HOME ECONOMICS EDUCATION

Broiler Feed Formulation Using Local Materials: A Case Study of the Poultry Farm in the School of Vocational Education, Abia State College of Education (Technical), Arochukwu

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Abstract

The experimental study focused on broiler Feed formulation using local materials; A study of Poultry Farm in School of Vocational and Technical Education in the Abia State College of Education (Technical) Arochukwu. The study aimed at formulating broiler Feed using locally available ingredients using the Poultry Farm of School of Vocational and Technical Education in Abia State College of Education (Technical) Arochukwu as the experimental laboratory. The experimentation comprised of feed formulated from locally available ingredients under four Treatments of Control Feed 1, Control Feed 2, T^1, and T^2. The population of the study comprised 100 broilers of the same breed, bought at 21 days old. Out of the 100 broiler birds, 25 were randomly selected for each of the Treatment groups. The Chicks were subjected to the same experimental control condition with different mixture of feeds Treatments, and the process was sustained for complete eight (8) weeks. Sources of the local feed materials were mainly maize, soybean meal, groundnut cake, palm kernel cake, brewer's dried grain, cassava meal and processed cassava peels, sorghum, rice bran, fish meal, meat meal, etc. Data for the study were obtained from the Initial Body Weight, Final Body Weight, Weight Gain, Feed Intake, Growth Rate Feed Conversion Ratio, and Survival Rate. Descriptive Statistical mean and Standard deviation were employed in evaluating the data, while Analysis of Variance (ANOVA) was used to analyzed the results. The results revealed among others that, T^2 has the highest Final Body Weight, highest Weight Gain, highest Growth Rate, highest Survival Rate, and good Feed Conversion Ratio. Also, it is suggested that T^1 performed better than the Control Feed 1 and Control Feed 2 during the period under consideration in Final Body Weight, weight gain, growth rate, survival rate, and good Feed Conversion Ratio. Ratio. It was concluded that the locally formulated feed improves broilers (T^2 and T^1) Final Body Weight, Weight Gain, Growth Rate, Survival Rate and good Feed Conversion Ratio in the Poultry Farm of the School Vocational Education in Abia State College of Education (Technical) Arochukwu. The study recommended among others that, the commercial feed (Control Feed 1 and Control Feed 2) should be substituted for locally formulated feeds T^2 and T^1 for broilers in the Poultry Farm of School of Vocational Education, Abia State College of Education (Technical) Arochukwu. Based on the evaluation report, management of the Poultry Farm of Vocational and Technical Education, Abia State College of Education (Technical) Arochukwu recommended for the use of the T^2 and T^1 broiler feeds in the School of Vocational and Technical Education Poultry Farm.

Keywords: formulation; broiler; weight gain; growth rate; local materials; treatments

1 Introduction

Tertiary Institutions running animal husbandry in agriculture have their pens for practical purposes (NIAS, 2024). This is because graduating students from these Institutions must be exposed to the

practical aspect of the course they registered for, as it is an aspect that can make them entrepreneurs in the long run (NIAS, 2024). It enables them acquire skills and entrepreneurial attitudes. This entrepreneurial attitude in skill in them the ability to match the market demand and consider the needs and requirements from the potential customers (Bellotti et al., 2012).

Successful poultry farming in Institutions of higher learning and in general depend on the availability of feed for the birds. Feeds constitute the bulk of capital expenses for the successful poultry keeping. Abia State College of Education (Technical) Arochukwu (ASCETA) run agriculture as a course under School of Vocational Education. They practice crop and animal husbandry. For the crop they have portions of land for the student practice, and also sections for the entire department.

For the animal husbandry, they have the goatry and poultry. The goatry has its goat on free range. The poultry unit has faced tremendous challenges due to high cost of feed with little nutritional values that improves the broilers' performance in terms of final body weight, growth rate, feed conversion ratio, and survival rate. The recent high cost of feeds has made it very difficult to revitalize the poultry unit in ASCETA. To help revitalize the poultry unit in ASCETA and also assist other poultry farmers in Arochukwu and other areas, the researcher proposed- broiler feed formulation using local materials. Broiler feed formulation using local material can refer to the process of creating a balanced diet for broiler chickens using locally available ingredients such as grains, oilseeds and by–products (Food and Agriculture Organization, 2013; Agbede et al., 2020)). This feed should meet the chicken's nutritional requirements for growth, health, and over all well-being (Cobb-Vantress, 2021). The formulation process involves selecting suitable ingredients, determining their nutrient content, and calculating appropriate amount to meet the nutritional needs of the chickens (Food and Agriculture Organization, 2013).

It is believed that the findings of this study will provide evidence that can guide feed formulation decisions, improve the practical value of the School's Poultry Farm and strengthen students' practical knowledge and efficient resources utilization in feed formulation using local materials in the School of Vocational and Technical Education, Abia State College of Education (Technical) Arochukwu.

1.1 Statement of the problem

Broiler poultry production plays an important role in providing animal protein, generating income and creating employment opportunities. It is also a practical enterprise for developing students' entrepreneurial and vocational skills. However, one of the major challenges facing broiler production is the high cost of feed with low performance in terms of final body weight gain, growth rate, feed conversion ratio and survival rate, which places considerable pressure on farmers and reduce the profitability of poultry enterprises. In Nigeria, the cost and availability of conventional feed ingredients, including maize and soybean meal, can affect the ability of poultry farmers to produce broilers economically. Adewoye and Akinfala (2023) explained that appropriate feed formulation is essential for meeting the changing nutritional requirements of broilers while managing production costs.

Feed is not simply a mixture of ingredients; it must supply the appropriate amounts of energy, protein, essential amino acids, vitamins and minerals required for healthy growth. The Nigerian Institute of Animal Science (NIAS, 2024) identifies different categories of approved feed ingredients, including cereal grains, roots and tubers, oilseed meals, animal protein sources, vitamins, minerals and feed additives. This provides opportunities for exploring locally available materials in broiler feed production. Nevertheless, the availability of an ingredient does not automatically make it

suitable for inclusion in poultry diets. Its nutritional composition, digestibility, cost, quality, storage stability and possible anti-nutritional factors must be considered. Poorly formulated diets may fail to meet the birds' nutrient requirements, resulting in unsatisfactory growth, inefficient feed utilisation and avoidable economic losses (Korve, 2024)

Although locally available materials may offer opportunities to reduce dependence on expensive conventional ingredients, their use requires careful selection and appropriate combination. Agbede et al. (2020), in their evaluation of adaptable feed ingredient mixtures for broiler production, demonstrated the importance of examining alternative ingredient combinations and their implications for broiler performance and feed costs. The central concern, therefore, is not merely whether local materials can be used, but whether they can be formulated into nutritionally adequate, affordable and stable diets that support satisfactory broiler growth.

This issue is particularly relevant to the School of Vocational Education, Abia State College of Education (Technical), Arochukwu, where poultry farming can serve as both a production activity and a practical learning opportunity for students. Dependence on costly commercial feeds may place pressure on the resources required to maintain poultry production and provide students with practical experience in animal husbandry and entrepreneurship. At the same time, the use of local materials without adequate nutritional assessment and proper formulation may compromise the performance and health of the birds. There is therefore a need to examine the suitability of locally available feed ingredients, their nutritional contributions and their potentials to support effective broiler production in the School.

The problem addressed by this study is the need to establish how locally available materials can be appropriately formulated into broiler feed without compromising nutritional adequacy which enhances the bird growth rate, weight gain, feed conversion ratio, and survival rate. Specifically, the study seeks to investigate the locally available materials suitable for broiler feed formulation, the appropriate combinations required to meet the nutritional needs of broilers at different growth stages, and the potential cost implications of using such materials at the School of Vocational Education, Abia State College of Education (Technical), Arochukwu.

1.2 Objectives of the study

The objectives of the study was to examine the formulation and utilization of broiler poultry feed using locally available materials for poultry farming in the School of vocational Education. Specifically, the study sought to:

1. To identify locally available feed ingredients used in formulating broiler diets.
2. To determine performance of broilers placed under different Feed Treatments.
3. To determine the production process/procedure for broiler feed formulation.
4. To determine the management of School of Vocational and Technical Education's satisfaction with the locally formulated feed products.

2 Conceptual review

According to Poultry Hub Australia (2026), feed formulation is the process of qualifying the amounts of feed ingredients that need to be combined to form a single uniform mixture (diet) for poultry that supplies all of their nutrient requirements (Poultry Hub Australia, 2026). Feed formulation is both a science and art, requiring knowledge of feed and poultry, and some patience and innovation (Poultry

Hub Australia, 2026). Typical formulation indicates the amounts of each ingredients (composition) in the diet. The nutrient composition of the diet particular class of poultry for which it is prepared.

Food and Agriculture Organization (2013) gave a general guideline for broiler feed formulation using local materials as follows:

1. Nutrient requirements of the class of poultry (e.g layers, broilers etc).
2. Feed ingredients in terms of nutrient composition and constraint in terms of nutrition and processing, and
3. Cost and availability of the ingredient.

2.1 Locally available feed ingredients for broiler feed formulation: availability, cost and stability

The International Institute of Tropical Agriculture (2022) argued that the formulation of broiler feed using locally available materials is an important strategy for reducing feeding costs and improving the sustainability of poultry production in Nigeria. Broiler chickens require adequate quantities of energy, protein, essential amino acids, fats, vitamins and minerals to support healthy growth, muscle development and efficient feed utilisation. These nutrients must be supplied in appropriate proportions to meet the changing nutritional requirements of birds at different stages of development. Consequently, the successful use of local feed ingredients depends not only on their availability and affordability but also on their nutritional composition, digestibility, safety and storage stability (NASEM, 2026).

According to the Nigerian Institute of Animal Science (NIAS, 2024), several locally sourced ingredients and agro-industrial by-products are recognised for use in animal-feed production in Nigeria. These include maize offal, palm kernel cake, wheat offal and other ingredients with varying nutritional characteristics. Agbede et al. (2020) also investigated adaptable feed ingredient combinations containing fish meal, groundnut cake and soybean meal for broiler production. These sources demonstrate the importance of evaluating available ingredients and combining them appropriately to meet the nutritional requirements of broilers.

For poultry farmers in Abia State, the use of locally obtainable ingredients may provide opportunities to reduce dependence on purchased commercial feed. However, local availability should be confirmed through market surveys and discussions with farmers, grain merchants, agricultural processors and feed suppliers. The following ingredients were considered relevant for the broiler feed formulation:

2.1.1 Maize

Maize is an important energy source in broiler diets because it supplies carbohydrates that birds use for growth, movement and other physiological activities (Cowieson, 2005). It is commonly used as a major ingredient in poultry feed and can be obtained through grain merchants, agricultural markets and distributors.

Availability: Maize is available in Nigerian agricultural markets, although the quantity supplied and market price may vary with harvesting seasons, transportation costs and demand from human-food and livestock-feed producers. For poultry farmers in Abia State, purchasing maize from reliable wholesalers or sourcing it during periods of adequate supply may help maintain continuity in feed production.

Cost: Maize can account for a substantial proportion of the ingredient cost of broiler diets. Its price may increase when supply is limited or demand is high. Therefore, feed formulators should compare

its current price with those of suitable alternative energy ingredients, such as sorghum and properly processed cassava products.

Stability: Properly dried maize can be stored for extended periods under suitable conditions. However, maize that is exposed to moisture may develop mould and become contaminated with mycotoxins, including aflatoxins. Such contamination can affect bird health and production performance. Maize should therefore be adequately dried, stored in a clean and well-ventilated environment and protected from moisture and pests.

In formulating broiler feed, maize should be included according to its energy contribution and the nutritional requirements of the birds. Its inclusion should also be balanced with protein sources, amino acids, minerals and vitamins to produce a complete diet (Aviagen, 2022; NIAS, 2024).

2.1.2 Soybean meal

Food and Agriculture Organization (2013) posited that Soybean meal is an important plant-based protein ingredient used in broiler feed. It supplies essential amino acids needed for muscle development, tissue repair and efficient growth. Its nutritional value makes it particularly useful in diets for young broilers, which require adequate protein and amino acids for rapid development.

Availability: Soybean meal may be obtained from feed-ingredient dealers, oil-processing businesses and agricultural markets. However, local supply can vary according to soybean production, processing capacity and demand from feed manufacturers. Poultry farmers in Abia State should identify dependable suppliers and determine whether soybean meal can be obtained consistently throughout the production period.

Cost: Soybean meal may be relatively expensive, particularly when demand is high or supplies are limited. Its cost should therefore be compared with that of other suitable protein sources, such as groundnut cake and fish meal. Nevertheless, an alternative ingredient should not replace soybean meal solely because it is cheaper; its nutrient composition and effect on the overall diet must also be considered.

Stability: Soybean meal should be stored in a dry, clean and well-ventilated environment. Moisture, insects and poor handling may reduce its quality during storage. Raw soybeans should not be used indiscriminately because they contain anti-nutritional factors, including trypsin inhibitors, which can interfere with protein digestion. Appropriate heat processing is required before soybeans are used in poultry feed.

Soybean meal is therefore a valuable ingredient when its cost, quality and availability are favourable. Its inclusion should be determined by the protein and digestible amino-acid requirements of the broilers.

2.1.3 Groundnut cake

According to Heuzé et al. (2018), Groundnut cake was obtained after oil extraction from groundnuts. It is a useful plant protein ingredient that may help reduce dependence on soybean meal in broiler diets. It also provides some energy, although its principal contribution to feed formulation is protein.

Agbede et al. (2020) included groundnut cake in formulated broiler diets, demonstrating its relevance as an ingredient for consideration in locally adaptable feeding systems.

Availability: Groundnut cake can be obtained from groundnut oil-processing businesses, agricultural markets and feed-ingredient dealers. Its availability in Abia State may depend on supplies from

producing areas and the activities of local distributors. Establishing relationships with reliable suppliers can help farmers maintain a regular supply.

Cost: Groundnut cake may be an economical alternative protein source when its market price is favourable relative to soybean meal. However, the price advantage may be reduced by transportation costs, inconsistent quality or the need to reject contaminated supplies. Farmers should therefore assess the cost per unit of usable protein rather than relying solely on the purchase price.

Stability: One major concern with groundnut cake is the risk of aflatoxin contamination arising from mould growth before or after processing. Aflatoxins can harm poultry and reduce production performance. Groundnut cake should be purchased from reputable suppliers, inspected for signs of spoilage and tested for mycotoxins where possible. It should also be stored under dry conditions.

Groundnut cake can contribute to economical broiler feed formulation, provided that its nutritional quality and safety are established before use.

2.1.4 Palm kernel cake

Palm kernel cake is a by-product of palm oil processing and is relevant to poultry feeding, particularly in southern Nigeria, where palm oil production and processing are established agricultural activities. It supplies some protein and energy and may be considered as a partial ingredient in broiler diets.

The NIAS (2024) suggested that palm kernel cake contains approximately 14% minimum crude protein and 2,450 kcal/kg minimum metabolizable energy, with a maximum crude fibre content of 15%. These figures are reference specifications rather than guaranteed values for every batch, so the actual ingredient quality should be verified before formulation.

Availability: Palm kernel cake may be obtainable from palm oil mills, local agro-processing businesses and feed-ingredient suppliers. Its potential availability makes it worth investigating for poultry production in Abia State. Nevertheless, seasonal variation, the operating capacity of mills and competition from other livestock-feed users may affect supply.

Cost: Palm kernel cake may be attractive when its price is lower than that of conventional ingredients. Buying directly from processors may reduce some distribution costs. However, savings must be considered alongside transportation, handling, nutrient digestibility and the cost of balancing the diet.

Stability: Palm kernel cake must be protected from moisture and contamination during storage. Its residual oil content may also affect storage quality, depending on processing and handling conditions. The ingredient should be inspected regularly for mould, unusual odour, insect infestation and other signs of deterioration.

Although palm kernel cake can be useful in locally formulated diets, its relatively high fibre content requires careful consideration. Excessive inclusion may dilute dietary energy and reduce nutrient utilisation, particularly in young broilers. Its inclusion level should therefore be determined through appropriate feed formulation and, where necessary, feeding trials.

2.1.5 Cassava meal and processed cassava peels

Njike and Ndife, (2021); and, Oyawoye et al. (2024) asserted Cassava is widely cultivated and processed in Nigeria. Cassava meal and properly processed cassava peels can supply carbohydrates and serve as partial alternatives to maize in poultry diets. Their use may also improve the utilisation of agricultural by-products that might otherwise be discarded.

Availability: Cassava roots and processing by-products may be obtained from cassava farmers, garri processors, flour producers and other agricultural processing businesses. Their availability around the study location should be investigated to establish whether they can provide a dependable supply for the School poultry farm.

Cost: Cassava products may be economical where they are available close to the farm. However, the cost of collection, peeling, drying, grinding, transportation and storage must be included when comparing them with maize. Wet cassava peels may appear inexpensive but can become costly when the expenses associated with safe processing and drying are considered.

Stability: Cassava peels contain cyanogenic compounds that can release hydrogen cyanide. They must therefore undergo appropriate processing to reduce cyanogenic compounds before being used in poultry diets. Adequate drying and hygienic storage are also necessary to limit mould growth and spoilage.

Cassava products are principally energy sources and should not be regarded as complete substitutes for all the nutrients supplied by maize or other ingredients. Their use must be accompanied by suitable protein sources, amino-acid supplementation and mineral and vitamin balancing where required. Inclusion should be based on the processed ingredient's nutrient composition and the requirements of the broilers.

2.1.6 Sorghum

Sorghum is a cereal grain that can supply energy in broiler diets and may serve as a partial alternative to maize when its price and availability are favourable. It is particularly useful for consideration where maize prices rise or where sorghum can be sourced reliably through agricultural markets (Sa'idu and Yakubu, 2024; Lakurbe et al., 2018).

NIAS (2024) recognised sorghum offal as an agro-industrial by-product, with specified nutrient characteristics. Whole sorghum grain and sorghum offal should, however, be treated as different ingredients because their nutrient composition and fibre content differ.

Availability: Sorghum is produced in Nigeria and may be available through grain dealers and feed-ingredient suppliers. Its supply to poultry farms in Abia State will depend on transportation networks, market demand and the cost of bringing it from producing areas.

Cost: Sorghum may become economically attractive when its price per unit of usable energy is lower than that of maize. Nevertheless, transportation expenses and the quality of the grain should be considered before deciding to use it.

Stability: Properly dried sorghum can be stored under suitable conditions. However, moisture, pests and fungal contamination can reduce its quality. Some varieties also contain tannins, which may interfere with nutrient utilisation. The variety and quality of sorghum should therefore be assessed before inclusion in broiler feed.

Sorghum can contribute to the diversification of energy sources in broiler diets, but its use should be determined by its nutrient value, processing requirements and cost relative to alternative ingredients.

2.1.7 Rice bran and rice offal

Heuzé et al. (2012) Opined that Rice bran and rice offal are by-products of rice processing. Depending on the processing method, they may supply energy, some protein, fat and fibre. They may be useful in locally formulated diets when their quality is acceptable and their price is competitive.

Availability: These materials can be obtained from rice mills and agricultural markets. Their availability to the College poultry farm will depend on the distance to rice-processing centres, the quantity produced and the reliability of suppliers.

Cost: Rice by-products may be less expensive than some conventional feed ingredients. However, the cost advantage should be assessed against their nutrient content, fibre level, storage requirements and transportation expenses. A cheap ingredient with a high fibre content may not necessarily reduce the cost of producing a kilogram of broiler weight gain.

Stability: Rice bran may deteriorate during storage because its residual oil can become rancid. High moisture levels can also encourage mould growth. Fresh, properly processed material should be purchased, stored in dry conditions and used within an appropriate period. Suppliers should be able to provide information about processing and storage practices.

Rice bran and rice offal should be included cautiously, with attention to their fibre and energy contributions. The actual inclusion level should be established through formulation rather than applying the same proportion to all rice by-products.

2.1.8 Fish meal

Fish meal is an animal-origin protein ingredient that can contribute essential amino acids and minerals to broiler diets. It may complement plant protein ingredients, particularly where the amino-acid composition of the overall diet requires improvement (Heuzé et al., 2015).

Availability: Fish meal may be sourced from fish-processing businesses and feed-ingredient dealers. Its availability and quality may vary according to processing methods, the type of fish used and the reliability of the supply chain.

Cost: Fish meal can be relatively expensive compared with some plant protein sources. Its inclusion should therefore be determined by its nutritional contribution and the extent to which it improves the balance of the complete diet. Excessive use may increase production costs without providing a proportionate economic benefit.

Stability: Fish meal must be properly dried and stored to prevent moisture absorption, microbial deterioration and rancidity. Poor-quality fish meal may also contain excessive salt, contaminants or other undesirable substances. It should be obtained from reliable suppliers and inspected before use.

Fish meal can be useful in balanced broiler diets, but its inclusion should be based on quality, cost and the specific nutritional requirements of the birds.

2.1.9 Brewers' dried grains

Brewers' dried grains are by-products of the brewing industry. They provide protein, fibre and some energy, although their nutritional composition varies with the raw materials used and the processing method (Heuzé et al., 2017).

Availability: Brewers' grains may be obtained from breweries, beverage-processing businesses and feed-ingredient suppliers. The quantity available to a poultry farm will depend on the distance to the processing plant, production schedules and the availability of transport.

Cost: These materials may be economical when purchased close to the source. However, wet brewers' grains can be expensive to transport because of their high moisture content. Drying and storage expenses should therefore be included when calculating the true cost.

Stability: Wet brewers' grains spoil quickly if not used or preserved appropriately. Drying can improve storage stability, provided that the material is dried adequately and stored under hygienic conditions. The ingredient should be checked for mould and other signs of deterioration.

Brewers' dried grains may be considered as a supplementary ingredient, but their fibre content and nutrient variability require careful formulation. Their suitability should be assessed against the growth stage of the broilers and the nutritional composition of the complete diet.

2.1.10 Vitamin and mineral supplements

Although the focus of local feed formulation is often on energy and protein ingredients, vitamins and minerals are equally important for broiler health and growth. Vitamins support normal metabolism, immunity and physiological functions, while minerals contribute to bone development, enzyme activity and other essential processes (Khan et al., 2021)

David et al. (2023) stated that some minerals may be obtained from suitable local sources, such as limestone or oyster-shell products. However, their purity and mineral composition must be verified. Commercial vitamin and mineral premixes may still be required because locally available agricultural ingredients cannot reliably provide all vitamins and trace minerals in the required proportions.

Cobb-Vantress (2022) provides different nutritional specifications for broilers at the starter, grower and finisher stages, illustrating the importance of meeting changing nutrient requirements as birds grow. Therefore, the feed formulator should use an appropriate premix and supplement minerals according to the formulation requirements rather than assuming that the major ingredients will supply all necessary micronutrients.

Availability: Vitamin and mineral premixes are generally obtained from reputable feed-ingredient suppliers. Their availability should be confirmed before feed production begins.

Cost: Although premixes form a relatively small proportion of a complete diet, they are important for nutritional adequacy. Their cost should be included in the overall formulation budget.

Stability: Premixes must be stored according to the manufacturer's instructions and protected from heat, moisture and direct sunlight. Expired or poorly stored supplements may lose potency.

2.1.11 Consideration of availability, cost and stability in ingredient selection

The stability of locally available feed ingredients should be determined by considering their nutritional contribution, market price, reliability of supply and storage characteristics (Poultry Hub of Australia, 2026. These factors are closely related. For example, an ingredient may be inexpensive during the harvesting season but become costly when supplies decline. Similarly, an ingredient that is readily available may not be suitable for long-term storage if it deteriorates quickly.

The NIAS (2024) provides useful guide for approved feed ingredients in Nigeria, including moisture limits, crude protein, metabolizable energy and fibre characteristics. These specifications can assist feed formulators in assessing ingredient quality. However, actual nutrient values may vary between

suppliers and batches, making laboratory analysis particularly useful when preparing diets for experimental purposes. Therefore, for the purpose of this study, the following procedural measures were employed:

1. **Conduct a local market survey:** The research identified the different suppliers, market prices, quantities and seasonal availability of maize, soybean meal, groundnut cake, palm kernel cake, cassava and other suitable ingredients This local market survey was conducted as recommended by the Poultry Hub of Australia (2026).
2. In line with the assertions of Poultry Hub Australia (2026); and, Pesti and Choct (2023), the researcher compared ingredients on nutritional basis, evaluatie the cost of supplying usable energy, protein and essential amino acids rather than selecting ingredients solely because they have low purchase prices.
3. The study assessed the ingredients quality by obtaining nutrients information from suppliers and conduct laboratory diagnosis where possible, especially when ingredients are obtained from a different sources or are intended for experimental diets (Poultry Hub Australia, 2026).
4. The study ensured safe processing by applying appropriate processing methods to ingredients such as cassava products and raw soybeans to reduce harmful or anti-nutritional substances(Heuzé et al., 2017).
5. The study maintained proper storage by storing the ingredients in a dry, clean, and well-ventilated conditions, using appropriate pest control and stock rotation practices to minimize spoilage. This is in line with the position of the Food and Agriculture Organization, (2013).
6. The study formulated different diets mix for different birds treatment to evaluate their performance based on the final body weight gain, growth rate, feed conversion ratio, and survival.

However, no single local ingredient can provide all the nutrients required by broilers. The success of local feed formulation depends on combination of ingredients in appropriate proportions, ensuring adequate supplementation, quality controlling and maintaining proper storage. The availability and affordability of the materials, and their suitability and stability must all be considered in order to produce an acceptable broilers' Feed rather than in isolation.

For the School of Vocational and Technical Education Poultry Farm, the most suitable ingredients should be identified through a local market survey and nutritional evaluation. Their effectiveness should then be assessed by comparing the cost of the formulated diets and the growth performance of broilers fed the diets under appropriate experimental conditions. This approach would provide a sound basis for determining whether locally sourced materials can support economical, nutritionally adequate and sustainable broiler production.

2.2 Steps in broiler feed formulation

In formulating a balanced broiler diet, the following steps were followed as recommended by Korve (2024); and Cobb-Vantress (2021):

1. Determine the nutrient requirements of broiler chickens at different stages of growth.
2. Identify locally available feed ingredients to meet the nutrient requirements taking into account their availability, cost and stability.
3. Consider the use of feed additives such as a complete and balanced diet.
4. Regularly monitor the growth and health of the birds, and adjust the diet as need.

Broiler feed is a specialized diet formulated to meet the nutritional requirements of broilers. The exact calculation and ratio of ingredients in a broiler feed vary depending on factors such as age, weight, and breed of the chicken, as well as the desired growth rate and feed efficiency. Typically, a broiler feed contain a mixture of ingredients such as corn, soya bean meal, wheat and barley, as well as vitamins, mineral, and amino acids. The ratio of these ingredients was carefully balanced to provide the correct amount of protein, energy, and other nutrients for optimal growth and health.

2.3 The importance of broiler feed formulation

The importance of broiler feed formulation lies in ensuring that the chickens receive adequate nutrition to support their growth and production, resulting in better performance, improved health and higher profitability for the farmer. Zampiga et al. (2021) argued that, a well- designed broiler feed formulation can also help to minimize feed waste and optimize feed conversion efficiency, leading to more sustainable and profitability poultry farming operations.

2.4 Steps in broiler feed formulation

To formulate a balanced broiler feed, the following steps was followed as explained by Singh (2019):

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2. Identify locally available feed ingredients to meet the nutrient requirements taking into account their availability, cost and stability.
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2.5 The importance of local materials in broiler feed formulation

Using local materials in broiler's feed formulation is important for several reasons.

1. **Cost effectiveness:** by using local ingredients, feed manufacturers can reduce the cost, as production and transportation impact costs are reduced.
2. **Sustainability:** Utilizing local resources helps to reduce the carbon footprint associated with feed production making it a more environmentally sustainable option.
3. **Availability:** Using locally sourced materials can ensure a consistent and stable supply of ingredients, reducing the risk of feed shortages and price volatility.
4. **Supporting Local Economies:** By purchasing ingredients from local supplies, feed manufacturers can support the local economy, create jobs and promote economic growth.

Overall, incorporating Local Materials in broiler formulation can improve, the efficiency, sustainability economic viability of the poultry industry

3 Methodology

The experimental broiler feeds comprised of feed formulated from locally available ingredients (including maize, soybean meal, groundnut cake, palm kernel cake, brewer's dried grain, cassava meal and processed cassava peels, sorghum, rice bran, fish meal, meat meal etc) in four Treatments in two Treatment 1 (T^1) and Treatment 2 (T^2) in comparison with the commercial feed Control Feed 1 and Control Feed 2, produced by two different producers in Nigeria. This was replicated a number of times in a complete random environment for the purpose of paving ways to assess the variations resulting from each of the Treatment group. The population of the study comprised 100 broilers of the same breed, bought at 21 days old. Out of the 100 broiler birds, 25 were randomly selected for each of the Treatment group (Control Feed 1, Control Feed 2, T^1, and T^2). The Chicks were subjected to the same experimental control condition with different mixtures and the process was sustained for complete eight (8) weeks.

The procedure adopted for the experimental study were: Purchase of feed materials from the local available ingredients; analysis of the nutrients composition; formulation of the nutritional feed diet; preparation of feed process and mixture of the ingredients according to a standard formulation; feed experimentation for randomly selected broiler Chicks on each Treatment group, initiated with a pilot test.

Sources of the local feed materials included maize, soybean meal, groundnut cake, palm kernel cake, brewer's dried grain, cassava meal and processed cassava peels, sorghum, rice bran, fish meal, meat meal, etc. Data for the study were obtained from the Initial Body Weight, Final Body Weight, Weight Gain, Feed Intake, Growth Rate Feed Conversion Ratio, and Survival Rate. Descriptive Statistical mean and Standard deviation were employed in evaluating the data, while Analysis of Variance (ANOVA) was used to analyzed the results.

Table 1. Nutritional composition of the different feed mixes for broilers (quantity, kg).

S/N	Nutritional component	Control Feed 1	Control Feed 2	T^1	T^2	Mean	SD
1	Crude Protein	19.48	21.33	23.17	24.00	22.00	1.73
2	Fat and oil	5.54	5.10	5.05	5.01	5.18	0.21
3	Carbohydrates	60.01	51.96	52.20	54.05	54.06	2.48
4	Water	7.18	10.29	10.09	9.10	9.17	1.25
5	Fibre, Ash, Minerals and other	7.79	11.32	9.49	7.84	9.61	1.24
	TOTAL	**100.00**	**100.00**	**100.00**	**100.00**		

Source: Authors' computation, 2026. T^1 and T^2 = locally formulated feeds.

3.1 Analysis of the results of the nutritional composition of the feed mixes

The results of the nutritional composition of the two Control Feed 1 and Control 2 in comparison with T^1 and T^2 are presented and analyzed using mean and Standard deviation (SD)

The results from Table 1, indicates that Crude Protein content were 19.48kg, 21.33kg, 23.17kg, and 24.00kg in Control Feed 1, Control Feed 2, T^1 and T^2 respectively. The mean value of the crude Protein content was 22.00 with a standard deviation of 1.73. The result suggest that T^2 had the highest Crude Protein of 24.00kg, followed by 23.17kg for T^1, Control Feed 2 followed with 21.33kg, while the Control Feed 1 has the lowest with 19.48kg. The implication is that the T^1 and T^2 with the highest

Crude Protein content could support successful muscle and tissue development, and faster growth rates in the broilers.

The Fat and Oil content were 5.54kg, 5.10kg, 5.05kg and 5.01kg in Control Feed 1, Control Feed 2, T^1 and T^2 respectively. Its mean value was 5.18, with standard deviation of 0.21. The Control Feed 1 has the highest Fat and Oil content of 5.54kg, Control Feed 2 ranked second wth 5.10kg, T^1 ranked third with 5.05kg, while T^2 has the lowest fat and Oil content respectively. The standard deviation indicates a low relative variation exist among the treatments and this suggest that Fat and Oil are considerable important source of concentrated energy that contributed to absorption of Fat soluble vitamins for broiler Chicks.

From Table 1, the Carbohydrates content were 60.01kg for Control Feed 1, 51.96kg for Control Feed 2, 52.20kg for T^1, and 54.05kg for T^2 respectively. The Carbohydrates content has a mean value of 54.06, with a standard deviation of 2.48. The implication is that Control Feed 1 has the highest content of Carbohydrate of 60.00kg, with T^2, and T^1 ranking second and third with 54.05kg and 52.20kg, while Control Feed 2 ranked the lowest with 51.96 respectively. The data also indicates that the Carbohydrates had the highest variation in standard deviation among the nutritional components. This further suggests that the variations in the treatments could have been contributed in the required energy for maintenance and movement of the broilers.

The results from Table 1 showed that the water contents in Control Feed 1, Control Feed 2, T^1 and T^2 were 7.18kg, 10.29kg, 10.09kg and 9.10kg respectively. Its mean value was 9.17, with a standard deviation of 1.25. This implies that Control Feed 2 has the highest water content with 10.29kg, followed T^1 with 10.09kg, and T^2 with 9.10kg, while Control Feed 1 has the lowest water content of 7.18kg. This result suggests that during the period of the experimentation, the important of moisture, storage stability, and sustainability to spoilage in the broilers feed formulation were considered according to the water content ranking rates.

Finally, the results from Table 1 indicated that Fibre, Ash, Minerals, and other components, had the aggregated content of 7.79kg in Control Feed 1, 11.32kg in Control Feed 2, 9.49kg in T^1 and 7.84kg in T^2 respectively. Its mean value was 9.61, with a standard deviation of 1.24. The result suggests that Control Feed 2 has the highest content of Fibre, Ash, Minerals, and other components with 11.32kg, followed by T^1 with 9.49kg and T^2 with 7.84kg respectively, while Control Feed 1 has the lowest content of Fibre, Ash, Minerals, and other components with 7.79kg. The high value of the Fiber content explains abnormal, normal and low digestive functions among the bird and further suggests why excessive Fibre intake could reduce nutrients digestibility and energy among the broilers.

4 Presentation, analysis and discussion of results

This section of the experimental study presents the analysis and discussion of the results obtained from the performance of broilers placed under different feed treatments during the period. This analysis is focused on the Initial Body Weight, Final Body Weight, Weight Gain, Growth Rate, Feed Conversion Ratio, and the Survival Rate under the four feeding treatments of Control Feed 1, Control Feed 2, T^1 and T^2. The essence of these different feeding treatments were to determine the best feed performance in comparison of commercial feed with locally formulated feed for the broilers.

4.1 Presentation of results

Table 2. Performance of broilers placed under different feed treatments.

PARAMETERS	CONTROL FEED 1	CONTROL FEED 2	T^1	T^2
Initial Number of Broilers	**25**	**25**	**25**	**25**
Initial Body Weight (g)	**538.98**	**537.64**	**538.13**	**537.65**
Final Body Weight (g)	**2,001.03**	**2,989.69**	**4,554.06**	**5,421.78**
Feed Intake (g)	**3,669.38**	**4,231.94**	**4,277.78**	**4,943.75**
Weight Gain (g)	**1,462.05**	**2,452.05**	**4,015.93**	**4,884.13**
Growth Rate (%)	**2**	**3**	**4**	**4**
Feed Conversion Ratio	**2.51**	**1.73**	**1.07**	**1.01**
Survival Rate (%)	**80.00**	**88.00**	**92.00**	**96.00**

Source: Authors' computation, 2026.

The formulae used in computing the data were as follows:

$$WG = FBW - IBW \tag{1}$$

where WG is the weight gain (g), FBW the final body weight and IBW the initial body weight.

$$SGR\left(\%\right) = \frac{\ln(FBW) - \ln(IBW)}{T} \times 100 \tag{2}$$

where SGR is the specific growth rate, FBW the final body weight, IBW the initial body weight and T the duration of the treatment.

$$FCR = \frac{FI}{WG} \tag{3}$$

where FCR is the feed conversion ratio, FI the feed intake and WG the weight gain.

$$SR\left(\%\right) = \frac{NBE}{NBB} \times 100 \tag{4}$$

where SR is the survival rate, NBE the number of broilers at the end and NBB the number of broilers at the beginning.

4.2 Discussion of results

The results from Table 2 showed that the Initial Body Weights of the broilers were 538.98g, 537.64g, 538.13g and 537.65g for Control Feed 1, Control Feed 2, T^1 and T^2 respectively. The result suggests that the Initial Body Weight were relatively indifferent across the feeding groups. However, Control Feed 1 recorded the highest Initial Body Weight of 538.98g, T^1 ranked second wth 538.13g, T^2 came third with 537.65g, while Control Feed 2 has the lowest Initial Body Weight of 537.64g. The small variations in the result suggests that the experimental groups were based on wider assessment with comparable Initial Body Weights as a basis for providing a useful performance evaluation of the broilers feeds.

From Table 2, the Final Body Weights of the broilers were 2,001.03g, 2,989.69g, 4,554.06g and 5,421.78g for Control Feed 1, Control Feed 2, T^1 and T^2 respectively. The result suggests that T^2 has

the highest Final Body Weight of 5,421.78g, T^1 ranked second wth 4,554.06g, Control Feed 2 ranked third with 2,989.69g, while Control Feed 1 recorded the lowest with 2,001.03g respectively. This further suggests that T^2 broilers with the highest Final Body Weight portrays a potential strong growth rate.

From Table 2, the results showed that Feed Intakes were 3,669.38g, 4,231.94g, 4,277.78g and 4,943.75g for Control Feed 1, Control Feed 2, T^1 and T^2 respectively. It is indicated that T^2 has the highest Feed Intake of 4,943.75g, follow by T^1 and Control Feed 2 with 4,277.78g and 4,231.94g respectively, while Control Feed 1 has the lowest Feed Intake of 3,669.38g. This implies that the broilers in T^2 consumed more feed than those in T^1, Control Feed 1 and Control Feed 2 respectively. Higher Feed Intake is generally assumed to be a contributing factor for increased body weight gain in the broilers. However, increase in the body weight gain are solely determined by the adequacy of the supplied nutrients/diets in the feed, but not merely the quantity of feed intake by the birds. Accordingly, Feed Intake should not be interpreted independently but in relation to the body weight gain, Feed Conversion Ratio, and the Growth Rate of the broilers.

The results from Table 2 indicated that the Weight Gains were 1,462.05g for Control Feed 1, 2,452.05g for Control Feed 2, 4,015.93g, for T^1 and 4,884.13g for T^2 respectively. The findings showed that T^2 has the highest Weight Gain of 4,884.13g, T^1 and Control Feed 2 ranked second and third wth 4,015.93g and 2,452.05g respectively, while Control Feed 1 has the lowest with 1,462.05g. This result suggests that during the period of the experimentation, T^2 broilers group had the highest body weight gain. This findings also suggests that T^2 higher weight gain was supported by the higher Feed Intake. The implication is that T^2 contained adequate nutrients/diets for the birds, hence, the higher gain body weight and proposes a better growth rate.

From Table 2, the findings indicates that the growth rate were 2%, 3%, 4% and 4% for Control Feed 1, Control Feed 2, T^1 and T^2 respectively. The Findings revealed that T^2 and T^1 have the highest growth rates of 4% and 4% respectively, Control Feed 2 recorded 3%, while Control Feed 1 recorded the lowest with 2% during the period of the experimental study. This findings are in consonance with the previous results (Final Body Weight Feed Intake, and weight gain) and further suggests that birds with higher weight gain, entails higher Feed Intake and higher growth rate. This is the case in T^2 and T^1 broilers.

From Table 2, Feed Conversion Ratio revealed that 2.51, 1.73, 1.07, and 1.01 for Control Feed 1, Control Feed 2, T^1 and T^2 respectively. It is shown that T^2 has the lowest Conversion Ratio of 1.01, while T^1 and Control Feed 2 followed with 1.07 and 1.73 respectively, while Control Feed 1 has the highest with 2.51. Generally, a feed conversion ratio of 1.00 is good and acceptable as this suggests better feed efficiency in birds. This result therefore suggests that T^2 and T^1 with the lowest Feed Conversion Ratios of 1.01 and 1.07 are good and acceptable Feed Conversion Ratios that indicates efficiency. Nevertheless, Control Feed 1 indicated a better efficiency Feed Conversion Ratio among the treatment groups. This findings may have had its roots from the aggregation of Fibre content with Ash, Minerals and other components. In this case, there is no way to ascertain the exact quantity of the Fibre content that aids digestion and Feed Conversion Rate. However, since the T^2 and T^1 Feed Conversion Ratios are good and acceptable and supported the birds to higher body weight gain, faster growth rate, higher Feed Intake, and higher Final Body Weight, the researcher therefore, is of the opinion that the Feed Conversion Ratios are efficient. Nevertheless, the study suggests a distinct analysis of the nutritional components during feed formulation to ascertain the positive and negative

effects of each nutrient components. Additionally, improvement in the Fiber content in subsequent broilers feed formulation is advocated.

The results from Table 2 showed that the Survival Rate of the broilers during the period under consideration were 88%, 80%, 92%, and 96% for Control Feed 1, Control Feed 2, T^1 and T^2 respectively. The results indicated that T^2 and T^1 has the highest survival rate of 96% and 92%, while Control Feed 2 and Control Feed 1 have the lowest with 80% and 88% respectively. This findings suggests that there might be healthy ingredients/diets in the locally formulated feed that support the health conditions of the birds during the period of the experimentation.

5 Conclusion

Since the results from the experimental study revealed that T^2 has the highest Final Body Weight, highest Weight Gain, highest Growth Rate, highest Survival Rate and Feed Conversion Ratio; and, also suggested that T^1 performed better than the Control Feed 1 and Control Feed 2 during the period under consideration in Final Body Weight, weight gain, growth rate, survival rate, with good Feed Conversion Ratio; the study concludes that the locally formulated feeds for T^2 and T^1 improve the broilers performance in terms of their Final Body Weight, Weight Gain, Growth Rate, and Survival Rate together with good Feed Conversion Ratio in the Poultry Farm of the School Vocational and Technical Education in Abia State College of Education (Technical) Arochukwu.

6 Recommendations

Based on the findings of this experimental study, it is recommended that the commercial feed (Control Feed 1 and Control Feed 2) should be substituted for locally formulated feeds Treatment 1 and Treatment 2 (T^1 and T^2) for broilers in the Poultry Farm of School of Vocational Education, Abia State College of Education (Technical) Arochukwu. Additionally, the aggregation of feed composition (as is in the case of Fibre, Ash, Minerals and other components) is discouraged. This is to ascertain the exact positive and negative effects of each of the components as well as the required quantity in each feed formula. Hence, the researcher recommends separation and improvement in the Fiber content in subsequent broilers feed formulation in order to increase the Feed Conversion Ratios in T^1 and T^2 broilers feeds. Based on the evaluation report, the management of the Poultry Farm of Vocational and (Technical) Education, Abia State College of Education Technical Arochukwu recommended for the use of the T^2 and T^1 broilers feed formulation in the Poultry Farm of School of Vocational and Technical Education for broilers.

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