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Effect of Enzyme Supplemented Cassava Peel – Maize Cob Mixture on Histopathological Examination of Liver of Growing Pigs

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A R T I C L E I N F O

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A B S T R A C T

This study assessed the effect of enzyme supplemented cassava peel–maize cob mixture (CPM-CM) on histopathological examination of growing pigs. Gilts were assigned randomly to four treatments (n = 10 pigs/ treatment). Each treatment consists of 5 replicate with 2 pigs each in a completely randomized design. Enzyme supplemented dried cassava peel and maize cob meal (CPMCM) at ratio 1:1 was incorporated into the experimental diet to replace maize as follows: treatment 1 (T1) control diet (0 % CPMCM with enzymes), T2 (10 % CPM-CM with enzymes), T3 (20 % CPMCM with enzymes), T4 (30 % CPMCM with enzymes). The trial lasted for 60 days, feed and water was given ad libitum. Evaluation of phyto-constituents in CPM-CM revealed the presence of Saponins (208.2 mg/100g), flavonoids (123.4 mg/100g), tannins (51.82 mg/100g), alkaloids (109.8 mg/100g), phenols (87.12 mg/100g) and cyanide (3.45 mg/100g). Outcome on hepatic histopathology shows normal tissue architecture with normal central vein, hepatic lobules, hepatic sinusoids, portal tract and biliary tract. There was absence of congestion in the portal blood vessels and coagulative necrosis. It was concluded that feeding different levels of CPM-CM up to 30 % had no toxic effect on liver tissues and was able to neutralize the activities of free radicals in the cells of animals

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INTRODUCTION

The high cost of feed is one of the main obstacles preventing Nigeria's livestock industry from growing. About 60% of feed, which is also food for many Nigerian households, is made from maize. The high cost of these items is frequently caused by competition between humans and animals for resources like soy beans and maize (Oladunjoye et al., 2010). Numerous research have been conducted on a variety of agricultural items that provide energy as alternatives to maize in poultry feed. Sweet potatoes, cocoyam, yam, rice by-products, tuber peels, molasses, sorghum, orange peels, tiger nut chaff, and wheat are a few of the items that have been tried (Daniel et al., 2024; Alagbe, 2019; Alagbe, 2017). One of such agro-industrial by- product is cassava peels and maize cob which are cheaper and unconventional alternative feed resources for livestock animals (Daniel et al., 2024).

More than 800 million people worldwide rely heavily on cassava in their diets (FAO, 2007; Abougasem et al., 2015), and it is the third-largest source of carbohydrates in the tropical region, after corn and rice (Ceballos et al., 2004). One crop that may be left in the ground for up to two years, until needed, is cassava, which is known as a food security crop (Barratt et al., 2006). In many European countries, cassava has been a significant and affordable feed, and experts in Africa have long recognized it as a suitable animal feed for the continent's growing population.

When properly balanced with other nutrients, cassava peels and maize cobs offer enormous promise as inexpensive sources of food and energy for animals. In Africa, there is currently a lot of interest in using cassava as an animal feed (Hahn, 1988). The cyanide concentration and the challenge of acquiring adequate amounts are the main obstacles to the expanded use of cassava products as animal feed (Daniel et al., 2024). Since only a small percentage of cassava's total production is now employed, mostly in compounded non-ruminant diets, its promise as a grain substitute in animal feed has not yet been fully realized.

In high concentrations, certain anti-nutrients found in agro-industrial waste can be hazardous to cells and even kill animals. On the other hand, little is known about feeding pigs a mixture of cassava peel and corn cob. This work is relevant because it will support livestock sustainability and advise farmers on the optimal level of inclusion to support animal health.

LITERATURE REVIEW

Study Area

This study was carried out in the Department of Animal Science, Faculty of Agriculture, University of Abuja Teaching and Research Farm, Main Campus, along Airport Road, Gwagwalada, Abuja, Nigeria. Between latitudes 8o571 and 8o551N and longitudes 7o051 and 7o 061E is Gwagwalada.

Processing of Cassava Peel – Maize Cob Mixture

We gathered fresh cassava peels and maize cobs from a number of open marketplaces in Gwagwalada, Nigeria. Samples were collected, transported to the University of Abuja's Biological Science Department for accurate identification by a qualified taxonomist, and then sun-dried separately for two

weeks to inhibit the growth of microorganisms and the levels of anti-nutrients. Samples were then transported to the lab for additional analysis after being separately hammer-ground into meals and combined in a 1:1 ratio.

Animals and Their Management

A breeding farm in Abuja sold forty-five-month-old mixed-breed gilts, which were then sent to the University of Abuja's pig section in Nigeria. Two weeks prior to the start of the trial, the piglets' arrival, the pens, the feeders, and the drinkers were thoroughly cleaned. Pigs were put on a two-week adaptation period, given a preventive medication, and fed a basal diet designed to satisfy their nutritional needs in accordance with NRC (1994). Following the acclimation phase, the animals were divided into four treatments (n = 10 piglets/treatment) at random after being stratified according to body weight. Five replicates of each treatment, each containing two pigs, are used in a fully randomized design.

Piglets were kept in 3.5 m2 semi-open concrete floor pens with drinkers and feeders to provide them with free access to fresh water. The investigation was conducted over 60 days using a completely randomized experimental design. Table 2 shows the results of Treatment 1 (T1) control diet—0 percent CPM-CM with enzymes; Treatment 2 (10 percent CPM-CM with enzymes); Treatment 3 (20 percent CPM-CM with enzymes); and Treatment 4 (30 percent CPM-CM with enzymes). Each replicate's daily feed intake was calculated by deducting the feed that was offered from the feed that was declined. Feed offered and denied was weighed at the end of the experiment and documented every day. Using the techniques described by the Association of Analytical Chemists (2016), proximate analyses of the experimental diet and test substance were performed.

Analysis of phyto-constituents in test ingredient was done according to the method recently published by Alagbe (2024).

METHODOLOGY

Histopathological Examination

Five pigs from each treatment were slaughtered for histological analysis at the conclusion of the experiment. The collected liver samples were preserved throughout the whole night in a 10% buffered neutral formalin solution. Hematoxylin and eosin were used to treat and stain the liver tissues that had been fixed. Following that, stained slices were examined under a microscope using the methods described by Daniel et al. (2024).

Table 1. Phyto-Constituents in Cassava Peel- Maize Cob Mixture

Components	Concentration (mg/100g)
Saponins	208.2
Flavonoids	123.4
Tannins	51.82
Alkaloids	109.8
Phenols	87.12
Cyanide	10.45

Table 2. Ingredient and Chemical Composition of the Experimental diets (%DM)

Ingredients	T1 (0 %)	T2 (10 %)	T3 (20 %)	T4 (30 %)
Maize	55.00	49.50	44.00	38.50
Wheat offal	6.97	6.97	6.97	6.97
Soya beans	24.00	24.00	24.00	24.00
Groundnut cake	7.00	7.00	7.00	7.00
CPM-CM	0.00	5.50	11.00	16.50
Bone meal	3.00	3.00	3.00	3.00
Limestone	1.50	1.50	1.50	1.50
Methionine	0.20	0.20	0.20	0.20
Lysine	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25
Enzymes	0.03	0.03	0.03	0.03
Salt	1.80	1.80	1.80	1.80
Total	100.0	100.0	100.	100.0
Determined analysis				
Crude protein (%)	18.30	18.00	17.90	17.80
Crude fibre (%)	4.00	4.38	4.50	4.71
Ether extract (%)	3.00	2.92	2.90	2.87
Calcium (%)	0.45	0.45	0.45	0.45
Phosphorus (%)	0.30	0.30	0.30	0.30
Energy (Kcal/kg)	2601.8	2558.7	2556.0	2550.1

*vitamin A, 13,000 I.U., vitamin E, 5 mg, vitamin D3, 3000 I.U., vitamin K, 3 mg, vitamin B2, 5.5 mg, niacin, 25 mg, vitamin B12, 16 mg, choline chloride, 120 mg, Mn, 5.2 mg, Zn, 25 mg, Cu, 2.6 mg, folic acid, 2 mg, Fe, 5 mg, pantothenic acid, 10 mg, biotin, 30.5 mg, and antioxidant, 56 mg are provided as premix per kg diet.

RESULTS AND DISCUSSION

The phyto-constituents in the mixture of cassava peel and maize cob were shown in Table 1. Alkaloids (109.8 mg/100g), phenols (87.12 mg/100g), tannins (51.82 mg/100g), cyanide (3.45 mg/100g), flavonoids (123.4 mg/100g), and saponins (208.2 mg/100g). Both nutritional and therapeutic properties have been reported for these phyto-constituents, including antimicrobial, anti-inflammatory, antioxidant, anti-tumor, hepato-protective, antiviral, antifungal, immuno-modulatory, cardio-protective, and anti-helminthic properties (Daniel et al., 2023; Musa et al., 2020; Adewale et al., 2021). The study's reported cyanide content fell under the EPA's (2004) acceptable limit of 200 mg. The findings about the phyto-constituents of CPM-CM are consistent with Daniel's report from 2025.

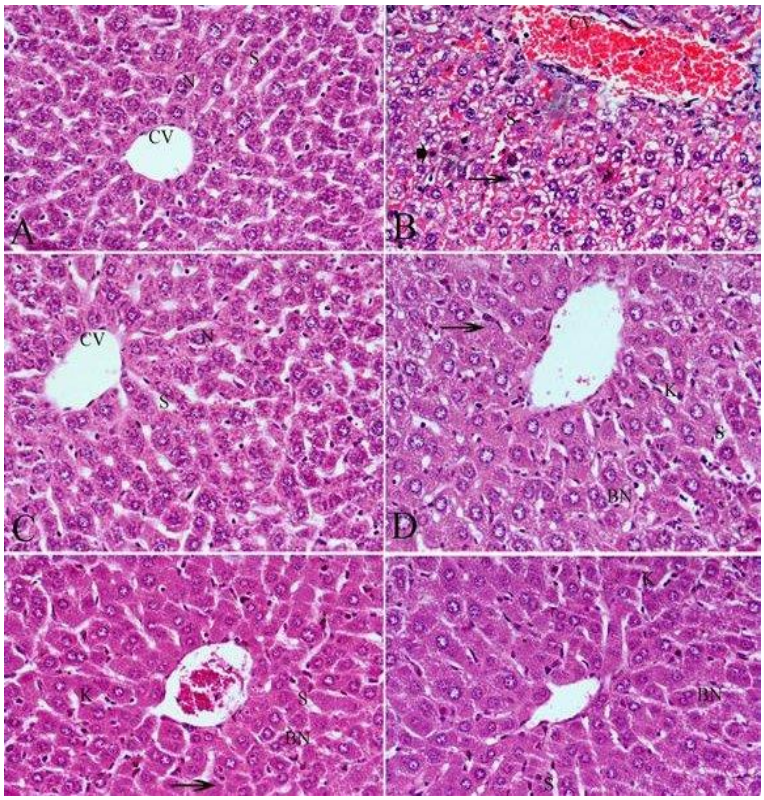
The liver sections under examination are shown in Plates 1-4, respectively. The basal diet is shown on plate 1 (control), whereas CPM-CM was substituted for maize at 10%, 20%, and 30% on plates 2, 3, and 4, respectively. All of the liver sections that were analyzed in this study, however, showed normal tissue architecture, including normal Kupffer cells, hepatic sinusoids, biliary

tract, lobules, and portal tract. Similarly, there was no coagulative necrosis, portal blood vessel congestion, or hepatocellular injury.

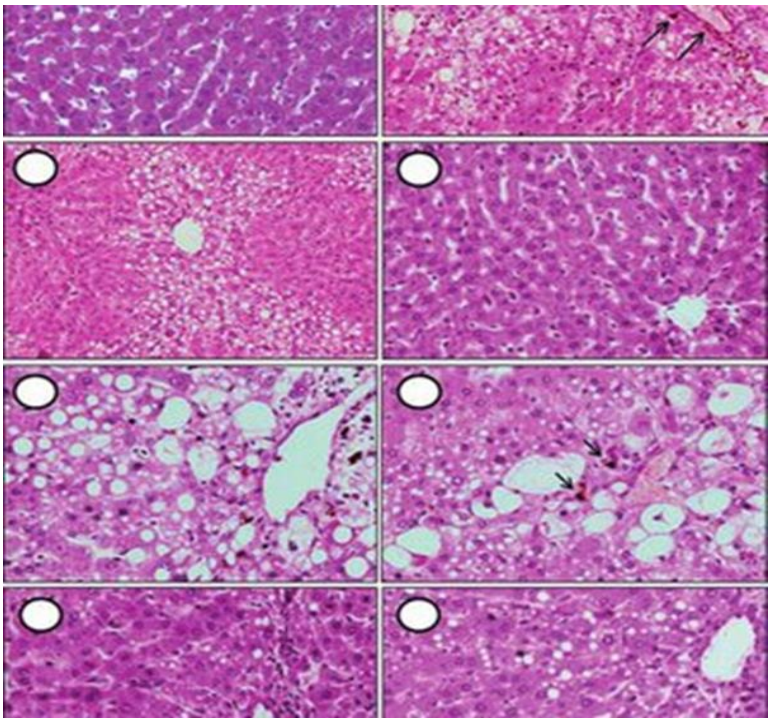
This result demonstrates that the phyto-constituents in CPM-CM have a number of pharmacological characteristics. For example, saponins have been proposed to stabilize liver cells and scavenge the actions of disease-causing free radicals (Shittu et al., 2023; Singh et al., 2022; John, 2024d). Animal bodies that include flavonoids and phenolic compounds have a wide range of antibacterial effects, inflammatory pathway blockages, and pain mediator suppression (Alagbe, 2025). These phytoconstituents work in concert to preserve intestinal flora balance and stop liver deterioration. The liver cells were not harmed because the cyanide concentration was likewise within an acceptable range. Pathogenic bacteria are the main cause of animal liver cell degeneration, claim Wang et al. (2017).

CONCLUSIONS AND RECOMMENDATIONS

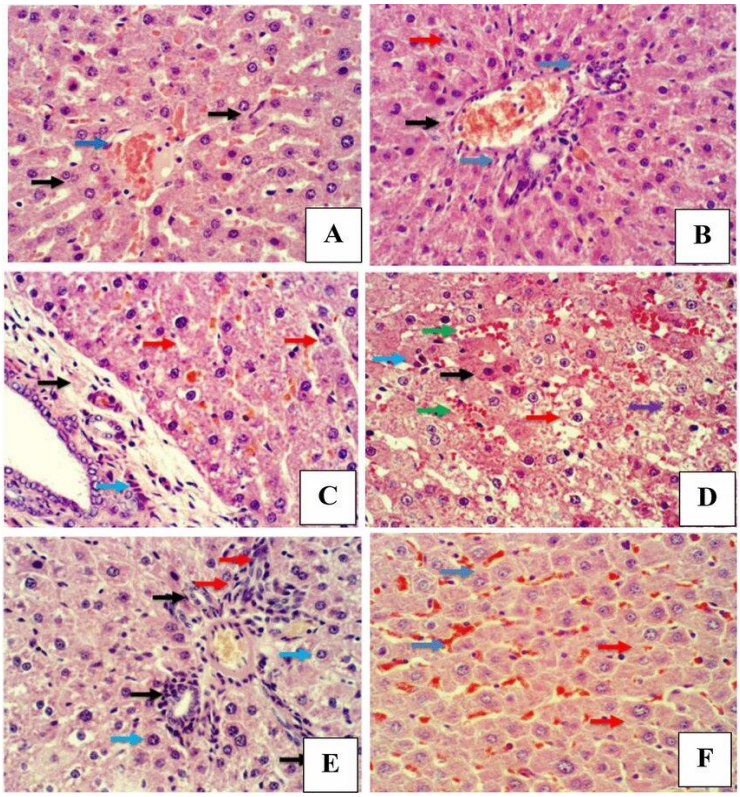
It was determined that administering varying concentrations of CPM-CM up to 30% could neutralize the actions of free radicals in animal cells and had no harmful effects on liver tissues. All of the identified phytoconstituents have medicinal properties, including hepatoprotective, immunomodulatory, anti-inflammatory, antioxidant, antibacterial, antiviral, and antifungal effects.



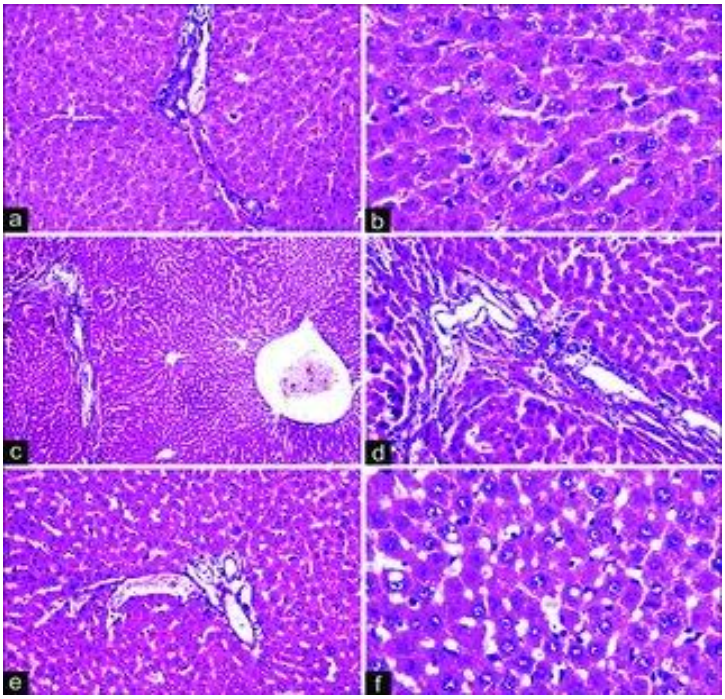
Pic 1. 0 % CPM-CM with Enzymes



Pic 2. 10 % CPM-CM with Enzymes



Pic 3. 20 % CPM-CM with Enzymes



Pic 4. 30 % CPM-CM with Enzymes

FURTHER STUDY

This research still has limitations, so further research is needed related to the topic of Effect of Enzyme Supplemented Cassava Peel – Maize Cob Mixture on Histopathological Examination of Liver of Growing Pigs in order to perfect this research and increase insight for readers.

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