment groups during which the animals were drenched AGALE at varying levels; T_1 (0mL), T_2 (5mL), T_3 (10mL) and T_4 (15mL).

Test Ingredient Preparation: *Gmelina arborea* leaves were collected from the *Gmelina arborea* trees at the College and rinsed thoroughly in water to remove any debris. The leaves were then air-dried completely, ground into a fine powder, and sieved to achieve a smooth leaf meal. This leaf meal was taken to the laboratory at the University of Ibadan for further processing. In the laboratory, the leaf meal was dissolved in 45 litres of distilled water for 24 hours, sieved using muslin cloth, and the filtrate was then filtered through Whatman's filter paper. The filtered solution was then processed using a rotary evaporator, which consisted of a pressure machine,

Table 1: Chemical and Gross composition of the experimental diet

Chemical composition		Gross composition	
Parameters	%	Ingredient	%
Dry Matter	92.75	Cassava peel	50.00
Crude Protein	15.19	Soyabean	14.00
Ether Extract	2.39	Wheat offal	22.00
Ash	8.24	Palm kernel cake	11.00
Neutral Detergent Fibre	32.30	Premix	1.00
Acid Detergent Fibre	11.35	Limestone	1.00
Acid Detergent Lignin	3.88	Salt	1.00
Cellulose	7.47	Total	100.00
Hemicellulose	20.95	Calculated analysis	
Nitrogen Free Extract	59.22	Metabolizable energy (Kcal)	2274.05
		Crude Protein %	13.80
		Crude Fibre %	8.60

sender flask, receiver flask, water bath, condenser, and the main unit. A quantity of the filtrate was poured into the sender flask, and the machine was activated. The bath temperature was set to 50°C to prevent denaturing the filtrate. As the process continued, vapor rose from the sender flask to the condenser. The condenser, with the aid of a water supply, condensed the vapor back into liquid form and directed it to the receiver flask. Once the *Gmelina arborea* filtrate reached a sticky consistency, it was transferred into petri dishes. The number of petri dishes used varied depending on the quantity of the extract. The AGALE was then freeze-dried to achieve a crystalline texture.

Table 2: Effect Aqueous *Gmelina arborea* Leaf Extract on the Oxidative Stability of West African Dwarf Sheep

Parameters	Level of AGALE administration (mL)				SEM
	0	5	10	15	
MDA(umol/L)	0.59	0.40	0.50	0.53	0.11
SOD(ng/mL)	53.50	31.67	100.00	50.00	12.11
CAT(u/mL)	4.36 ^b	14.14 ^a	9.45 ^{ab}	11.27 ^a	1.46
GSH(umol/L)	199.38 ^a	199.03 ^a	185.33 ^b	152.33 ^b	7.82

^{abc} means on the same row with different superscripts are significantly different ($p < 0.05$) MDA: Malondialhyde, SOD: Superoxide dismutase, GSH: Glutathione, CAT: Catalase, AGALE: Aqueous *Gmelina arborea* leaf extract

Data Collection and Statistical Analysis: After the feeding trial the bleeding of the animals was done in the early hour of the day for blood sample collection. Approximately 5mL of blood was collected directly from jugular vein of three (3) selected animals from each treatment, using a non-contaminated hypodermic needle and syringe into sets of sterilized sample bottles without an anticoagulant. The samples were taken to the laboratory, for the determination of oxidative stress biomarker, such as Glutathione peroxidase was spectrophotometrically analyzed as described by Li *et al.* (2015). Malondialdehyde (MDA) was assayed as described by Chakraborty, and Pradhan (2011). Superoxide dismutase (SOD) activity in blood serum was determined by the method of Didion *et al.* (2002). All data obtained were subjected to analysis of variance using statistical package; (SAS, 2005) and the means among the variables were separated using Duncan multiple range test of the same statistical package.

RESULTS AND DISCUSSION:

Presented in Table 2 is the effect of aqueous *Gmelina arborea* leaf extract (AGALE) on the oxidative stability of West Africa Dwarf (WAD) sheep. AGALE had no significant ($p > 0.05$) effect on the oxidative stability of WAD sheep except the catalase and Glutathione values. Catalase values of the sheep observed in this study varied significantly ($p < 0.05$) across the treatment groups in which sheep administered 5mL recorded the highest value (14.14 u/mL) while the lowest value was obtained in sheep administered 0 mL (4.36 u/mL) AGALE. The glutathione values observed in this study, animals administered 0 (199.38 µmol/L) and 5mL (152.33 µmol/L) AGALE recorded similar value but significantly higher those administered 10 (185.33 µmol/L) and 15 (152.33 µmol/L) mL AGALE respectively. Phytochemical properties, including secondary metabolites found in plant extracts, have been reported by (Salem *et al.*, 2012) to enhance animal performance. Oxidative stress has been implicated in many disease states, including helminthic, inflammation, wounds, and other neurodegenerative

disorders (Jones, 2008) Herbal anti-oxidants are bioactive phytoconstituents with the ability to scavenge reactive oxygen and nitrogen species, which are the major causes of oxidative stress in the body (Burton and Jauniaux 2011). The use of natural antioxidant in the management of disorders associated with oxidative stress is becoming an attractive alternative in recent time (Vijay and Vimukta, 2014). The variation observed in the catalase (CAT) values of the experimental WAD sheep could be attributed to the abundance phenolic compound present in the AGALE enhancing the antioxidant activities of the sheep across the treatment groups. This results corroborated with the findings of Cartea *et al.* (2011) who reported similar beneficial roles of phenolic compounds in free radical-mediated processes on the antioxidant properties of sheep. The increased glutathione values observed in WAD sheep administered 0 (199.38 $\mu\text{mol/L}$) and 5mL (199.03 $\mu\text{mol/L}$) AGALE can be ascribed to non-effective antioxidant in treatment 3 and 4 resulted in poor growth and several diseases (Parnian *et al.*, 2014).

CONCLUSION:

It was concluded that 5mL AGALE administration enhanced the activity of antioxidant stability which invariably reduced the oxidative stress values of WAD sheep observed in this study.

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