IJAAR PUBLISHING®

Open Access Journal of Science Research | ISSN: 3027-1185
Vol. 4, Issue 1 (2026) | www.ijaar.org

FORMULATION OF CHICKEN (LAYERS) FEED

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ABSTRACT

This study titled Formulation of Chicken (Layers) Feed Using Locally Available Ingredients was conducted to formulate layers feed from locally sourced materials and to evaluate its nutritional quality through proximate analysis. The formulated feed was prepared using maize, soybean meal, groundnut cake, wheat offal, fish meal, bone meal, limestone, salt, layer premix, methionine, lysine and toxin binder. Proximate analysis was carried out using standard laboratory methods, where moisture content was determined by oven-drying to a constant weight, crude protein was analyzed using the Kjeldahl method, crude fat was determined by ether extraction, crude fiber was measured through acid and alkali digestion, ash content was obtained by incineration in a muffle furnace, and nitrogen-free extract was calculated by difference. The results showed a low moisture content (3.40%), indicating good storage stability, while a high ash content (54.60%) reflected the inclusion of mineral-rich ingredients essential for eggshell formation in laying hens. The crude fat (6.23%) and crude fiber (16.70%) contents suggest support for energy supply and digestive health, whereas the relatively low crude protein and nitrogen-free extract values indicate the need for further nutrient balancing. In conclusion, the study demonstrates that locally available ingredients can be used to formulate layer feed with acceptable nutritional characteristics; however, proper formulation and routine proximate analysis are necessary to ensure that the feed meets standard nutritional requirements for optimal poultry production.

Key words: Eggshell, bone meal, ash

https://doi.org/10.46654/4106-2045

BACKGROUND OF THE STUDY

Poultry nutrition is a well-established area of animal science; however, many small-scale poultry farmers still lack adequate knowledge of the specific dietary requirements of laying hens. A common assumption among farmers is that any grain-based feed is sufficient for egg production, whereas laying hens require carefully balanced levels of energy, protein, calcium, phosphorus, essential amino acids, vitamins, and minerals to sustain optimal egg yield, eggshell quality, and overall health (Leeson & Summers, 2005). Deficiencies or excesses of these nutrients can result in reduced egg production, poor shell quality, lowered hatchability, and weakened immune response (FAO, 2013). Feed formulation is therefore not a random combination of available feedstuffs but a scientific process that involves balancing nutrients based on the birds' physiological needs and the chemical composition of feed ingredients. Feed accounts for approximately 60–70% of the total cost of poultry production, making it the most critical factor affecting profitability in commercial and small-scale layer operations (Olomu, 2011). In developing countries such as Nigeria, the high cost of commercial poultry feed poses a major challenge to farmers, particularly smallholder producers who depend on poultry farming for their livelihoods and household nutrition. Commercial layer feeds are often expensive due to reliance on imported raw materials and premixes, as well as fluctuating market prices. In addition, such feeds may not always be adapted to local environmental conditions or ingredient availability. This has increased interest in the formulation of nutritionally adequate layer feeds using locally available ingredients such as maize, soybean meal, groundnut cake, wheat offal, bone meal, limestone or oyster shell, and vitamin–mineral premixes (Akinmutimi *et al.*, 2006). When properly formulated, feeds based on local ingredients can support optimal egg production, good body condition, and improved resistance to disease, while also reducing production costs and dependence on imported materials (Abdollahi *et al.*, 2014).

STATEMENT OF THE RESEARCHPROBLEM

Despite the recognized importance of balanced nutrition in achieving optimal egg production, many poultry farmers in Nigeria are unable to provide adequately formulated diets for their laying hens. The high cost of commercial feeds, driven by dependence on imported ingredients and market instability, makes them unaffordable for many small-scale farmers (Olomu, 2011; FAO, 2013). As a result, farmers often resort to feeding unbalanced rations composed of locally available ingredients without proper knowledge of nutrient requirements or ingredient composition. Furthermore, there is limited consideration of regional variations in the nutrient quality of local feed ingredients. Ingredients such as maize, groundnut cake, and wheat offal are commonly used, yet their nutrient content can vary significantly due to differences in processing, storage, and source (Babiker *et al.*, 2011; Ravindran *et al.*, 2014). Without scientific formulation and evaluation, such variability can lead to nutrient deficiencies or excesses, resulting in poor egg production, inefficient feed utilization, and economic losses..Although several studies have explored the use of alternative and local feed ingredients, there remains a gap in developing scientifically validated and economically viable layer feed formulations that are practical for smallholder farmers. There is therefore a need to formulate and evaluate a cost-effective layer feed using locally available ingredients that meets established nutritional standards. This study seeks to address this gap by formulating a balanced layer feed and assessing its nutritional quality through proximate analysis.

SIGNIFICANCE OF THE STUDY

This study is significant because it addresses the challenge of high feed costs and limited access to nutritionally balanced feeds faced by poultry farmers, particularly smallholder producers. Feed constitutes a major portion of poultry production costs, often accounting for up to 70% of total expenses (Olomu, 2011; FAO, 2013). By formulating a cost-effective feed using locally available ingredients, this study provides an opportunity to reduce production costs while maintaining adequate nutritional quality. The findings of this study will benefit poultry farmers by providing practical guidance on the formulation of affordable layer feeds that meet nutritional requirements. Animal nutritionists and feed formulators may also benefit from data on the proximate composition of locally sourced feed ingredients and formulated diets. In addition, agricultural extension agents and policymakers can use the results to promote local feed production and enhance food security through sustainable poultry farming (Akinmutimi et al., 2006).

AIM AND OBJECTIVES OF THE STUDY

The main aim of this research is to formulate a nutritionally balanced and cost-effective feed for laying hens using locally available ingredients and to evaluate its nutritional quality using proximate analysis.

The specific objectives of this study are to

1. Formulate a balanced feed ration for laying hens using locally available feed ingredients.

2. Determine the proximate composition of the formulated layer feed.

3. Compare the nutritional quality of the formulated feed with standard nutritional requirements for laying hens.

4. Assess the cost-effectiveness of the formulated feed relative to commercially available layer feeds.

5. Provide practical recommendations for small-scale poultry farmers on formulating nutritionally adequate and affordable layer feeds.

METHODOLOGY

1 Feed Ingredients and Quantities Used:

The feed for laying hens was formulated using locally available feed ingredients. The ingredients and their respective quantities used in the formulation are presented

S/ N	Ingredients	Quantity (kg)	Function
1.	Maize	4.5	Energy source
2.	Soybean meal	1.5	Plant protein source
3.	Groundnut cake	0.7	Plant protein source
4.	Wheat offal	1.0	Fiber and energy
5.	Fish meal	0.3	Animal protein source
6.	Bone meal	0.3	Source of Calcium and phosphorus
7.	Limestone	1.5	Calcium source
8.	Salt	0.03	Electrolyte balance
9.	Layer premix	0.025	Vitamins and trace minerals
10.	Methionine	0.01	Essential amino acid
11.	Lysine	0.015	Essential amino acid
12.	Toxin Binder	0.02	Bind mycotoxins and reduces toxin effects

All ingredients were sourced from local markets and agro-input stores.

Feed Formulation

The layer's feed was formulated using the above-listed locally available ingredients to meet the nutritional requirements of laying hens as recommended by the National Research Council (NRC, 1994). Ingredient inclusion levels were selected to provide adequate energy, protein, minerals, and essential amino acids required for egg production.

FEED PREPARATION

All feed ingredients were weighed according to the specified quantities and milled where necessary. The ingredients were thoroughly mixed manually to obtain a homogeneous mash. The formulated feed was stored in clean, airtight containers to prevent moisture absorption and contamination prior to laboratory analysis.

PROXIMATE ANALYSIS OF THE FORMULATED FEED

Proximate analysis was carried out on the formulated feed to determine its chemical composition. The parameters analyzed included moisture content, crude protein, crude fat (ether extract), crude fiber, ash, and nitrogen-free extract. All analyses were conducted according to standard procedures outlined by the Association of Official Analytical Chemists (AOAC, 2005).

- Moisture content was determined using the oven-drying method.

- Crude protein was determined using the Kjeldahl method.

- Crude fat was determined using Soxhlet extraction.

- Crude fiber was determined by acid and alkali digestion.

- Ash content was determined using a muffle furnace.

- Nitrogen-free extract was calculated by difference.

RESULTS

Table 1: Proximate Composition of the Formulated Layers Feed (%):

S/N	Parameters	Percentage (%)
1.	Moisture	3.4
2.	Crude protein	5.6
3.	Crude fat	6.23
4.	Crude fibre	16.7
5.	Ash	54.6
6.	Nitrogen - Free Extract (NFE)	2.24

The proximate composition provides an indication of the nutritional quality of the formulated feed and its suitability for laying hens.

DISCUSSION

MOISTURE CONTENT

The moisture content of the formulated feed was low (3.40%), indicating good storage stability and a reduced risk of microbial growth and spoilage. This result agrees with the findings of Olomu (2011) and FAO (2013), who reported that poultry feeds with moisture content below 12% are considered safe for storage and less susceptible to mold growth and mycotoxin contamination. The low moisture value observed in this study may be attributed to proper drying of ingredients and adequate processing during feed formulation.

ASH CONTENT

The ash content of the formulated feed was relatively high (54.60%), indicating a high level of mineral content. This finding is consistent with the reports of Okonkwo and Akubuo (2001), who observed increased ash values in layer diets formulated with substantial amounts of limestone and bone meal for eggshell formation. However, the ash value obtained in this study is higher than values reported by Akinmutimi et al. (2006), who recorded moderate ash levels in conventional layer feeds. The high ash content in this study may be due to the relatively high inclusion levels of limestone, bone meal, salt, and vitamin–mineral premix, which may have diluted the proportion of other nutrients such as protein and carbohydrates.

CRUDE FAT (ETHER EXTRACT)

The crude fat content of the formulated feed was 6.23%, which falls within the range reported by Oluyemi and Roberts (2000) for layer diets. This result agrees with findings by Adeyemo and Longe (2007), who reported that moderate fat levels in poultry feeds improve energy supply and enhance palatability. The observed fat content can be attributed to the inclusion of maize, groundnut cake, and fish meal, which are known lipid-containing ingredients.

CRUDE FIBER CONTENT

The crude fiber content recorded was 16.70%, which is higher than the values recommended by NRC (1994) for laying hens. Similar high fiber values were reported by Esonu et al. (2001) when wheat offal and other fibrous by-products were included in poultry diets. While moderate fiber levels support gut health, excessively high fiber may reduce nutrient digestibility and feed efficiency. The high fiber level in this study may be due to the inclusion of wheat offal and other plant-based ingredients used to reduce feed cost.

CRUDE PROTEIN CONTENT

The crude protein content of the formulated feed was relatively low (5.60%) compared to the recommended protein level for laying hens, as reported by NRC (1994) and Olomu (2011). This result disagrees with findings by Akinmutimi et al. (2006), who obtained higher protein values in layer diets formulated with soybean meal and fish meal. The low protein value observed in this study may be due to ingredient variability, formulation emphasis on mineral components, or dilution effects caused by high ash and fiber contents.

NITROGEN-FREE EXTRACT (NFE)

The nitrogen-free extract content was low (2.24%), indicating limited readily available carbohydrates. This finding is lower than values reported by Aduku (2005) for conventional layer feeds. The low NFE value may be attributed to the reduced proportion of energy-rich ingredients such as maize and the increased inclusion of mineral and fibrous components in the formulation.

SUMMARY OF FINDINGS

The proximate analysis results revealed low moisture content, high mineral composition, moderate fat content, high fiber level, low crude protein, and low nitrogen-free extract. These findings indicate that while locally available ingredients can be used to formulate layer feed with good storage stability and mineral adequacy, careful adjustment of ingredient proportions is required to improve protein and energy levels to meet recommended nutritional standards for laying hens.

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