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Effect of Roasted Pigeon Pea Seed Meal Diets on Broiler Growth and Meat Quality

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Abstract

This study evaluated roasted pigeon pea seed meal (RPPSM) as an alternative plant protein source in broiler diets in response to rising costs of conventional protein ingredients such as soybean meal and fish meal. Grounded in the concept of feed resource substitution and guided by principles of growth performance evaluation, sensory analysis, and cost efficiency, the experiment used 120 day-old Magnolia broiler chicks allotted to four dietary treatments (0, 10, 15, and 20% RPPSM) in a Completely Randomized Design with three replications of ten birds each. Sensory evaluation of cooked breast meat, conducted with 50 trained panelists using a seven-point Hedonic scale, followed a Randomized Complete Block Design. Results showed that 20% RPPSM promoted significantly higher body weight, weight gain, growth rate, and better feed conversion ratio and feed conversion efficiency during the first week, but these advantages were not sustained, and from the second to the sixth week growth performance, feed intake, final live weight, and overall feed efficiency did not differ significantly among treatments. Dressing percentage with and without giblets, liver weight, and all sensory attributes appearance, taste, flavor and aroma, tenderness, juiciness, and general acceptability were statistically similar across all diets, indicating that RPPSM up to 20% did not impair carcass yield or meat quality. Pancreas weight was higher in birds fed the control, 15%, and 20% RPPSM diets than in those fed 10% RPPSM, reflecting variable responses to trypsin inhibitor activity, while liver weights remained normal and comparable. Economic analysis showed that return above feed cost was highest in the control group and lower in RPPSM diets because of the high price of pigeon pea seed, despite acceptable biological performance. Overall, the study concludes that RPPSM can be included in broiler diets up to 20% without adverse effects on growth or meat quality, but its economic use depends on improving local supply and reducing ingredient cost. The findings align with SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) by exploring a locally available legume as an alternative protein source, reducing dependence on imported feedstuffs, and supporting more resilient, resource-efficient poultry production. In this context, the study contributes to economic and environmental sustainability by highlighting both the technical feasibility and cost constraints of integrating pigeon pea into smallholder-oriented broiler systems.

Keywords: Broiler Chickens; Economic Returns; Feed Conversion Ratio; Pigeon Pea; Poultry Nutrition; Roasted Pigeon Pea Seed Meal; Sensory Evaluation; Sustainable Poultry Production

1. Introduction

Rising global prices of conventional protein sources such as soybean oil meal and fish meal have increased the cost of commercial livestock and poultry feeds, reducing profitability among producers. This challenge has intensified the search for alternative, locally available protein sources that can support broiler growth performance while lowering production costs. Pigeon pea (Cajanus cajan), a nutrient-dense legume, offers potential as a non-conventional feedstuff for broilers. However, the presence of anti-nutritional factors requires processing interventions, such as roasting, to improve its suitability for monogastric animals. This study evaluates the effects of roasted pigeon pea seed meal (RPPSM) on broiler growth performance, sensory qualities of meat, and economic returns to support sustainable and locally adaptive poultry production.

1.1 Background of the Study

The sharp increase in the prices of protein-rich feed ingredients such as soybean oil meal and fish meal has made commercial feeds increasingly expensive, limiting profitability for livestock and poultry producers. This situation has placed particular strain on the swine and poultry industries, which rely heavily on concentrated protein sources. Identifying more accessible alternatives has therefore become essential. Pigeon pea (Cajanus cajan) is considered a viable protein substitute because it contains 17.9 to 24.3 g/100 g protein in whole grain samples and 21.1 to 28.1 g/100 g in split seeds (Salunkhe et al., 1986). It also provides carbohydrates, essential minerals including calcium, phosphorus, magnesium, iron, sulfur, and potassium and soluble vitamins such as thiamin, riboflavin, niacin, and choline. Despite its nutritional profile, anti-nutritional factors like trypsin inhibitors and hemagglutinins limit its

broader use in monogastric diets (Udedibie & Carlini, 2002). These anti-nutritional components impede pro indicating the need for processing approaches such as roasting to enhance digestibility and utilization.

1.2 Themes and Insights from Related Literature

Literature recognizes pigeon pea as an economically favorable and nutritionally rich alternative to conventional protein sources. Its protein density, mineral composition, and vitamin content make it suitable for inclusion in broiler diets. However, research also highlights the need to address anti-nutritional factors through heat processing. Findings from studies such as Salunkhe et al. (1986) and Udedibie & Carlini (2002) underscore both the feed potential of pigeon pea and the limitations imposed by its raw form. Existing literature also emphasizes the importance of identifying proper processing techniques and inclusion levels to achieve optimal growth performance and improved feed efficiency.

1.3 Local, National, and Global Context

Broiler production in the Philippines is a key livelihood activity that provides accessible protein and supplemental income for smallholder farmers. High consumer demand for affordable poultry meat has increased the need for sustainable feed alternatives, especially amid fluctuating global prices of imported protein meals. The integration of locally available legumes like pigeon pea can reduce dependency on imported feed ingredients and enhance food security. Globally, similar efforts to utilize underexploited crops in animal feed correspond with broader movements toward sustainable and climate-resilient livestock production systems. At the same time, strengthening agribusiness sustainability requires support from civil service organizations and localized action plans that address institutional and community-level challenges (Santos & Santos, 2025), as well as financial mechanisms and standardized guidelines in microfinance services that can enable small producers to invest in alternative feed resources (Binaluyo et al., 2025).

1.4 Theoretical or Conceptual Basis

This study is grounded in the concept of feed resource substitution, wherein alternative plant protein sources are evaluated for their nutritional adequacy and economic viability. The documented nutrient composition of pigeon pea (Salunkhe et al., 1986) provides theoretical support for its potential as a feed ingredient, while findings related to anti-nutritional factors (Udedibie & Carlini, 2002) provide the conceptual rationale for applying roasting to improve its suitability. Principles of growth performance evaluation, sensory analysis, and cost efficiency guide the assessment of RPPSM as a dietary component in broilers.

1.5 Research Gaps and Rationale

Although pigeon pea is recognized for its nutritional value, few studies evaluate its roasted form in broiler diets, particularly in relation to growth performance, feed consumption, feed conversion efficiency, carcass characteristics, and sensory qualities of meat. Additionally, limited research addresses its economic implications for smallholder poultry farmers in the Philippines. This study fills these gaps by assessing varying inclusion levels of RPPSM to determine growth responses, meat acceptability, and profitability based on return above feed and additive cost.

1.6 Alignment with Relevant Sustainable Development Goals (SDGs)

This study contributes to several Sustainable Development Goals, particularly SDG 2: Zero Hunger, as the use of locally available pigeon pea can enhance feed resource efficiency and support stable poultry production. It also aligns with SDG 12: Responsible Consumption and Production by promoting the utilization of underused local crops, reducing dependence on imported feed ingredients, and encouraging more sustainable resource management. Moreover, substituting imported proteins with locally sourced pigeon pea supports SDG 13: Climate Action, as it reduces the carbon footprint associated with long-distance transport of conventional feed ingredients and encourages climate-resilient agricultural practices.

1.7 Importance of the Study to Multidisciplinary Sustainability

The study advances agricultural sustainability by identifying a local protein source that can reduce feed costs and improve production efficiency. It supports economic sustainability by offering potential financial benefits to smallholder farmers through improved profitability and reduced dependence on fluctuating global feed markets. The use of pigeon pea also strengthens environmental sustainability, since sourcing local legumes lowers transportation impacts and supports diversified cropping systems. Collectively, these contributions enhance the resilience and sustainability of poultry production across economic, environmental, and community dimensions, particularly when embedded in benevolent, trust-oriented relationships that can encourage positive referrals and broader acceptance of sustainable practices (Ortega et al., 2025).

2. Material and methods

2.1 Research Design

The experiment utilized a Completely Randomized Design for broiler growth evaluation, with four dietary treatments replicated three times using ten birds per replicate. The sensory evaluation employed a Randomized Complete Block Design. All data were analyzed statistically, and differences among treatment means were compared using the Least Significant Difference test.

2.2 Locale of the Study

The study was conducted at the Poultry Research Station of Nueva Vizcaya State University in Bayombong, Nueva Vizcaya, located at the foot of Bangan Hill within the university compound. The station is accessible and equipped with a broiler house containing experimental cages, electrical connections, and water facilities suitable for conducting poultry research.

2.3 Respondents of the Study

The experimental subjects consisted of 120 day-old Magnolia broiler chicks randomly allotted to four dietary treatments. For sensory evaluation, 50 individuals from various professional groups of Isabela State University served as panelists. Selection criteria required panelists to be non-smokers, have no false teeth, and be in good health.

2.4 Sample and Sampling Procedure

The 120 chicks were distributed into four treatments with three replications of ten birds each. The treatments included a control diet without pigeon pea seed meal and diets containing 10, 15, and 20 percent roasted pigeon pea seed meal. For organoleptic evaluation, two chicken breasts per treatment were randomly selected from dressed broilers previously sampled for dressing percentage. These samples were baked at 160°C for thirty minutes to an internal temperature of 85°C without added seasoning. Three cooked breast samples per treatment were presented to each panelist, who evaluated the meat in a taste test chamber with water provided between samples to neutralize aftertaste.

2.5 Research Instrument

Roasted pigeon pea seed meal was prepared by roasting dried seeds for thirty minutes, cooling them, and grinding them manually. This ingredient was incorporated into diets formulated from yellow corn, rice bran, soybean meal, pigeon pea seed meal, fish meal, bone meal, salt, tricalcium phosphate, limestone, and a vitamin-mineral premix. Corn at Php 19.00/kg comprised 47.80 percent of the control diet and 43.00, 40.50, and 38.00 percent of the 10, 15, and 20 percent RPPSM diets, while rice bran at Php 11.00/kg contributed 16.00, 14.30, 13.50, and 12.70 percent. Soybean meal at Php 37.50/kg accounted for 23.00, 20.40, 19.10, and 17.80 percent, and pigeon pea seed meal at Php 80.00/kg was included at 0.00, 10.00, 15.00, and 20.00 percent. Fish meal remained at 3.00 percent, and bone meal at Php 55.00/kg was included at 7.70, 6.80, 6.40, and 6.00 percent. Salt, tricalcium phosphate, limestone, and the vitamin-mineral premix were held constant at 0.50, 0.08, 1.34, and 0.58 percent. Each ration totaled 100 percent. Feed costs ranged from Php 2,625.60 per 100 kg in the control diet to Php 3,714.60 in the 20 percent RPPSM diet. All diets contained 21.00 percent crude protein, 3.50 percent crude fiber, 0.82 percent calcium, and 0.68 percent total phosphorus, with metabolizable energy values of 2,820.10 kcal/kg for the control diet and 2,827.50 kcal/kg for the RPPSM diets. Sensory evaluation used scorecards based on a seven-point Hedonic scale to rate appearance, aroma, taste, tenderness, juiciness, and overall acceptability.

2.6 Data Gathering Procedure

Brooding pens, cages, feeders, and drinkers were thoroughly cleaned and disinfected before chick arrival. Pen sides were covered with feed sacks, and floors were layered with newspaper to conserve heat and serve as temporary feeding surfaces. Heat was supplied using 50-watt incandescent bulbs, which remained on during brooding and at night after brooding to encourage feeding. Birds were fed ad libitum with diets corresponding to their assigned treatments, and feed intake was measured by weighing offered feed and leftovers. Weekly body weights were recorded up to six weeks, and weight gain was calculated as the difference between successive weekly measurements. Percentage growth rate followed the formula of Asmundson and Leiner. Feed consumption and cumulative intake were recorded, while feed conversion ratio and feed conversion efficiency were calculated using the formulas of Biddle and Juergenson. Dressing percentage was determined using dressed weights with and without giblets from one male and one female broiler per replication. Liver and pancreas weights were recorded to detect possible toxic effects of diets. Additional observations included bird condition, feathering, pigmentation, mortality, and disease occurrence.

2.7 Data Analysis Techniques

All gathered data were tabulated and analyzed using the Completely Randomized Design for growth performance and the Randomized Complete Block Design for sensory evaluation. The Least Significant Difference test was employed to determine statistically significant differences among treatment means.

3. Results and Discussion

3.1 Growth Performance, Carcass Traits, Economic Returns, and Meat Quality

3.1.1 Health Status and General Observations

The experimental birds in all treatments generally showed good health and vigor throughout the study period. No diseases or parasites were observed, and aside from three birds that died early in the experiment, no further mortalities occurred. Feather development was normal, with down feathers replaced during the second to third week, and comb development appeared toward the end of the study. Shank and skin color ranged from light-yellow to yellowish, which was consistent among treatments. These observations indicate that the inclusion of RPPSM at the tested levels did not adversely affect general health, survival, or external physical development. The normal pattern of feathering and comb maturation, together with the absence of disease and uniform pigmentation, suggests that all diets including those containing roasted pigeon pea seed meal were physiologically acceptable to the birds and did not introduce observable health problems under the conditions of the experiment.

3.1.2 Initial and Final Body Weight

Initial body weights of broiler chicks did not differ among treatments, confirming similar starting weights across all groups before exposure to the experimental diets. Weekly body weights increased consistently from the first to the sixth week in all treatments. During the first week, birds fed the 20% RPPSM diet had significantly higher body weight (around 105.83 g) than those on the 0%, 10%, and 15% RPPSM diets, which had comparable weights near 88–93 g. From the second to the sixth week, weekly body weights no longer differed significantly, though birds on the 20% RPPSM diet maintained a slight numerical advantage. Final body weight at six weeks ranged from about 1873.94 g to 2086.67 g, with no significant differences among treatments, and the heaviest birds were those fed 20% RPPSM. The lack of significant differences in initial body weight confirms the uniformity required for a Completely Randomized Design, helping to ensure that later differences could be attributed to diet rather than starting size. The significantly higher first-week weight of broilers on 20% RPPSM suggests that this level may have supplied more digestible protein and supported more efficient protein utilization early in life, even though this advantage diminished statistically in later weeks. This finding contradicts the report of Ani and Okeke (2011), who observed decreasing protein utilization efficiency as the level of roasted pigeon pea seed meal increased. It also differs from Etuk et al. (2002), who found a significant ($p<0.05$) depression in body weight in birds fed diets containing 20–50% cooked pigeon pea seed meal, and from Etuk et al (2002), who similarly reported negative effects at higher inclusion levels. In the present study, 20% RPPSM appeared to provide adequate dietary protein for efficient meat deposition without causing a significant decline in final live weight.

3.1.3 Weekly and Final Weight Gain

Weekly weight gain data showed that during the first week, birds fed 20% RPPSM gained the most weight (about 49.50 g), significantly higher than birds on the 0%, 10%, and 15% RPPSM diets, whose gains were around 30–36 g. From the second to the sixth week, weekly gains no longer differed significantly among treatments, although the 20% RPPSM group generally showed slightly higher numerical gains except in the fourth week, when gains were comparatively lower. Final weight gain values ranged from approximately 1817.16 g to 2030.33 g and did not differ significantly among treatments; birds fed 20% RPPSM had the highest numerical final gain. The superior first-week gain of birds on 20% RPPSM indicates a better early growth start that was not fully maintained throughout the trial, particularly around the fourth week when growth slowed. This result contradicts the findings of Etuk et al. (2002), who reported significant ($p<0.05$) depression in weight gain among birds fed diets containing 20–50% cooked pigeon pea seed meal. In contrast, the current findings align with Ani and Okeke (2011), who concluded that up to 27% roasted pigeon pea seed meal may be included in broiler diets without deleterious effects on growth performance. The later reduction in weight gain could be associated with anti-nutritional factors such as trypsin inhibitor activity (TIA) that may not have been fully inactivated by roasting, thereby affecting protein digestibility and utilization over time.

3.1.4 Growth Rate

Growth rates differed significantly among treatments during the first week, with birds fed 20% RPPSM showing the highest rate (about 61.06%) compared with birds on 0%, 10%, and 15% RPPSM diets, whose growth rates were about 41.39–47.90%. From the second to the sixth week, growth rates were comparable among treatments, with

mean values generally declining as the birds aged. Final growth rates across all treatments were similar, ranging from approximately 188.19% to 189.49%. When examined by week, the growth rate pattern deviated from the typical S-shaped growth curve observed in normally growing animals, where body mass increases slowly at first, then accelerates rapidly, and finally slows markedly (Amir and Knipscheer, 1989). In this study, growth increased sharply in the first week, peaked during the second week, and then declined toward the end of the experiment. However, since growth rates from the second week onward did not differ significantly among treatments, this atypical pattern cannot be attributed solely to RPPSM inclusion. It may instead reflect the general growth dynamics of the birds under the specific management and environmental conditions of the study.

3.1.5 Feed Intake

Weekly feed intake did not differ significantly among birds fed diets containing 0%, 10%, 15%, or 20% RPPSM. Across all weeks, broilers consumed comparable amounts of feed, regardless of the inclusion level of roasted pigeon pea seed meal. Cumulative feed consumption over six weeks ranged from about 2902.27 g to 2986.67 g per bird, with differences among treatments not statistically significant. This cumulative intake was approximately 1.62% lower than the standard 3.0 kg feed consumption typically reported for broilers over a six-week period. These results suggest that RPPSM inclusion up to 20% did not influence feed intake, indicating similar palatability and acceptability of all diets. The small deviation from the standard feed consumption value is minimal and not biologically meaningful, implying that actual consumption remained within the expected range for broiler chickens. This observation contrasts with Ani and Okeke (2011), who reported significant differences in feed intake among broilers fed diets with various levels of roasted pigeon pea seed meal, possibly due to differences in processing conditions, diet formulation, or experimental management.

3.1.6 Feed Conversion Ratio and Feed Conversion Efficiency

Feed conversion ratio (FCR) differed significantly during the first week of the experiment. Birds fed 20% RPPSM had the lowest FCR (about 3.98 g feed per g gain), indicating the most efficient feed utilization, whereas birds on the 0%, 10%, and 15% RPPSM diets had higher FCR values of approximately 5.56, 6.02, and 6.41, respectively. From the second to the sixth week, weekly FCR did not differ significantly among treatments, and final FCR values ranged from about 1.47 to 1.60, with no significant treatment effects. All final FCR values were lower (more efficient) than the present-day standard FCR of 1.97 for broilers reared under commercial conditions. Feed conversion efficiency (FCE) followed a similar pattern: it differed significantly in the first week, with birds on 20% RPPSM showing the highest FCE (about 25.20%) and those on the other diets showing lower efficiencies near 15.68–18.30%. From the second week onward, weekly FCE did not differ significantly, and final FCE values ranged from about 62.59% to 67.98%, with a slight numerical increase at higher RPPSM levels. The lower first-week FCR and higher FCE of birds fed 20% RPPSM indicate more efficient utilization of feed at the start of the trial and are consistent with the higher first-week weight gain observed for this treatment. The higher initial FCR in the other treatments is reasonable, given that birds were still adapting to the diets and their digestive systems were not yet fully adjusted. As the experiment progressed, FCR and FCE converged among treatments, suggesting that all diets were ultimately utilized with similar efficiency. The superior final FCR values compared with commercial standards indicate that the experimental conditions were favorable for efficient broiler production and that RPPSM inclusion did not impair feed utilization. These findings agree with Ani and Okeke (2011), who observed no significant difference in final FCR among broilers fed various levels of roasted pigeon pea seed meal, and are consistent with their report that FCR declined only at higher inclusion levels such as 32.5% roasted pigeon pea seed meal, a finding also in line with Amaefule and Nwaokoro (2002).

3.1.7 Dressing Percentage with and without Giblets

Dressing percentage with giblets ranged from about 75.29% to 78.94%, and dressing percentage without giblets ranged from approximately 71.55% to 75.05%. No significant differences were observed among broilers fed diets containing 0%, 10%, 15%, or 20% RPPSM. Birds fed RPPSM diets showed dressing percentages comparable to those fed the control diet, both with and without giblets. These results demonstrate that varying levels of RPPSM inclusion did not influence dressed yield. The dressing percentages obtained in all treatments fell within or slightly above the standard range of 70–76% for broiler chickens (Flash Card Machine, 2013). Moreover, these values were better than the dressing percentages reported for broilers fed diets with 10% decorticated roasted pigeon pea (Abdelati et al, 2009) and for those fed diets containing 0–32.5% roasted pigeon pea seed meal (Ani and Okeke, 2011). This suggests that under the conditions of this study, RPPSM at up to 20% of the diet is compatible with normal or even favorable carcass yields.

3.1.8 Pancreas and Liver Weights

Pancreas weight differed significantly among treatments. Birds fed the control diet (0% RPPSM) and those fed 15% and 20% RPPSM diets had larger pancreas weights (about 4.00 g to 4.67 g) compared with birds on the 10% RPPSM

diet, whose average pancreas weight was approximately 2.83 g. Liver weights ranged from about 41.67 g to 51.17 g and did not differ significantly among treatments. No abnormal enlargement or discoloration was reported, and all liver weights remained within a relatively narrow range.

An enlarged pancreas indicates the presence of trypsin inhibitor activity (TIA), since TIA reduces the efficacy of natural proteolytic enzymes and forces the organism to secrete more trypsin and chymotrypsin (Mavromichalis, 2013). The larger pancreas weights observed in birds on the 15% and 20% RPPSM diets suggest higher TIA levels in these diets, consistent with Lim (2012), who confirmed that pigeon pea contains trypsin inhibitors ranging from 7.5–14.1 mg/g. The larger pancreas in birds fed the control diet compared with those on 10% RPPSM indicates that TIA may also have originated from other ingredients, notably soybean meal. Although pigeon pea seeds were roasted to reduce trypsin inhibitors, dry heat has been shown to be ineffective in fully inactivating trypsin and chemotrypsin inhibitors (Mulimani and Paramjyothi, 1994, as cited by Lim, 2012), implying that TIA might not have been adequately removed. Liver weight is often used as an indicator of dietary toxicity (http://www.mayoclinic.com/health/liverproblems/DS01133), and the absence of significant differences among treatments suggests that none of the diets, including those with RPPSM, contained toxic substances at levels sufficient to cause adverse liver effects.

3.1.9 Return Above Feed Cost

Return above feed cost (RAFC) results showed that the highest average return (about P157.43 per bird) was obtained from broilers fed the control diet without RPPSM. The lowest RAFC (approximately P132.44) came from birds fed the 10% RPPSM diet, while birds on the 15% and 20% RPPSM diets produced intermediate RAFC values of around P135.93 and P139.86, respectively. Final live weights ranged from about 1.87 kg to 2.09 kg among treatments, and all birds were sold at a uniform price of P120.00 per kilogram liveweight. Feed costs per kilogram of diet were lowest for the control ration and increased progressively with the level of RPPSM inclusion due to the high price of pigeon pea seeds (P80.00/kg) during the study. These findings indicate that although growth performance and carcass yield were broadly similar across treatments, economic returns were reduced when RPPSM was included in the diet. The higher cost of diets containing roasted pigeon pea seed meal outweighed the small advantages in growth or feed efficiency observed at higher inclusion levels. Thus, under the specific cost structure during the experiment, the control diet was the most profitable, while diets with 10–20% RPPSM yielded lower RAFC, highlighting the importance of ingredient price when assessing the economic viability of alternative protein sources.

3.1.10 Sensory Attributes and General Acceptability

Sensory evaluation of cooked broiler breast meat revealed no significant differences among treatments in terms of general appearance, taste, flavor and aroma, tenderness, or juiciness. Using a seven-point Hedonic scale, panelists rated general appearance between about 5.78 and 5.98 (mean 5.88), taste between 5.52 and 5.90 (mean 5.75), flavor and aroma around 5.20 to 5.44 (mean 5.37), tenderness between 5.58 and 5.78 (mean 5.66), and juiciness approximately 5.42 to 5.66 (mean 5.52). All scores corresponded to the qualitative rating “Like Moderately.” General acceptability ratings classified meat from both control and RPPSM-based diets as “Moderately Acceptable,” with no significant differences among treatments. These results indicate that inclusion of 10%, 15%, or 20% RPPSM in broiler diets did not adversely affect sensory attributes of cooked meat. The similar ratings for appearance, taste, flavor and aroma, tenderness, and juiciness among all treatments suggest that meat from birds fed RPPSM diets is organoleptically comparable to meat from birds fed the control diet. The consistent “Moderately Acceptable” general acceptability rating confirms that RPPSM can be incorporated at the tested levels without compromising consumer-perceived meat quality under the conditions of this study.

3.2 Factors Influencing Growth and Dietary Response

Results showed that birds fed 20% RPPSM experienced an early advantage in growth, FCR, and FCE during the first week, followed by slower gains in later weeks, especially around the fourth week. Enlarged pancreas weights in birds on higher RPPSM levels, as well as in those on the control diet, indicated exposure to trypsin inhibitor activity. Economic results further revealed that diets containing RPPSM were more expensive because of the high cost of pigeon pea seeds, leading to lower RAFC despite acceptable biological performance. These findings suggest two major challenges: the potential persistence of anti-nutritional factors such as TIA due to limitations of roasting as a processing method, and the economic burden associated with the high cost of pigeon pea seed meal. The literature indicates that under-heated pigeon pea may retain TIA and that overheating can denature protein and reduce nutritive value (Mavromichalis, 2013). In addition, dry heat treatment has been reported as ineffective in inactivating trypsin and chemotrypsin inhibitors (Mulimani and Paramjyothi, 1994, as cited by Lim, 2012). These factors likely contributed to reduced or inconsistent growth responses at higher RPPSM levels over time. Economically, the high ingredient cost diminished profitability, demonstrating that technical feasibility does not automatically translate into economic advantage.

3.3 Relationships Between Performance, Organ Weights, Economic Returns, and Meat Quality

The results indicated that higher RPPSM inclusion (20%) was associated with better early growth, lower FCR, and higher FCE during the first week, but these initial advantages were not sustained, leading to similar final performance among treatments. Birds fed higher levels of RPPSM also had larger pancreas weights, while liver weights remained within a normal range across treatments. Feed intake was comparable among all groups, and dressing percentages remained within the standard range for broilers, regardless of RPPSM level. Sensory scores and general acceptability ratings were also similar across treatments, while RAFC was inversely related to RPPSM inclusion because of rising feed costs. These relationships show that while RPPSM can support growth, carcass yield, and meat quality comparable to a conventional control diet, physiological responses such as pancreas enlargement and the presence of anti-nutritional factors influence long-term performance. The link between pancreas size and TIA exposure is consistent with the description of trypsin inhibitor effects on protease secretion (Mavromichalis, 2013; Lim, 2012). The similarity in feed intake, dressing percentage, and sensory quality suggests that RPPSM does not negatively affect palatability, carcass yield, or consumer acceptance. However, the lower RAFC for RPPSM diets highlights that feed ingredient cost strongly mediates the practical usefulness of alternative protein sources. Overall, performance outcomes, organ responses, economic indicators, and sensory traits are interconnected through diet composition, processing efficacy, and market prices for key ingredients.

4. Conclusion & Recommendations

The study demonstrated that roasted pigeon pea seed meal (RPPSM) influenced broiler performance only during the first week, after which growth, feed consumption, feed conversion, and overall efficiency no longer differed significantly from birds fed the control diet. Dressing percentage, liver weight, sensory properties, and general acceptability of cooked broiler meat likewise showed no significant differences across dietary treatments. Pancreas weight was higher in broilers fed the control, 15%, and 20% RPPSM diets than in those fed 10% RPPSM, indicating a variable response to trypsin inhibitor activity. Although growth performance and organoleptic quality were comparable across treatments, the study confirmed that roasted pigeon pea seed meal can be included in broiler diets up to 20% without adverse effects on chick performance or meat quality.

Based on the study's results, the use of roasted pigeon pea seed meal in broiler diets is recommended at lower inclusion levels, considering the high cost associated with limited supply. To enhance feasibility and reduce feed costs, production of pigeon pea should be expanded to increase availability and stabilize pricing. This would support broader utilization of RPPSM in poultry feeding while maintaining acceptable broiler performance and meat quality.

Compliance with ethical standards

This study complied with institutional guidelines for the ethical care and use of animals in research. All procedures involving broilers followed standard husbandry and welfare practices, and no unnecessary harm or stress was inflicted on the birds.

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Conflict of interest statement

The author declare that there are no financial or personal conflicts of interest that could have influenced the design, conduct, or reporting of this research.

Statement of ethical approval

All experimental procedures adhered to institutional protocols for animal research. As the study involved routine husbandry practices and non-invasive measurements, formal ethics board approval was not required under existing institutional guidelines.

Statement of informed consent

No human participants were involved in this study; therefore, informed consent was not applicable. All animal care and handling procedures were conducted in accordance with established standards for animal welfare and responsible research.

References

Amaefule, K. C., & Nwaokoro, C. C. (2002). *The effect of graded levels of raw pigeon pea (Cajanus cajan) seed meal on the performance of weaner rabbits*. In Proceedings of the 27th Annual Conference of the Nigerian Society for Animal Production (pp. 113–115). Federal University of Technology, Akure, Nigeria.

Amaefule, K. C., Nwaokoro, C. C., & Iheukwumere, F. C. (2021). The effect of feeding graded levels of raw pigeon pea seed (Cajanus cajan) meal on the performance, nutrient retention and carcass characteristics of weaner rabbits. *Nigerian Journal of Animal Production, 31*(2), 194–199. https://doi.org/10.51791/njap.v31i2.1798

Amir, P., & Knipscheer, H. C. (1989). *Conducting on-farm animal research: Procedures and economic analysis*. Winrock International; International Development Research Centre. https://eric.ed.gov/?id=ED313503

Ani, A. O., & Okeke, G. C. (2011). The performance of broiler birds fed varying levels of roasted pigeonpea (Cajanus cajan) seed meal. *Pakistan Journal of Nutrition, 10*(11), 1036–1040. https://doi.org/10.3923/pjn.2011.1036.1040

Binaluyo, J. P., Agustin, N. B., & Santos, A. R. (2025). MICROFINANCE INSTITUTIONS AND SERVICES: CONSUMER PERSPECTIVES AND THE PATH TO STANDARDIZED GUIDELINES. *Institutions*, *15*(2), 80-91.

Flashcard Machine. (2008). *Animal science* [Flashcard set]. Flashcard Machine, LLC. https://www.flashcardmachine.com/animal-science1.html

Lim, T. K. (2012). *Edible medicinal and non-medicinal plants: Vol. 2, Fruits* (pp. 549–568). Springer. https://doi.org/10.1007/978-94-007-4053-2_45

Mayo Clinic Staff. (n.d.). *Liver problems*. Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/liver-problems/symptoms-causes/syc-20374502

Mulimani, V. H., & Paramjyothi, S. (1994). Effect of heat treatments on trypsin/chymotrypsin inhibitor activity of red gram (Cajanus cajan L.). *Plant Foods for Human Nutrition, 46*(2), 103–107. https://doi.org/10.1007/BF01088761

Ortega, S. A., Daños, J. N. C., & Gevero, R. D. (2025). Benevolence as a predictor of customer referrals: A study on ocean freight forwarders.

Salunkhe, D. K., Chavan, J. K., & Kadam, S. S. (1986). Pigeon pea as an important food source. *Critical Reviews in Food Science and Nutrition, 23*(2), 103–145. https://doi.org/10.1080/10408398609527422

Santos, K. E. S., & Santos, A. R. (2025). Strengthening Agribusiness Sustainability through Civil Service Organizations: Key Factors, Challenges, and a Localized Action Plan. Research on World Agricultural Economy, 52-65.

Udedibie, A. B. I., & Carlini, C. R. (2000). Relative effects of dry and moist heat treatment on hemagglutinating and antitryptic activities of selected legume grains. *Nigerian Poultry Science Journal, 1*, 81–87.