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# Formulation and Nutrient Assessment of Poultry Feed from Domestic Waste and Its Effect on The Growth of Poultry Birds

**Johnson J.T.[1]*, Chibuike P.O[1]., and Ifeakor O.D[2]**

[1]*Department of Biochemistry, Faculty of Science, Federal University Otuoke, Bayelsa State Nigeria.*

[2]*Department of Public Health, Faculty of Allied Medical Sciences, College of Medical Sciences University of Calabar, Calabar, Nigeria.*

***Correspondence:**
Johnson J. T., Department of Biochemistry, Faculty of Science, Federal Univesity Otuoke, Bayelsa State, Nigeria.

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## ABSTRACT

*Poultry feed from locally generated domestic waste in Bayelsa State was formulated and compared with the commercially available feed (Top feed). The waste materials used for the local formulation were; Yam peel, Prawn head, Pineapple peel, Avocado Pear peel, Coconut Chaff, Fish head, Crayfish chaff. Proximate composition, vitamins, mineral and anti- nutrient contents of the local formulae as well as the commercially available feeds was evaluated using standard methods and results obtained were compared with each other. Results shows that the nutrient composition of the local feeds formulated from waste material compares favourably well with that of the commercial feed with anti-nutrient (Tannins, Oxalate, Phytic acid, HCN) within FAO tolerable limits. Thirty (30) days feeding trial was conducted to evaluate the growth performance of the broilers fed on locally formulated feed from domestic waste compare with commercial poultry feed. Ten Forty-five (45) day old broiler were randomly allotted into two groups of five (5) birds each. The poultry birds were fed ad-libitum for a period of four weeks and weight gain where recorded every three days. Result shows the significant ($P< 0.05$) increase on the growth rate of birds fed with commercial poultry feed when compared with those fed with locally formulated feed from domestic waste. Despite this significant growth noticed in birds fed with commercial poultry formulae, it is evidence from the result that the locally made formulae contains lots of nutrients which can support growth of poultry birds and also devoid of additives promotion. Thus, utilization or incorporation of at least 20% of domestic waste in poultry feed can help reduce the cost of livestock production and also ameliorate the burden and dangers possess by the disposal and poor management of domestic waste in the environment while at the same time reducing the act of artificial growth substances added to commercial poultry feed.*

## Keywords

Formulation, Domestic waste, Broiler, Commercial feed, Proximate analysis.

## Introduction

Poultry production has experienced a tremendous improvement in the past few decades and this great improvement encompassed almost all aspects of poultry production such as nutrition and genetic selections. Nutrition is central in poultry production due to its direct influence on performance and production economics while Feed formulation is the applied nutrition where nutritional knowledge is applied to meet the nutritional needs for at least 60% of the total production costs in bird production [1]. Thus, further improvements in feed formulation process would maximize performance and profitability in poultry production and one of the ways to improve feed formulation is to improve feed quality by reducing nutrient variability and thus, considerable nutrient variability can result in under-feeding or over-feeding of essential nutrients, resulting in reduced bird performance, added inputs costs, and increased environmental pollution. Possible way to improve feed formulation is by accounting for the requirements of the essential and non-essential amino acids in feed, especially in low protein diets.

Poultry meat and egg account for about 10% of the total amount of all meat and egg produced yearly globally. Poultry, through the

provision of meat and egg continue to serve as an excellent and cheap source of animal protein for many populations including Nigerians [2]; and the meat nutrients quality depends largely on the composition of poultry feed.

Energy sources are the most important and, in most cases, contains some harmful preservatives, which speeds up their growth that can easily be transferred from birds to humans [3].

This continually recurring challenge has compelled the search for alternatives to eliminate mycotoxins such as zearalenone (ZEN), [4]. Many published studies of bird feeding to date have focused on seed and feeder preferences [5]. Feed formulation can also be improved by estimating the maximum safe level of feed ingredients accurately. Potentials and new cultivars of feed ingredients can contain limiting factors (e.g anti-nutritional factor, fibre, amino acids profiles etc.) when fed at high levels, these ingredients are evaluated in feeding trials involving feeding increasing levels of the test ingredients and eventually measuring the response e.g. growth [6].

Nigeria was once known to be enjoying active boom in poultry production but currently experiencing challenge of increasing cost of poultry production occasion by high cost of poultry feed as well as fungal growth and mycotoxin production during in poultry feeds during processing [7]. Mycotoxins contamination of agricultural commodities and it derivatives has attracted worldwide attention because of the significant associated health dangers on humans, poultry and livestock in general [7].

More so, agricultural waste from their seeds, rind, skins etc can have a serious environmental impact, which is becoming harder to solve if not properly manage or dispose. Despite the numerous nutritional benefits from most agricultural produce (plant and sea foods) only a small portions are utilized directly for human consumption while the remaining part may be converted into nutrient for either feed or into fertilizer but not much has been done on the nutritional and anti-nutrient contents of many locally available agricultural (fruits and sea food) waste e.g. pulp, seeds, rind, fish bone, crab back, prawn head etc., which are most times discarded Obizoba *et.al.* [8], Akubor and Onimawo [9], Animawo, Adepoju and Adeniji [10], Ene-obong [11], Itam [12], Essien [13] and Edet [14].

The use of commercial poultry feed (corn meal) is one of the complementary advances to stimulating growth in poultry birds [15] and the presence of bioactive growth stimulating hormone, and some preservatives has made poultry birds promising source of modern carriers of diseases. Poultry feeds especially from grains (corn) serves as a reservoir for mycotoxins and fungi belonging to the genius Fusarium produce aflatoxin such as zearalenone, an oestrogenic mycotoxin. It is frequently implicated in reproductive disorder of farm animals and occasionally in hyper oestrogenic syndrome in humans. One of the basic principle of domestic waste poultry feed production is that all constituent in the whole waste extract work collectively based on the natural nutrient of each waste and are free from preservatives, and hence a comprehensive framework of improved feed [16], which can stimulate the growth of the bird and innate prevention of some infection cause by microbes which can result to bird flu and other possible zoonotic infection upon consumption of birds.

This research is therefore geared to the formulation and nutrient assessment of poultry feed from domestic wastes and the effect on growth of poultry birds.

## Materials and Methods

### Location

The experiment was conducted in the animal house and the laboratory of the Department of Biochemistry, Federal University Otuoke, Bayelsa State and has a coordinate of 4˚42'23.418'North and 6˚ 19'44.472 East and it lies 21km south of the Atlantic Ocean.

### Sources of Materials

Yam peel, Avocado pear peel, Pineapple peel, Coconut chaff, Crab shell, Fish head, Prawn head and crayfish chaff were used for the formulation. 140kg of prawn head, 101kg of crayfish chaff, 15kg of coconut chaff, 20kg of crab shell and 50kg of fish head were all collected from a local Swali market in Yenegoa, the Bayelsa State capital while 25kg of pineapple peel and 170kg of yam peel were obtained from a local seller in Otuoke community. The samples were obtained in their fresh state and in sufficient quantity for the analysis.

### Preparation of Samples

The samples were properly washed with running water and rinsed with distilled water. The samples were then cut open with kitchen knife into smaller pieces. The water was allowed to drain and they were placed on a foil and dried using a hot air circulating oven (Gallenkamp hotbox size one) at 50$^{o}$c until a constant weight was obtained which indicate dryness.

The samples were then blended into powder and sieved using a 3mm diameter size brass sieve to obtain a fine powder, which was placed in labelled airtight transparent containers.

### Experimental Birds

45-day-old broiler chicks were bought from a local rarer in swali market, Yenegoa the Bayelsa state capital.

### Housing

The existing rectangular shaped poultry house, dwarf walled and the upper part netted with wire gauze top, the floor well cemented and covered with wood shavings providing adequate temperature, light and ventilation. 14 broiler birds were used for the study and was divided into two groups of seven birds each per group.

For the first two (2) weeks the pens were covered with tarpaulin to conserve heat for the chicks. The stove and the lanterns were strategically located and the heat provided for 24hours for four (4) weeks. Routine inspection of the bird was carried out and good sanitation maintained.

### Experimental Feed Formulation

A standard broiler feed was formulated from the powder of the above-mentioned materials. They were measured, mixed properly to obtain a homogenous mixture then constituted into a feed and this was used to feed the birds in-group 1.

The second groups were fed with standard commercial (chow) feed, which contains maize as its main source of energy to serve as a control in-group 2.

### Feeding

The birds were fed *ad-libitum* with their respective feeds from day one. The feeding was done based on the method describe by Abo-Acres (1985); that the requirement of a broiler per day is 125g at 5-10 weeks of age. The required amount of feed was given to the birds and at the end of each day, the left-over feed in the feeder was subtracted from the feed given in order to determine the actual quantity consumed by the broiler.

### Feed Conversion Ratio

The expression of the efficiency of broilers to convert feeds into meal. It is obtained by dividing the total kilograms of feeds consumed by the total kilograms' live weight produced.

Feed conversion Ratio = Total kg. Feed consumed / Total kg. Live weight of broilers produced.
Average daily feed intake = Quantity of feed given (g) – Quantity refused / Number of days the experiment lasted.
Average Body weight gain (kg) = Weight of birds per replicates (kg) / Number of birds per replicates.

### Determination of Proximate Analysis

The proximate composition/ constituents of the formulated feed; carbohydrate, crude fats, crude protein, moisture, ash content/ organic matter, crude fiber and calorie where determined by the methods of the association of official analytical chemist [17].

### Determination of Vitamins

The vitamin A content of the composed feed was determined by the methods of association of vitamin chemists (A O V C 2015) using the spectrophotometer as described by Kirk and Sawyer, at 325nm. Vitamin B (Niacin, thiamin and Riboflavin) were determined using a flame photometer while vitamin C was estimated by the 24 dinitrophenol hydrazine methods as described in (A O A C 2015).

### Determination of Mineral

The mineral composition of the freshly composed feed was determined using the method of James (1995). Calcium and Magnesium were determined by the versanate EDTA complexiometric titrimetry. Sodium and Potassium were determined using a flame photometer. Phosphorus was obtained by the variable –molybdete colorimetric method.

### Phytochemical Estimation

Qualitative and quantitative analysis were carried out on the formulated feed using standard approved methods; tannins was determined by the ferric chloride test described by Harbone (1973). Oxalate by the Method of Munro & Bassir [18] as modified by Dye (1956), Hydrocyanide determination was done by the method of Balogoplan [19], phytate was determined spectrophotometrically as described by [20,21].

## Statistical Analysis

Data on daily feed intake, daily weight gain, feed conversion ratio, initial body weight and final body weight gain of the treatment group and nutrients composition of the two feeds were subjected to "t" –test and also statistical package for social sciences version 21 where necessary and values at $p<0.05$ were regarded as significant.

## Results

Proximate composition, anti-nutrients, vitamins, and minerals of commercial and formulated poultry feed prepared from domestic wastes (coconut chaff, prawn head, pineapple peel, avocado pear peel, crayfish chaff, yam peel, crab shell, fish head) and possible effect on growth rate (weight changes) were evaluated and the results are as presented below in figures 1-5, based on Mg/100g of dried matter.

The result of the moisture, ash, protein, lipids, fibre and carbohydrate content of the commercial and formulated poultry feed is presented in figure 1. Statistical analysis reveals the commercial feed having a higher ash content compared to the formulated feed. However, the locally formulated feed recorded a significant ($p<0.05$) high values for moisture, proteins, carbohydrate. Organic matters, crude fibre, and lipids of both samples compares favourably well with each other at $P> 0.05$ significant level composition.

Vitamin A, thiamine, pyroxidoxamine, and cobalamins content of formulated feed were slightly ($p>0.05$) higher than that of the commercial feed.

Anti-nutrients composition of both commercial feed and locally formulated feed indicates the presence of hydrocyanide and phytic acid in formulated feed. However, tannins and oxalate content of both feeds compared favourably with each other within recommended safe range.

The result of the mineral content of both the locally formulated and commercial feed shows that Magnesium, Phosphorus, Chlorine, Calcium concentration of the locally formulated feed were higher than that of the commercial feed while Sodium, Manganese, and Iron contents compares favourably well with each other.

The body weight changes of the broiler chicks fed on the locally formulated feed and the commercial feed shows that at week one (1), the weight of the two groups compares well with each other. However, slight changes were noticed after worth, the broiler chicks fed with commercial feed recorded high weight. At the end of week four (4) feeding, which mark the end of the trial feeding period the weight of the broiler chicks fed on the commercial feed was higher compared with the locally formulated feed but the mark differences not as much as that recorded in week 2 and 3.

## Discussion

Locally formulated poultry feed was composed from domestic wastes (pineapple peel, yam peel, prawn head, crab shell, avocado pear peel, coconut chaff, crayfish chaff, fish head) in Bayelsa State. The compositions of the formulated feed were analysed and values obtain were compared with that of the commercial poultry feed (Top feed).

The vitamins and minerals content of formulated feed shows that it has high thiamine, retinol, pyridoxamine, cobalamins compared to that of the commercial feed. This indicates that the energy and other nutrients domicile in the composed poultry feed can be properly utilized e.g. thiamine being a co-enzyme for pyruvate decarboxylase. The vitamin A serves as an antioxidant and a good immune booster.

More so, four anti-nutrients of varying levels were found in the locally formulated feed. There include; tannins, oxalate, HCN, phytic acid with values ranging from 0.1ug/100g, 0.5ug/100g, 1.0ug/100g, 0.3ug/100g respectively for the formulated feed and all are below FAO recommended tolerable levels which are; 4.0ug/100g, 3.5ug/100g, 2.5ug/100g, 3.0ug/100g. Ingredients containing tannins give an unpleasant taste and reduce composition due to decrease palatability. In addition, tannins affect animals through several mechanisms including the formation of strong complexes with feed components such as proteins and minerals, the loss of endogenous proteins and inactivation of digestive enzymes thus interfering with digestion and thus, the low tannin content enhance palatability and nutrient utilization.

Plants with high oxalate content may produce acute metabolic calcium deficiency (hypocalcaemia) when using such plant product as a main food source.

Phytate is a strong form of phosphorous, which is commonly found in plants seeds and in many tubers [22]. The presence of phytate

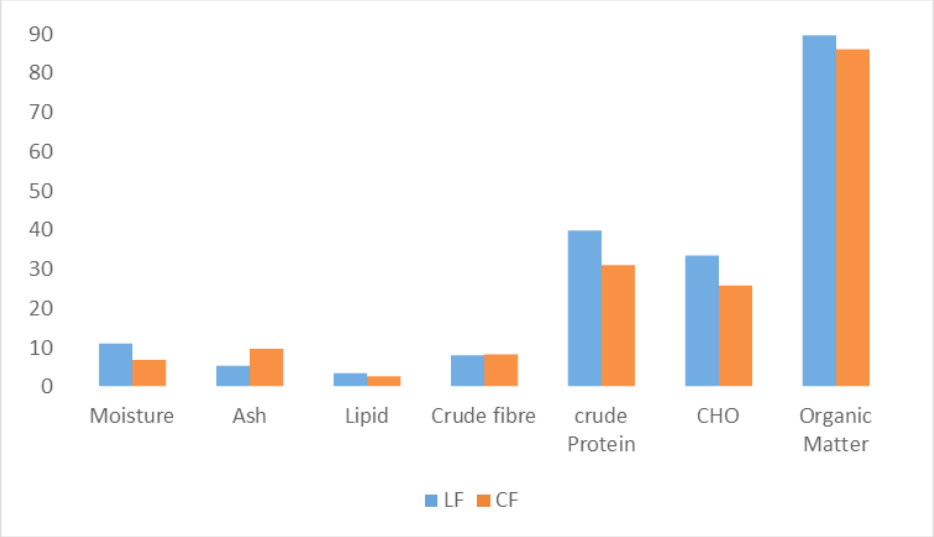


**Figure 1:** Proximate Composition of Locally Formulated Feed/ Commercial Feed.

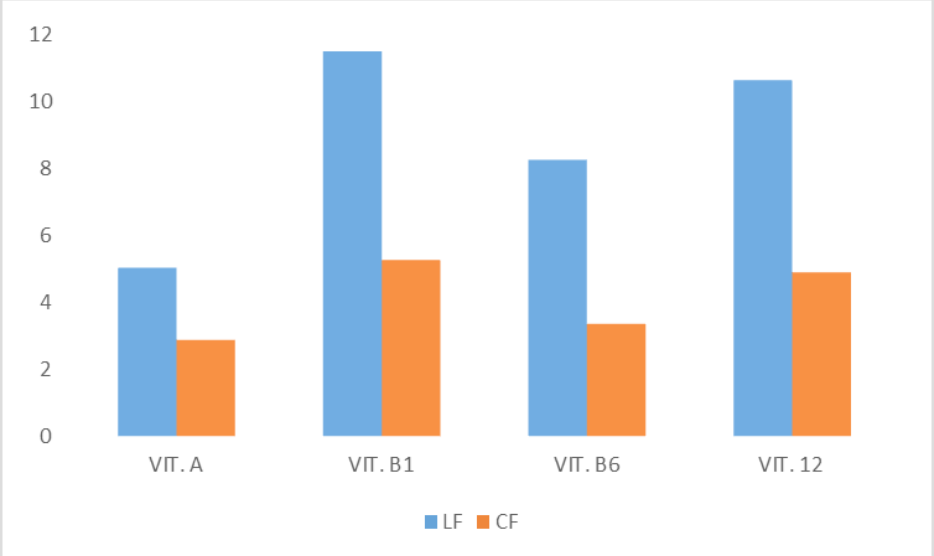


**Figure 2:** Vitamin Composition of Locally Formulated Feed/ Commercial Feed.

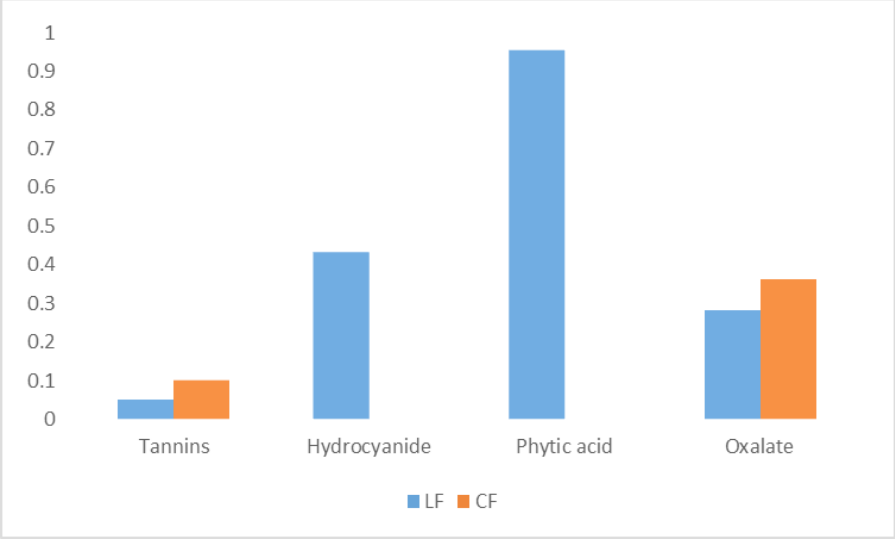


**Figure 3:** Anti-Nutrient Composition of Locally Formulated Feed/ Commercial Feed.

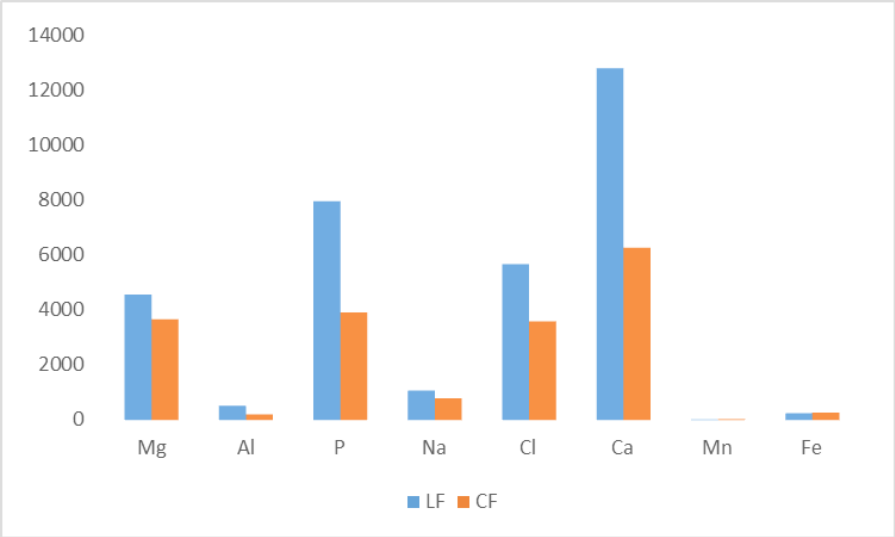


**Figure 4:** Mineral Composition of Locally Formulated Feed/ Commercial Feed.

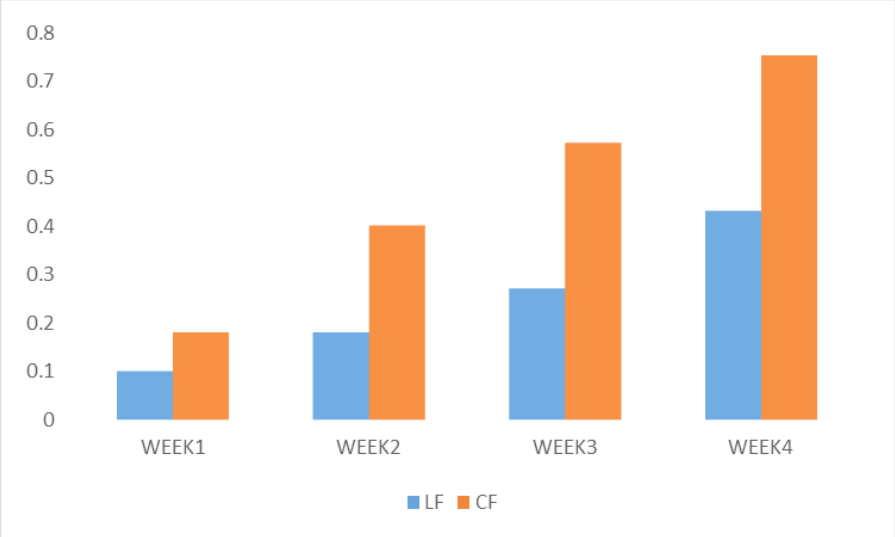


**Figure 5:** Body Weight Changes; Week 1-4 (Kg).

in foods has been associated with reduced mineral absorption especially iron due to structure of phytate which has a high density of negative charged phosphate groups which form very stable complexes with mineral ions causing non- availability for intestinal absorption [23]. Cyanide can trigger peripheral numbness, light- headedness, mental confusion, stupor, cyanosis, and convulsion in man [24]. The minimum lethal dose of HCN taken by man through mouth is reported to be 0.5mg and 3.5mg/kg body weight [25].

More so, it was observed that the growth rate of the birds was significantly different, the body weight changes shows that the birds fed on the commercial feed recorded a steady growth rate in terms of body weight changes throughout the 30 days (4 weeks) trial compared to the birds fed on the locally formulated feed, and this may be because of steroids compounds (Hormonal) like estradiol -17 Beta, Progesterone, Testosterone etc. Contained in the commercial feed which tends to stimulate the growth of the birds and this can be detrimental to human health.

Drying, storage, and shipment of these wastes are cost effective, efficient, and inexpensive and eco-friendly utilization is becoming more and more necessary. Hence, reducing, recycling and reusing of waste generated from homes or food-processing industries is one of the important and challenging issues around the world.

## Conclusion

Domestic wastes are one among the major sources of the municipal solid wastes which are presently not exploited, but dumped as landfills which is provoking environmental threat. Thus, domestic waste or agricultural waste in general from food processing industries, markets, roadside vendors and even from our kitchens can be exploited for the production of fortified feeds which can be used in feeding poultry birds, cattles, fishes, rabbits, pet animals and pigs as they are highly nutritious and cost effective than the conventional (commercial) feeds. They are also good sources of minerals such as Ca, P, Mn, K, Mg, and Zn. These can further be used in the pharmaceutical processing industries for the production of drugs, as these processed by-products are also rich sources of dietary fibre, which has several benefits on health.

Incorporation of domestic waste up to 10% substituting maize and other ingredients in broiler chicken diet enriching the poultry productions business without any adverse effect on the performance of the birds.

Finally, this will also improve both sustainability and competitiveness of the sector by way of minimizing the final waste disposal for Nigerian food industry.

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