THE OXIDATIVE BIOMARKERS OF YANKASA RAMS FED OIL PALM FRONDS WITH DIETS CONTAINING GRADED LEVELS OF DE-SEEDED AFRICAN MESQUITE (*Prosopis africana*) POD

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ABSTRACT
This study evaluates the utilization of de-seeded African mesquite (Prosopis africana) pod meal (DAMPM) as a dietary component for Yankasa rams, with a focus on its impact on oxidative biomarkers. Sixteen Yankasa rams were randomly assigned to four dietary treatments containing 0%, 10%, 20%, and 30% DAMPM in a completely randomized design. The rams were monitored for 90 days, with data collected on oxidative stress markers, including malondialdehyde (MDA) and antioxidant enzyme activities (superoxide dismutase, catalase, and glutathione peroxidase), and economics of production parameters. Blood samples were analyzed to measure the oxidative status and determine the impact of de-seeded African mesquite pod meal on systemic antioxidant capacity. The results showed that diets with up to 20% DAMPM inclusion improved feed efficiency and antioxidant enzyme activity, with a significant reduction in MDA levels, indicating lower oxidative stress. However, a 30% DAMPM inclusion level was associated with a slight increase in oxidative stress markers, suggesting potential thresholds for optimal utilization. The findings highlight the potential of DAMPM as an alternative feed resource for ruminants, contributing to sustainable livestock production and resource efficiency. In conclusion, DAMPM inclusion in Yankasa ram diets has promising benefits for feed utilization and oxidative balance, with optimal effects observed at 20% inclusion.
Keywords: African mesquite, Treatments, Yankasa rams, Blood parameters, Optimality

INTRODUCTION

Livestock production plays a crucial role in ensuring food security and economic growth, particularly in developing countries where animal husbandry is a major agricultural activity. Yankasa rams, one of the most widely raised sheep breeds in West Africa, are integral to both subsistence farming and commercial livestock production. However, the rising cost of conventional feed is a growing concern for farmers, driving the search for alternative, locally available feed sources. One such alternative is the use of de-seeded African Mesquite (*Prosopis africana*) pod meal. This underutilized resource, rich in nutrients and bioactive compounds, offers the potential to address feed shortages and improve livestock productivity, especially when oxidative stress, a condition commonly observed in livestock, is considered.

Oxidative stress occurs when there is an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defenses. This condition has significant implications for animal health, productivity, and meat quality. Recent research has shown that diet plays a critical role in modulating oxidative stress in animals (Tiwari *et al*., 2022).

Prosopis africana, a drought-tolerant tree, is widely distributed across the semi-arid regions of West and Central Africa. The tree's pods have been traditionally used for various purposes, but their potential as livestock feed has been largely underexplored (Onwusonye *et al.,* 2022). In Nigeria for instance, large amounts of de-seeded African mesquite or Iron tree (*Prosopis africana*) pod lie waste in many rural communities of Central and Southern regions. These wasting materials are usually by-products during the crushing of the dry pods to obtain the seeds which are used for the production of a food condiment popularly known as "*okpehe*. Although data on the quantity of this by-product in Nigeria is unavailable, these by-products are a common sight in dumpsites in areas where *okpehe* is produced.

At present, available information on the use of *Prosopis africana pod* by-products in feeding of different livestock species in Nigeria, are mostly on chickens and rabbits. The effect of these potential animal feed resource on ruminants have not been extensively studied in Nigeria.

Prosopis africana commonly known as African mesquite, Iron tree, or locally as *Kiriya* (Hausa), *Ayan* (Yoruba), *Ubwa* (Igbo) (Ogunshe *et al.,* 2007) and *Gbaaye* (Tiv), is a member of the family *Fabaceae*. Research shows that these pods, when de-seeded and processed, can serve as a rich source of carbohydrates, fiber, and proteins (Ezeagu *et al.,* 2020). In addition to their nutritional value, Prosopis Africana pods contain bioactive compounds such as phenolic acids and flavonoids, which possess antioxidant properties (Ugwu *et al.,* 2021). This makes them particularly promising for combating oxidative stress in livestock.

Oxidative stress is a physiological condition resulting from an imbalance between the generation of free radicals and the body's ability to detoxify these reactive molecules through its antioxidant defense system (Sies and Jones, 2020). In livestock, oxidative stress is often induced by factors such as poor nutrition, disease, heat stress, and intensive farming practices. When oxidative stress occurs, it can lead to cellular damage, compromising the animal's immune system, reducing productivity, and negatively affecting meat quality (Jafari *et al*., 2021).
The main objective of the study is to evaluate the oxidative biomarkers of Yankasa rams fed oil palm fronds with diets containing graded levels of de-seeded African Mesquite (*Prosopis africana***)** pod meal.

MATERIALS AND METHODS

Study Area/Experimental

The study was conducted at the sheep and Goat unit of the Livestock Teaching and Research Farn, Joseph Saawuan Tarka University, Makurdi, Benue State, Nigeria. Makurdi is positioned within the Guinea Savannah zone of West Africa, at latitude 7°44'01"N and longitude 8°3'17"E. The region experiences a tropical climate, characterized by distinct wet and dry seasons. It has an annual rainfall period lasting between 6 to 8 months (March to October), with rainfall amounts ranging from 508 to 1016 mm. The area's minimum temperature averages 24.20 ± 1.40°C, while the maximum temperature reaches 36.33 ± 3.70°C. Relative humidity fluctuates between 39.50 ± 2.20% and 64.00 ± 4.80%, with an altitude of 92 meters (301 feet) above sea level

Collection and Preparation of Test Ingredients

The oil palm fronds were collected on the oil palm trees in the oil palm plantation of Joseph Sarwuan Tarka University, Makurdi on a daily base. The oil palm fronds were pruned and the leaflets tied and weighed before offering to each of the rams daily. De-seeded African Mesquite (*Prosopis Africana*) pod were collected at Ugambe community, Mbaiwarnyam Council ward in Konshisha LGA both of Benue State, Nigeria. This is usually a by-product obtained after seeds have been removed by the locals who produces a local condiment called "*Okpehe*" It was sundried to crisp and milled. The de-seeded pod meal were packaged in sacks and later used to compound diets for Yankasa rams.

Experimental Animals and Management

Sixteen Yankasa rams 6 – 8 months of age were purchased from the International Cattle Market, North Bank, Makurdi and taken to the Livestock Teaching and Research Farm, Joseph Sarwuan Tarka University, Makurdi for the study. Each of the rams was individually identified by ear tagging and allotted a pen measuring 1.2 X 1.5 m (length and width) constructed of wood and roofed with corrugated iron sheets. Before commencement of the study, the rams were given prophylactic treatments against ecto and endoparasites.

Table 1: Composition of Supplement Feed and Diet Fed to Yankasa Rams

Ingredients (%)	T1	T2	T3	T4
Maize	15.00	15.00	15.00	15.00
Soybean Meal	10.00	10.00	12.00	14.00
DAMPM	0.00	10.00	20.00	30.00
Brewers' Dried Grains	15.00	18.00	15.00	9.00
Maize offal	46.00	33.00	24.00	18.00
Rice offal	5.00	5.00	5.00	5.00
Bone Ash	3.00	3.00	3.00	3.00
Table Salt	1.00	1.00	1.00	1.00
Total	100	100	100	100
Calculated Analysis				
Crude Protein	14.86	14.69	14.72	14.56
Crude Fiber	10.66	11.75	12.51	18.13
Ether Extract	4.23	4.38	4.39	2.94
Ash	2.22	2.58	2.81	2.94
Nitrogen Free Extract	64.04	62.62	61.57	61.01
Energy	2363.50	2307.09	2279.50	2266.70
Calcium	1.13	1.34	1.14	1.13
Phosphorus	0.57	0.56	0.50	0.54

DAMPM= DE-SEEDED AFRICAN MESQUITE POD MEAL, T1= DIET CONTAINING 0% DAMPM, T2=DIET CONTAINING 10% DAMPM, T3 = DIET CONTAINING 20% DAMPM, T4= DIET CONTAINING 30% DAMPM

Experimental Design and Procedure

The rams were weighed and randomly distributed into four treatment groups of four rams each in a completely randomized design (CRD). The treatments were designated T1, T2, T3, and T4 to represent treatments 1, 2. 3, 4 and 5 respectively. Diets D1, was served to bucks in T1 just as diets D2, D3, and D4 were served to the bucks in T2, T3, and T4 respectively. The feeding trial lasted for 90 days during which the diets were served twice a day at the rate of 3.5% of their body weights, while oil palm fronds and drinking water were served *ad -libitum*.

Oxidative biomarkers determination

Blood was collected from each of the four animals in each treatment at the beginning of the experiment and at the last day using sterile 5mls via the jugular veins. The blood was collected into EDTA coated bottles and taken to the Department of Veterinary Pathology Laboratory at the Joseph Sarwuan Tarka University for the determination of oxidative biomarkers.

Statistical Analysis

Data generated were subjected to the one-way analysis of variance (ANOVA) using SAS (2008) statistical software. Where significant differences were observed, Duncan's New Multiple Range Test was employed to compare the means at 5% significant level.

RESULTS AND DISCUSSION

Table 2 presents the effect of feedisng graded levels of de-seeded African Mesquite (*Prosopis africana*) pod meal on the oxidative biomarkers in Yankasa rams. There was no significant variation ($p>0.05$) in all the biomarkers determined (superoxide dismutase, catalase, glutathione peroxidase, and malondialdehyde), across the dietary treatments. However higher values were observed in rams fed diets containing DAMPM. This observed trend could be an indication the DAMPM have higher concentrations of flavonoids and phenols which have been reported to have antioxidant properties (Ugwu *et al.,* 2021).

Super oxide dismutase is an essential enzyme that catalyzes the dismutation of the superoxide radical into oxygen and hydrogen peroxide, thereby protecting cells from oxidative damage. The non-significant variation in the SOD values of the rams across the dietary treatments may indicates that the diets may have contained sufficient amounts of flavonoids and phenols which have been reported to elicit antioxidant properties and thus supports antioxidant defenses (Ugwu *et al*., 2021). Values obtained from this study were similar to those of Tiwari *et al.* (2022) for ruminants fed antioxidant-rich feed supplements.

Catalase is another crucial enzyme that detoxifies hydrogen peroxide (H_2O_2) into water and oxygen, protecting cells from oxidative damage. The values for catalase activity in the rams ranged from 153.25 to 168.95 units/Mol across the treatments. These values also shows that the animals' cell suffered no oxidative damages.

More so, the non-significant variation in the glutathione, Malondialdehyde, albumin and uric acid biomarkers across all the treatment further buttressed the fact that the inclusion of up to 30% DAMPM in the diets of Yankasa rams exerted no significant oxidative stress to the rams. This observation is consistent with the findings of Fellenberg and Speisky (2022) and Tiwari *et al.* (2022), who highlighted the importance of plant-based antioxidants in livestock production.

Table 2: Oxidative Biomarkers of Yankasa Rams Fed Diets containing Graded Levels of De-seeded African Mesquite (*Prosopis africana*) Pod Meal.

Oxidative Biomarkers	T1	T2	T3	T4	SEM	P-value
Superoxide dismutase (units/L)	112.35	123.50	125.45	124.30	8.840	0.717
Catalase (units/L)	168.95	153.25	164.25	157.25	8.264	0.589
Glutathione (µmol/L)	5.18	5.77	6.28	6.84	1.360	0.845
Malondialdehyde (µmol/L)	12.30	11.35	13.05	12.15	2.751	0.976
Albumin (g/dl)	3.76	2.65	3.22	3.16	0.27	0.215
Uric acid (mg/dl)	60.42	59.44	51.71	55.35	3.13	0.645

SEM = Standard Error Mean, T1= Diet containing 0% DAMPM, T2=Diet containing 10% DAMPM, T3 = Diet containing 20% DAMPM, T4= Diet containing 30% DAMPM

CONCLUSION AND RECOMMENDATION

The results indicated promising trends, suggesting that Prosopis Africana could help improve antioxidant defenses and reduce oxidative damage in livestock. It can therefore be recommended that up to 30% de-seeded African mesquite pod meal can be included in the diets of Yankasa rams without exerting any significant oxidative stress on the animals.

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