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**ORIGINAL ARTICLE**

# Improving the Growth of Broilers Using Maize Waste Enriched with Groundnut Paste and Single Cell Protein

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## ABSTRACT

Poultry feed from maize wastes was enriched with groundnut paste and single cell protein (*Saccharamyyoes cerevsiae*). The wastes were fermented with *Saccharamyoes cerevisiae* following sterilization at 121$^0$C for 15 minutes and addition of mineral salt and the content incubated at 30$^o$C for 3 days with frequent agitation for aeration. The fermented (enriched) wastes and broiler starter were analyzed for parameters such as pH, and proximate compositions as well as nutritional studies for 21 days using three-day old broilers housed in three compartments comprising of five broilers per cage. The chick growth response showed that there was no significant difference in the weight gain of the broilers fed with groundnut paste and broiler starter. However, the weight gain of broilers fed with enriched groundnut paste and broilers fed with broilers starter differ ($P < 0.05$) from broilers fed with maize wastes enriched with groundnut paste. The results obtained in this study suggest that compounding animal feeds from locally sourced raw materials (wastes) is feasible but with requisite knowledge of their nutritional compositions.

***Key words:***

## Introduction

Once the poultry man has selected a good bird, with high livability, high genetic capacity to grow or lay eggs efficiently and has prepared the housing and management essential for a successful operation, the next thing is to procure the most efficient nutritionally complete diet that will give the best possible result at the least possible cost[12]. Poultry farmers desire feed that will be highly utilizable and hence maximize profit. [2] such feed is achieved in this study work.

Although good information is available concerning the nutrient composition of most of the poultry feeding stuffs commonly used in the temperate area of the world, relatively much less is known about the nutrient composition of tropical poultry feed stuffs. A considerable amount of research is needed particularly on metelizable energy values of tropical feed stuff, before it will be possible to scientifically formulate poultry feeds in the tropics with the greatest possible accuracy and flexibility[12], hence the need to carry out this research.

The world today is suffering from a serious shortage of feed ingredient such as wheat, corn and soyabeans, because of rapidly increasing human population. Means must be urgently sought to close the gap between this explosive population increase and availability of food. This problem is the greatest challenge facing mankind[3].

In recent years, there has been considerable interest in exploiting microbial fermentation for the production of protein. Single cell organisms such as

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yeasts and bacterial grow very quickly and double cell mass, even in large scale industrial fermentation in three (3) to four (4) hours. A range of nutrients substrate can be used including maize grains, sugar beat, sugar cane and its products, hydrosates from wood and plants and waste product from food manufacture[10].

In addition, large culture of microorganisms as a direct source of microbial protein was considered as a solution to the shortages of food or feed in Germany during the First World War. In Berlin, Delbric and his co-workers developed the first culture process for growing brewers yeast (*Saccharomyces cerevisiae*) on a large scale. The yeast was incorporated mainly into soups and sausages. Food yeast (*Candida utilis*) again made an important contribution in the diet in Germany during the Second World War[11].

In the light of protein shortage, microorganism offer may possibly for protein production. They can be used to replace totally or partially the valuable amount of conventional vegetable and animal protein feed. For this development of technologies to utilize, the waste products would play a major role for the production of single cell protein[8].

Good content and balance in essential amino acid are characteristics of single cell protein produced from either alkane or methanol[1]. Growth medium composition governs the protein and lipid contents of microorganisms. Yeasts, moulds and higher fungi have higher cellular lipids contents and lower nitrogen and protein contents when grow in media having high amount of available carbon as energy source and low nitrogen[7].

## Materials and methods

### *Source of Waste And Standard Feed (Broiler Starter)*

Maize purchased locally from Bosso market, Minna was processed into akamu. The waste obtained following sieving of the wet milled maize corn (steeped) for 24 hours was used for feed production or the fermentation process.

Groundnut paste was purchased from groundnut cake producing industry in Bosso area of Minna, Niger State.

The commercial feed or standard feed (broiler starter) was purchased from ECWA Feeds, IBB Road, Minna, Niger State

### *Fermentation of Waste For Feed Production*

150g of freshly prepared wet waste obtained in 3.1 above was mixed with 300ml of distilled water (1:2w/v) in 1000ml flat bottom flask. the following reagent were added: 3g sodium nitrate, 0.5g potassium chloride, 0.5g magnesium sulfate, 0.01g of ferrous sulfate and 1g of potassium phosphate or czapek medium (5 times concentrated excluding carbon sources) and this was shaken thoroughly to mix very well, plugged with cotton wool and sterilized in an autoclave at $121^0$C for 15 minutes.

After cooling, it was inoculcated with cell suspensions of pure cultures of *Saccharomyces cerevisiae* as described by Adeyemo *et al* [4] and incubated for 3 days at $30^0$C with intermittent shaking to aerate the medium.

### *Drying And Packaging of Enriched Feeds (Maize Waste And Groundnuts Paste Enriched With Single Cell Protein)*

The fermented paste in slurry form was dried in a hot oven at $70^0$C for 18 hours as described by Adeyemo *et al*[4]. Dried fermented maize and groundnuts paste was pulverized by crushing in mortal and then stored in airtight container or polyethylene bags.

### *Chemical/Proximate Analysis*

The chemical and physicochemical parameters such as pH, moisture content, ash content, crude protein, and crude fat content by ether extraction, were determined according to information from[5].

### *Chick Growth Studies*

The nutritional qualities of fermented (enriched feeds) and commercially prepared poultry feed (broiler starter) was determined by growth studies using 3-day old broilers as described by McDonald *et al* [9] and Adeyemo *et al;*[4]. 15 broilers (From Obasanjo farm) were randomly allocated to 3 compartments (5 broiler per compartment).

These were fed for a 3-week period and weight gain and feed consumption were recorded for 7 days following the initial 14 days of acclimatization.

0.5g/liter of Amprolium (vitamins and antibiotics) was administered to chicken throughout the studies. Gumboro vaccines were given for the first two weeks as directed by the supplier.

### *Statistical Analysis*

The data obtained was subjected to Analysis of Variance and Mean Separation Using LSD. (Least Significant Difference).

### *Results*

The pH of Broiler Starter, Enriched Maize and Groundnut paste used for chick growth study is shown in Table 1. The pH of broiler starter was higher (6.3) than that of the enriched Groundnut

**Table 1:** Chemical analysis of enriched maize, groundnut paste and broiler starter.

| Type of feed | pH | MC (%) | Ash | CP (%) | CF (%) | CHO |
|---|---|---|---|---|---|---|
| Enriched maize waste | 4.7 | 10.2 | 2.2 | 10.5 | 3.7 | 60 |
| Enriched groundnut paste | 3.1 | 8.0 | 2.5 | 17.5 | 4.0 | 67 |
| Broiler starter | 6.3 | 16.0 | 8.3 | 22.5 | 5.2 | 72 |

MC – Moisture content, CP – Crude Protein, CF – Crude Fat, CHO – carbohydrate

pastes (3.1) and enriched maize waste (4.7). The moisture content of broiler starter was higher (16.0%) than the enriched maize waste (10.21%) and enriched groundnut paste (8.0%). The proximate analysis as determined indicated that the protein content of broiler starter (22.5%) was higher than that of the enriched maize waste (10.5%) and groundnut paste (7.5%). The Broiler starter was very rich in crude fat (5.2%) than the enriched groundnut paste (4.0) and the enriched maize waste (3.7%). Similarly, the Carbohydrate value of broiler starter was higher (72%) than that of Groundnut paste (67%) and maize waste (60%).

Table 2 shows the weight gain of broilers that fed on maize waste enriched with single cell protein. The weight gain was not constant for the seven days recorded.

Table 3 shows the weight gain of broilers that fed on enriched feed (maize waste enriched with groundnut paste and Single Cell Protein). Like in table 1, the weight gain was not constant.

Table 4 shows the weight gains of broilers that fed on standard feed (broiler starter). The average weight gain increased with day. The highest weight gain was on day seven (7) by sample number four (4).

**Table 2:** Increase in weight of Broiler (g) Enriched maize waste

| Days | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 14 | 35.3 | 44.1 | 32 | 35.9 | 30.9 |
| 15 | 40.3 | 42.0 | 34 | 35.5 | 30.6 |
| 16 | 35.9 | 40.0 | 34.5 | 35.3 | 30.9 |
| 17 | 37.5 | 40.0 | 34.5 | 35.3 | 30.9 |
| 18 | 37.5 | 45.1 | 28.5 | 37.3 | 32.0 |
| 19 | 39.2 | 42.1 | 30.5 | 36.3 | 30.4 |
| 20 | 37.8 | 40.2 | 30.2 | 36.2 | 30.6 |

**Table 3:** Increase in weight of Broiler (g) Enriched Groundnut paste

| Days | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 14 | 31.0 | 43.2 | 40.5 | 40.3 | 39.5 |
| 15 | 31.3 | 42.5 | 38.6 | 40.6 | 40.5 |
| 16 | 31.3 | 43.4 | 39.6 | 43.6 | 42.5 |
| 17 | 32.1 | 46.3 | 40.5 | 47.3 | 45.9 |
| 18 | 34.8 | 50.0 | 44.2 | 55.0 | 50.2 |
| 19 | 37.5 | 54.8 | 49.4 | 60.3 | 49.2 |
| 20 | 43.1 | 62.6 | 60.4 | 70.8 | 69.1 |

**Table 4:** Increase in weight of Broiler (g) Broiler starter

| Days | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 14 | 70.8 | 76.5 | 116.3 | 130.8 | 120.3 |
| 15 | 77.5 | 80.8 | 123.7 | 141.2 | 126.1 |
| 16 | 80.3 | 86.8 | 132.9 | 147.2 | 136.9 |
| 17 | 86.2 | 94.8 | 142.9 | 158.89 | 150.1 |
| 18 | 92.1 | 100.0 | 148.9 | 167.0 | 158.0 |
| 19 | 96.2 | 104.0 | 152.5 | 172.0 | 158.2 |
| 20 | 104.1 | 111.1 | 160.0 | 183.8 | 173.4 |


**Plate 1:** Photograph of the broilers

*Discussion*

The pH of Broiler Starter, Enriched Maize and Groundnut paste used for chick growth study is shown in Table 1. The pH of broiler starter was higher (6.3) than that of the enriched Groundnut pastes (3.1) and enriched maize waste (4.7). The moisture content of broiler starter was higher (16.0%) than the enriched maize waste (10.21%) and enriched groundnut paste (8.0%). The proximate analysis as determined indicated that the protein content of broiler starter (22.5%) was higher than that of the enriched maize waste (10.5%) and groundnut paste (7.5%). The Broiler starter was very rich in crude fat (5.2%) than the enriched groundnut paste (4.0) and the enriched maize waste (3.7%). Similarly, the Carbohydrate value of broiler starter was higher (72%) than that of Groundnut paste (67%) and maize waste (60%)

The chick growth response of enriched maize and groundnut paste and broiler starter is shown in table 3. Although there were differences in the mean values obtained in the weight gain from chick fed with broiler starter and enriched groundnut paste respectively, they were however not significantly different ($P<0.05$). However, the weight gain by broilers fed with these feed were significantly different from the enriched maize waste.

The results obtained in this work shows that, the enrichment or fermentation of waste by single cell protein improved the nutritional value of maize and groundnut paste, which reflected in the weight gain of broilers that fed on it. Such gain in weight differed significantly from those chick fed with enriched maize waste. ($P<0.05$) but were in comparable ratio with chick fed with commercial broiler starter.

The difference in proximate composition of fermented maize and groundnut paste obtained in this study is in agreement with Bahlla and Joshi (1994) and Adeyemo *et al.* (1999). These authors established that, there was no significant difference between weight gain between the chick fed with fermented waste (pomace) and those fed with grower mash. Also the low moisture content of groundnut (8.0%) gives the assurance of the safety of this product from microbial growth and possible toxin production. (Akoma *et al.*, 1999) the low pH (3.1) recorded in the groundnut as against 6.3 of broiler starter might have been responsible for the decrease in the weight of broiler that fed on it on day five. Low pH could be injurious to the health of birds. McDonald *et al.* (1987) reported that poultry feed should have pH range of 5.6-7.0.

*Conclusion*

The growth of broilers was improved using waste fermented with *Saccharomyces cerevisiae* (Single Cell Protein).

The waste, which should be discarded due to its poor nutritional qualities, has been improved by fermentation. The result of this work is of great importance in the control of environmental pollution and can reduce the cost of feed for poultry farmers.

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