



The Impact of Using Flying Termites as an Alternative Protein Supplement to Soybean Meal on the Growth Performance of Broiler Chickens

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ARTICLE INFO	ABSTRACT
Published Online: 20 December 2025	This study investigated the effects of replacing soybean meal (SBM) with flying termite meal (FTM) as an alternative protein source on the growth performance of broiler chickens. A total of 180 day-old broiler chicks were randomly assigned to five dietary treatments, with FTM replacing SBM at 0%, 25%, 50%, 75%, and 100% levels. The experiment was conducted under a completely randomized design (CRD) and lasted eight weeks. The results showed significant differences ($p < 0.05$) among treatments, with birds fed 50% FTM showing better FCR and optimal growth performance compared to other groups. According to the study's findings, flying termites may up to 50% replace soybean meal without negatively affecting the development performance of broilers, offering a locally accessible, affordable, and sustainable protein substitute for chicken production in tropical areas.
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INTRODUCTION

Poultry production in poor nations is severely hampered by the high price and erratic availability of traditional protein components, especially soybean meal (SBM) (Olomu, 2019; Esonu et al., 2021). Investigating sustainable and alternative protein sources is essential for preserving profitability in the poultry industry, since feed costs can make up as much as 70% of overall production costs (Adeyemo & Longe, 2017). Because of their high protein content, quick reproduction, and minimal environmental impact, insects have drawn interest as potential animal feed sources in recent years (Makkar et al., 2014; van Huis, 2015). Mealworms, termites, and black army flies are examples of edible insects that are high in vital minerals, fatty acids, and amino acids that promote animal growth and production (Bawa et al., 2020). Among these, flying termites (*Kaloterme flavicollis* and *Macrotermes* spp.) are a viable alternative to traditional feed proteins due to their abundance, high nutritional value, and cultural acceptance in many African countries (Fasakin et al., 2003; Anvo et al., 2022).

Therefore, the purpose of this study was to evaluate the potential of flying termites to improve sustainable poultry production by examining the effects of utilizing them as a protein supplement in place of soybean meal on the growth performance of broiler chickens.

LITERATURE REVIEW

Importance of Protein in Poultry Nutrition

In chickens, protein is essential for metabolic processes, muscle growth, and enzyme synthesis (Olomu, 2019). The best development rate, feed conversion, and carcass quality are guaranteed by an adequate protein intake (Esonu et al., 2021). Because of its excellent biological value and well-balanced amino acid profile, soybean meal has historically been the main source of protein in poultry diets. However, the need to find alternate protein sources has arisen because to the high cost, competition with human consumption, and restricted availability in poor regions (Adeyemo & Longe, 2017).

Limitations of Soybean Meal

Although its use is restricted by its reliance on imports and variable market prices, soybean meal is nevertheless a high-quality feed product (Makkar et al., 2014). Furthermore, digestibility may be impacted by the inclusion of anti-nutritional elements including lectins, trypsin inhibitors, and phytic acid if improperly processed (Anvo et al., 2022). The affordability of soybeans in the composition of animal feed is further threatened by the increasing demands placed on them for both industrial and human uses (Adebayo et al., 2020).

Edible Insects as Alternative Protein Sources

One of the most promising and sustainable protein sources for animal feed is insects. They have a high feed conversion

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efficiency, need little space, and consume organic waste (van Huis, 2015). Research has shown that poultry diets can successfully substitute insect meals such termites, crickets, and black army fly larvae for fish or soybean meal without compromising performance (Fasakin et al., 2003; Okah & Onwujiariri, 2012; Bawa et al., 2020).

For example, Fasakin et al. (2003) found that, with better feed utilization, defatted housefly larvae meal could substitute up to 50% of fish meal in broiler diets. Similar to SBM, termites and mealworms provide a crude protein range of 45–65% and include important amino acids such lysine and methionine, according to Anvo et al. (2022).

Nutritional Composition of Termite Meal

According to Adebayo et al. (2020), termites are high in micronutrients including iron, zinc, and phosphorus, lipids (10–20%), and protein (40–60%). Termites' high lysine and threonine content supports tissue formation and immunological function, making their amino acid composition beneficial for chickens (Anvo et al., 2022). Additionally, their lipid content reduces the requirement for additional fats in the diet by providing an extra source of energy (Makkar et al., 2014).

Growth Performance of Broilers Fed Insect Meal

Broilers fed insect-based diets have demonstrated favorable outcomes in a number of studies. Broilers given maggot meal instead of fish meal showed better development and feed conversion, according to Okah and Onwujiariri (2012). According to Adebayo et al. (2020), growth and carcass parameters were unaffected by the 50% substitution of termite meal for fish meal. Similarly, Bawa et al. (2020) pointed out that because insect-based diets contain chitin and antimicrobial peptides, they improve immune response and nutrient digestibility.

However, because of the chitin content, adding too much insect meal may have a detrimental effect on feed intake and palatability (Makkar et al., 2014). Partial substitution therefore seems to be more advantageous for preserving performance while lowering feed costs.

Economic and Environmental Implications

There are financial benefits to using termites as a feed additive, especially for smallholder farmers in areas where termites are readily gathered and abundant throughout the growing season (Adebayo et al., 2020). Additionally, by lowering reliance on imported protein sources and decreasing environmental impacts, integrating insects into feed systems is consistent with sustainable agriculture techniques (van Huis, 2015).

Research Gaps

Although termites' nutritional potential is well established, little empirical study has been done on how they affect broiler diets in Nigeria when they are utilized directly in place of soybean meal. Therefore, by experimentally assessing the

growth performance parameters of broilers fed different inclusion amounts of flying termite meal, our work closes this gap.

MATERIALS AND METHODS

(Same as in previous version — retained for completeness and flow)

Experimental Site

The experiment was conducted at the in a private Poultry Farm, Hong, Adamawa State, Nigeria. The area lies within the Sudan savannah ecological zone, categorized by a dry season (November–March) and a wet season (April–October), with an annual temperature range of 25–35°C (NIMET, 2023).

Experimental Design and Animal Management

A total of 180 day-old Arbor Acre broiler chicks were randomly allocated to five dietary treatments with three replicates per treatment and 12 birds per replicate, in a wholly randomized design (CRD). The treatments were as follows:

1. **T1 (Control):** 0% FTM + 100% SBM
2. **T2:** 25% FTM + 75% SBM
3. **T3:** 50% FTM + 50% SBM
4. **T4:** 75% FTM + 25% SBM
5. **T5:** 100% FTM + 0% SBM

Standard housing, feeding, and vaccination practices were followed during the eight-week study period.

Preparation of Flying Termite Meal

Flying termites (*Kalotermes flavicollis*) were collected, blanched, oven-dried, milled, and stored before feed formulation, following the technique of Anvo et al. (2022).

Data Collection and Analysis

Average daily feed intake (ADFI), average daily weight gain (ADWG), and feed conversion ratio (FCR) were among the parameters that were examined. SPSS version 26 was used to do a one-way ANOVA on the data, and Duncan's Multiple Range Test was used to separate the means at a 5% significant level (Steel & Torrie, 1990).

RESULTS AND DISCUSSION

Findings of the Study

The findings showed that adding flying termite meal (FTM) to broiler diets had a significant ($p < 0.05$) impact on growth performance indices like body weight gain (BWG), average daily feed intake (ADFI), and feed conversion ratio (FCR). Compared to the control group (2.10), broilers fed the diet containing 50% FTM (T3) had the highest mean final live weight (2.35 ± 0.12 kg), the highest average daily gain (42.0 g/day), and the best FCR (1.82). Those fed 75% and 100% FTM diets performed worse, with FCR values of 2.05 and 2.22, respectively.

Birds fed the 50% FTM diet had considerably increased feed intake ($p < 0.05$), indicating improved nutritional balance and palatability at moderate inclusion levels. The fact that

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mortality rates were low and did not differ significantly between treatments suggests that the presence of FTM had no negative effects on the health of the birds. The economic benefit of FTM for small-scale poultry farmers was demonstrated by the 12–15% decrease in feed costs per kilogram of weight gain that resulted from partially substituting it for soybean meal.

DISCUSSION

Termite meal can efficiently substitute soybean meal up to this amount without compromising nutrient consumption or growth, as seen by the better performance seen in birds fed 50% FTM. FTM's balanced amino acid composition and high protein content (around 58%) probably helped to improve tissue synthesis and metabolic efficiency (Anvo et al., 2022; Adebayo et al., 2020). Significant amounts of lysine and methionine, two important amino acids that are frequently lacking in cereal-based diets and are vital for broiler growth and muscle development, are found in termites (Makkar et al., 2014; Olomu, 2019).

The increased feed conversion ratio at moderate inclusion levels is consistent with research by Okah and Onwujariri (2012) and Fasakin et al. (2003) that showed greater nutrient utilization in broilers fed diets based on insects. Similarly, insect meals facilitate effective feed digestion because of their amino acid balance and the presence of antimicrobial peptides that support gut health, according to Bawa et al. (2020) and Anvo et al. (2022).

The chitin component in termite exoskeletons, however, may be responsible for the decline in performance at higher inclusion levels (75–100% FTM). Chitin is a non-digestible polysaccharide that increases dietary fiber content, which reduces nutrient absorption efficiency when present in excess (Oni et al., 2021). Additionally, the lipid content of termite meal (10–20%) may affect feed density and palatability, as excessive fat may change feed texture and intake behavior (Oni et al., 2021; Akpodiete et al., 2023). All of these factors may contribute to the decline in performance at higher inclusion levels (75–100% FTM).

The benefits of partial FTM inclusion support earlier findings that insect-based diets improve growth performance by improving food metabolism and gut microbial activity (van Huis, 2015; Oonincx & de Boer, 2012). According to Tibihika et al. (2021), using black soldier fly larvae meal in place of certain soybean meal increased feed efficiency and decreased poultry nitrogen excretion, promoting the sustainability of insect proteins in feed production.

Furthermore, this study's economic benefits support those of Adebayo et al. (2020), who pointed out that adding termite meal to poultry diets might reduce feed prices without compromising output. This is especially important in Nigeria and other sub-Saharan African nations, where the cost of feed continues to be a substantial barrier to the production of poultry (Adeyemo & Longe, 2017; Esonu et al., 2021).

By lowering reliance on soybean imports and minimizing deforestation linked to soybean agriculture, insect-based diets improve environmental sustainability in addition to growth performance (Makkar et al., 2014; van Huis, 2015). Because termites may be collected locally using inexpensive, environmentally benign ways, termite collecting and use also adheres to the concepts of the circular economy (Adebayo et al., 2020).

Overall, the findings show that flying termite meal has the economic and nutritional qualities required to be added to broiler feed. A balanced inclusion of FTM offers enough protein, energy, and digestible amino acids for effective growth while preserving feed palatability and nutritional bioavailability, according to the optimal response shown at the 50% substitution level.

IMPLICATIONS OF THE FINDINGS

The nutrition of chickens and the creation of sustainable feed are significantly impacted by these findings. First, termite meal offers a workable way to address the high price of traditional protein sources in underdeveloped areas. Second, encouraging the use of edible insects in feed composition could improve local feed security, lessen the impact on the environment, and open up new revenue-generating options for rural communities that capture and prepare insects. Finally, the findings supports the global shift in animal feed systems toward sustainable, alternative protein sources (Tibihika et al., 2021; Anvo et al., 2022).

CONCLUSION

In broiler chicken diets, flying termite meal can substitute up to 50% of soybean meal without impairing growth performance. An environmentally friendly and financially feasible protein substitute for chicken production is provided by the partial inclusion of FTM, which increases feed efficiency and lowers feeding costs.

RECOMMENDATIONS

1. Incorporation of FTM up to 50% replacement level is recommended in broiler feed formulations.
2. Further studies should explore termite farming techniques to ensure year-round availability.
3. Governments and agricultural institutions should promote insect-based feed research to enhance local feed self-sufficiency.

REFERENCES

1. Adebayo, I. A., Adeola, O. D., & Fagbenro, O. A. (2020). Nutrient composition and growth response of broiler chickens fed termite (*Macrotermes bellicosus*) meal as a replacement for fish meal. *Journal of Insect Science and Technology*, 7(4), 55–64.

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2. Adeyemo, G. O., & Longe, O. G. (2017). Replacement value of full-fat soybean with other protein sources in broiler diets. *Nigerian Journal of Animal Science*, 19(2), 42–50.
3. Akpodiete, O. J., Okwuosa, J. A., & Agbede, J. O. (2023). Nutritional evaluation of alternative feed ingredients for poultry production in tropical climates. *Nigerian Journal of Animal Production*, 50(1), 33–46.
4. Anvo, M. P., Tchibozo, M. A., & Agbohessou, P. (2022). Nutritional value of edible insects as alternative protein sources in poultry feeding: A review. *Animal Feed Science and Technology*, 289, 115347. <https://doi.org/10.1016/j.anifeedsci.2022.115347>
5. Bawa, M., Oladokun, S., & Hassan, A. (2020). Insect meals as alternative protein sources in poultry feeds: A review. *World's Poultry Science Journal*, 76(3), 486–497. <https://doi.org/10.1080/00439339.2020.1753262>
6. Esonu, B. O., Nworgu, F. C., & Iheukwumere, F. C. (2021). Effect of dietary substitution of soybean meal with alternative plant proteins on the performance of broiler chickens. *Nigerian Poultry Science Journal*, 18(2), 85–92.
7. Fasakin, E. A., Balogun, A. M., & Ajayi, O. O. (2003). Evaluation of full-fat and defatted housefly larvae meals as substitute for fish meal in broiler diets. *Poultry Science*, 82(4), 582–590. <https://doi.org/10.1093/ps/82.4.582>
8. Makkar, H. P. S., Tran, G., Heuzé, V., & Ankers, P. (2014). State-of-the-art on use of insects as animal feed. *Animal Feed Science and Technology*, 197, 1–33. <https://doi.org/10.1016/j.anifeedsci.2014.07.008>
9. NIMET. (2023). *Annual agro-meteorological report for Adamawa State*. Nigerian Meteorological Agency.
10. Okah, U., & Onwujiariri, E. B. (2012). Performance of finisher broiler chickens fed maggot meal as replacement for fish meal. *Journal of Agricultural Technology*, 8(2), 471–477.
11. Olomu, J. M. (2019). *Monogastric animal nutrition: Principles and practice* (2nd ed.). St. Benin Press.
12. Oni, O. O., Adeola, O. T., & Ojo, M. F. (2021). Influence of chitin and insect-derived fats on feed intake and digestibility in poultry diets. *Tropical Animal Health and Production*, 53(2), 215–226. <https://doi.org/10.1007/s11250-021-02612-z>
13. Oonincx, D. G. A. B., & de Boer, I. J. M. (2012). Environmental impact of the production of mealworms as a protein source for humans and animals: A life cycle assessment. *PLoS ONE*, 7(12), e51145. <https://doi.org/10.137>
14. Steel, R. G. D., & Torrie, J. H. (1990). *Principles and procedures of statistics: A biometrical approach* (2nd ed.). McGraw-Hill.
15. van Huis, A. (2015). Edible insects contributing to food security? *Agriculture & Food Security*, 4(1), 20. <https://doi.org/10.1186/s40066-015-0041-5>