

Effect of Enzyme Supplemented Cassava Peel – Maize Cob Mixture on Meat Quality and Partial Budget Analysis of Grower Pigs

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ABSTRACT

This study assessed the effect of enzyme supplemented cassava peel – maize cob mixture (CPM-CM) on meat quality and partial budget analysis of grower pigs. Forty, 5 months' gilts were assigned randomly to four treatments (n = 10 piglets/ 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 (CPM-CM) 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 % CPMCM with enzymes), T3 (20 % CPMCM with enzymes), T4 (30 % CPMCM with enzymes). A completely randomized design model was adopted and the study lasted for 8 weeks. Feed and water was given ad libitum. Results on phyto-compounds shows that CPM-CM contained saponin (208.2 mg/100g) while flavonoids, tannins, alkaloids, phenols and cyanide contained 123.4 mg/100g, 51.82 mg/100g, 109.8 mg/100g, 87.12 mg/100g and 10.45 mg/100g respectively. Proximate analysis of breast muscle showed that increasing the level of CPM-CM improved ($p < 0.05$) moisture, dry matter, crude protein, ether extract and ash content except the pH level ($p > 0.05$). Replacement of maize with CPM-CM also decreased feed cost with a significant increase ($p < 0.05$) in total profit. It was concluded that increasing the level of CPM-CM will increase the nutritional value of meat and also increased the profit margin without compromising the health status of animals

INTRODUCTION

Farmers in Africa are now compelled to search within for less expensive raw resources due to the recent economic downturn and challenges with livestock production inputs in recent years (Yusuf, 2004). It is necessary to develop and incorporate alternative feed-stuffs that, when used in compounding swine diets, will at least lower the cost of animal feed ingredients and encourage farmers to enter the swine farming industry in order to maximize the profit of poultry products (Dessie et al., 2017; Denton et al., 2005). Because of Nigeria's continuously growing population, there is also a demand for more animal production there (Diara et al., 2012; Dela, 2016).

A balanced diet should include at least 35g of animal protein per day, however many Nigerians only ingest 10g (Ekeyem et al., 2006; Edache et al., 2012). Deliberate efforts must be taken to improve the environment, management systems, nutrition, and disease control if we are to achieve notable success in expanding the availability of animal protein in Nigeria (Alves and Setter, 2012). The possible feedstuffs are maize cob and cassava peel.

Typically, cassava is grown to produce roots for both people and animals. About 250 million tonnes of cassava are produced worldwide, with 47% of that amount coming from Africa, according to FAO (2011). Nigeria produces over 30% of Africa's total output. According to FAO (2011), animal feed accounts for over one-third of cassava production. Since the 1960s, the output of cassava roots has been rising continuously; but, in the 2000s, it increased by +40%, from 161 to 227 million tonnes, between 1997 and 2007. Additionally, it increased from 25% in 1997 to 34% in 2007 (76 million tons) in animal feed. Africa accounts for 132 million tonnes, followed by Latin America with 35 million tonnes, Asia with 82.5 million tonnes, Oceania with 277,000 tonnes, and Nigeria with 39 million tonnes, which is the world's largest producer (FAO 2011).

One of the most widely farmed grains, maize (*Zea mays*), produces cobs that can be used to make pig feed (Ndubuisi et al., 2008). There is an abundance of maize cobs that might be used as feed, as estimates from Bozovic et al. (2004) show that 180–200 kg of cobs are produced for every tonne of grains. About 2.4, 1.5, 0.9, and 0.7 million tonnes of maize cobs were produced in 2009 and 2010 by Sub-Saharan Africa, which includes South Africa, Nigeria, Tanzania, and Malawi (FAO, 2012). Nowadays, when the grain is extracted, the maize cob is either used intact or pulverized into smaller pieces. Cobs of maize can be thrown away, ploughed back into fields for cultivation, or burned for cooking or warmth (Abu et al., 2015).

Although maize cobs and cassava peels, two agricultural byproducts, have the potential to be used as substitute feed ingredients, their suitability for feeding animals with monogastric stomachs is limited due to their low protein content and high levels of anti-nutritional elements such as cyanide, oxalate, and saponin (Barrat et al., 2006). Little is known about using a blend of cassava peel and maize cobs in place of corn. Small-scale farmers that are attempting to formulate farm-based feeds, who consistently struggle to produce using commercial feeds, will also benefit greatly from this research.

LITERATURE REVIEW

Location of the Experiment

Situated between latitudes 8o571 and 8o551N and longitudes 7o051 and 7o 061E, the Piggery Unit, University of Abuja Teaching and Research Farm, Main Campus, along Airport Road, Gwagwalada, Abuja, Nigeria, was the site of this study.

Collection, Authentication and 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 and brought to the University of Abuja's Department of Crop Production for accurate identification and verification. To stop the growth of microorganisms and the levels of anti-nutrients, the samples were then sun-dried individually for 14 days. Samples were then transported to the lab for additional analysis after being separately hammer-ground into meals and combined in a 1:1 ratio.

Animal Management and Experimental Procedure

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 1 shows the results of Treatment 1 (T1) control diet (0 % CPM-CM with enzymes), T2 (10 % CPM-CM with enzymes), T3 (20 % CPM-CM with enzymes), and T4 (30 % 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.

Parameters Evaluated

Determination of Chemical Analysis of Pork

Four pigs were chosen at random from each treatment at the conclusion of the experiment to have a sample of breast muscle meat chemically analyzed. Each pig was stunned before the jugular vein was severed with a sharp knife to complete the slaughter process. The chemical makeup of breast muscle meat samples was ascertained.

Determination of Meat Ph

The pH value of the breast muscle was immediately measured and recorded using a glass electrode pH meter.

Proximate Analysis

The moisture content was calculated as a percentage of fresh sample weight as follows:

$$\text{Moisture \%} = \frac{\text{Weight of fresh sample} - \text{Weight of dry sample}}{\text{Weight of fresh sample}} \times 100$$

By following the guidelines provided by the Association of Analytical Chemists (2000), the analysis of crude protein, crude fiber, ether extract, and ash was completed. The experimental diet was analyzed using the AOAC (2000) methodology. Phyto-compounds in CPM-CM were prepared using the recently released Alagbe (2024) technique.

Partial Budget Analysis

The cost of each feed ingredient (₦) was multiplied by its quantity to get the cost of feed per kilogram. The final dress weight of the carcass was multiplied by the current cost per kilogram of pork to determine the income per kilogram per weight. The feed cost per kilogram was multiplied by the total feed conversion ratio to determine the feed cost per kilogram per weight. The entire cost of production for the duration of the experiment was deducted from the total revenue to determine the total profit.

METHODOLOGY

Statistical Analysis

All data collected were subjected to a One - Way ANOVA analysis of variance. Means showing significant differences were separated using Duncan's Multiple Range Test (Duncan, 1980). The SPSS (v20) statistical package of 2011 was used for all statistical analysis.

Table 1. 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.

Table 2. Phyto-Compounds in Cassava Peel- Maize Cob Mixture (CPM-CM)

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

Table 3. Effect Partial Replacement of Maize With CPM-CM on Proximate Composition of Meat

| Parameters (%) | T1 | T2 | T3 | T4 | SEM |
|----------------|--------|--------|--------|--------|------|
| pH | 6.21 | 6.20 | 6.28 | 6.25 | 0.02 |
| Moisture | 70.00b | 76.90a | 77.10a | 77.20a | 3.88 |
| Dry matter | 30.00a | 24.10b | 22.90b | 22.80b | 0.92 |
| Crude protein | 18.73b | 22.45a | 23.04a | 23.11a | 0.04 |
| Ether extract | 2.98b | 3.84a | 3.82a | 3.79a | 0.01 |
| Ash | 0.84b | 1.39a | 1.41a | 1.42a | 0.03 |

a,b Means with different superscripts are significantly different ($p < 0.05$), T1: 0 % CPM-CM; T2: 10 % CPM-CM; T3: 20 % CPM-CM; T4: 30 % CPM-CM; SEM: standard error of mean

Table 4. Partial Budget Analysis of Growing Pigs Fed Different Levels of CPM-CM

| Parameters (₦) | T1 | T2 | T3 | T4 | SEM |
|-------------------|---------------------|---------------------|---------------------|---------------------|-------|
| Feed cost (FC)/kg | 135.6 ^a | 129.7 ^b | 125.6 ^c | 121.4 ^d | 2.15 |
| FC/kg/weight | 386.7 ^a | 342.5 ^b | 340.8 ^b | 337.6 ^c | 6.06 |
| Income/kg/weight | 1200.3 ^c | 1571.8 ^b | 1588.6 ^b | 1600.3 ^a | 21.33 |
| Profit/kg/weight | 723.6 ^d | 1229.3 ^c | 1247.8 ^b | 1262.7 ^a | 15.67 |

a,b,c,d Means on the same row with different superscripts are significantly different ($P < 0.05$); FC: feed cost; T1: 0 % CPM-CM; T2: 10 % CPM-CM; T3: 20 % CPM-CM; T4: 30 % CPM-CM; SEM: standard error of mean

RESULTS AND DISCUSSION

Table 2 lists the phyto-compounds in the mixture of cassava peel and maize cob. There are 208.2 mg of saponin, 123.4 mg of flavonoids, 51.82 mg of tannins, 109.8 mg of alkaloids, 87.12 mg of phenols, and 10.45 mg of cyanide in 100g. According to the findings, CPM-CM contains substances that have anti-inflammatory, antioxidant, antifungal, antiviral, anti-helminthic,

immunostimulatory, anti-tumor, cytotoxic, and antidiarrheal effects, among other nutritional and therapeutic qualities (Musa et al., 2020; Adewale et al., 2021; Singh et al., 2022; Singh et al., 2021). The findings of this investigation are consistent with those of Daniel et al. (2024).

Table 3 shows the impact of partially substituting CPM-CM for maize on the proximate composition of meat. With the exception of pH (6.21 – 6.25) ($p>0.05$), the treatment had an impact on moisture (70.00 – 77.20%), dry matter (22.80 – 30.00%), crude protein (18.73 – 23.11%), ether extract (2.98 – 3.79%), and ash (0.84 – 1.42%). According to Cho et al. (2012) and Choi et al. (2005), the pH values found in this investigation fell between 6.00 and 6.30. Gye-Woong Kim and Hack-Youn Kim (2018) reported a decreased crude protein concentration (23.04 to 24.00%). Nonetheless, the values matched those that In (2013) had obtained. In animals' bodies, proteins are essential for cell growth and repair as well as infection prevention (Jin et al., 2004).

According to Park et al. (2001), the content of the ether extract ranged from 1.55% to 3.90%. Meat samples with too much fat may encourage cardiovascular illness (Rhim et al., 1995). However, our investigation demonstrates that the meat sample showed hypolipidemic properties due to the presence of phyto-compounds. According to Xiong et al. (2007), the experiment's ash content fell between 1.00 and 2.00 percent. The findings indicate that by raising the concentration of minerals in the meat sample, giving various amounts of CPM-CM enhanced the meat's nutritional value. The outcome is consistent with the Norman et al. (2003) research.

Table 4 shows a partial budget analysis of growing pigs fed varying amounts of CPM-CM. Profit is impacted by feed costs, which are the largest variable cost in pig production enterprises, accounting for 64% to 76% of total expenses (Choi et al., 2015; Ojediran, 2020a). At the grower's phase, the feed cost/kg was impacted by the lower cost of the maize cob-cassava peel mixture. This shown that a pig farmer can profitably employ CPM-CM. In treatment 1, the control food was found to be the mostcostly (₦131.6/kg), whereas treatment 4 had the lowest feed cost (₦121.40/kg).

This suggests that a farmer's financial situation could be enhanced by using industrial or agricultural wastes with high nutritional value, such as dried maize cob or cassava peel (Ojediran et al., 2019; Adesehinwa et al., 2008). As the amount of CPM-CM increased, the feed cost dropped linearly. This is comparable to the finding by Irekhore et al. (2006) that feed costs were decreased when grower pigs were fed cassava peel. According to Adesehinwa et al. (2019), a review also confirmed that CPM-CM diets had lower feed costs, which translated into higher profit margins.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, CPM-CM has a number of nutritional and therapeutic benefits when fed to grower pigs in place of corn. This is demonstrated by the meat quality, as an increase in CPM-CM markedly increased the breast muscle's moisture content, ether extract, crude protein, and ash. Additionally, this substitution lowers the overall cost of feed, increasing farmers' overall profits.

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 Meat Quality and Partial Budget Analysis of Grower Pigs in order to perfect this research and increase insight for readers.

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