

1 **RAW JACKFRUIT (ARTOCARPUS HETEROPHYLLUS) SEEDMEAL: EFFECT ON GROWTH**  
2 **PERFORMANCE, ORGAN WEIGHT, CARCASS YIELD, AND ECONOMIC PRODUCTION OF**  
3 **GUINEA FOWL KEETS**  
4

5 **Jackfruit seed meal is a promising alternative feedstuff for poultry**  
6

7 **ABSTRACT**

8 Ensuring food security and sustainable agriculture is vital as the global population expands, leading to  
9 increased protein demand. However, competitive demand for feed ingredients such as maize and soybeans has  
10 driven up costs. As a result, alternative feed sources, including Jackfruit by-products like seeds, have been  
11 explored. This study aimed to assess the effects of incorporating raw jackfruit seedmeal (JSM) into the diet of  
12 guinea fowl keets, specifically regarding growth performance, carcass yield, organ weights, and economic  
13 production. The seven-week study involved 120 keets divided into different treatments, each replicated three  
14 times. Treatments 2, 3, and 4 included JSM at 10%, 15%, and 20%, respectively, while treatment one served  
15 as the control without JSM. Increasing the level of JSM resulted in a consistent decline in all relevant  
16 indicators, as observed through proximate analysis. Treatment four, which included 20% JSM, exhibited the  
17 best performance in terms of final weight (745g) and daily weight gain (15g). Notably, the gizzard was the  
18 most significant parameter among carcass features, with treatment four showing the highest value (3.95%),  
19 while the control diet had the lowest value (2.83%). Diets containing 15% and 20% JSM had the most  
20 favorable outcomes in terms of feed cost per weight gain, with the 20% JSM diet demonstrating the highest  
21 gross margin and revenue. Importantly, dietary inclusion of JSM did not significantly impact the performance  
22 of guinea fowl keets, and incorporating 20% JSM into their diet resulted in a significant increase in  
23 productivity and feed utilization.

24 **Keywords:** Alternative feedstuff, carcass analysis, guinea fowl, nutrition, by-product, farmers.

25 **INTRODUCTION**

26 In terms of animal protein intake, guinea fowl production has enormous potential for achieving food security.  
27 The human population in affluent countries is stable, however, the population in underdeveloped countries  
28 such as Nigeria continues to grow fast. Thus, it is crucial to identify alternative protein sources to meet the  
29 need of the growing population (Mailafia et al., 2010). Economic indicators show that as the population  
30 grows, more people will need to be fed. Agricultural outputs must be boosted rather than food imports into  
31 such countries (Allen, 1983). Due to their widespread availability and cheap market price, guinea fowl have  
32 recently emerged as a significant source of animal protein (Obike et al., 2011). The primary function of guinea

33 fowl is as a source of eggs. The bird may lay up to 190 eggs in a single season, which is a rather large output  
34 that might sustain the population for up to three years (Gwaza & Elkanah, 2017). While laying qualities can  
35 vary by breed (Onunkwo & Okoro, 2015), guinea fowl eggs stand out due to their thick shell, large amount of  
36 yolk, high vitamin, and mineral content, and extended shelf life when compared to chicken eggs (Ayorinde,  
37 1989). Eggs have many applications, including both culinary and industrial uses (Agbolosu et al., 2014).  
38 Meat from guinea fowl is known for its distinctive flavor and darker color. Its appropriate texture is due to the  
39 white muscular fibers, which are similar in number to chicken muscles but larger in size than geese muscles  
40 (Bernacki et al., 2012a). Compared to other poultry, guinea fowl have a better slaughter performance  
41 (Ebegbulem & Asuquo, 2018) a decent ratio of essential portions in the carcass, and acceptable sensory  
42 features (Kyere et al., 2020). Nutritionally, guinea fowl flesh stands out from other types of poultry due to its  
43 greater protein and lower fat composition (Ayorinde, 1989). The amount and quality of guinea fowl meat  
44 produced are affected by several factors. The genotype (variety) and sex of guinea fowl are essential factors in  
45 determining the quality of the meat, as was noted by (Baéza et al., 2001). Also, age and husbandry conditions  
46 are highlighted as crucial factors in assessing the quality of meat obtained in guinea fowls as observed by  
47 (Yamak et al., 2018). Yet, the quality and nutritional richness of the meal continuously influence the output  
48 outcomes of these birds. Guinea fowl can adapt to different sources of protein and energy because they  
49 consume a wide variety of plant and animal foods in the wild. Some feeding criteria are adopted in nations  
50 where guinea fowl are a common meat-type poultry species (Yildirim, 2012), normalizing compound feed.  
51 Although often grown on small-scale farms, in many countries these birds are viewed as an attraction and  
52 potentially employed to collect eggs primarily for self-supply of the farm (Batkowska et al., 2021). To  
53 enhance food production and protein needs, alternative livestock species and non-conventional feedstuff that  
54 have not yet had a huge impact on Nigerian animal production need to be explored and adopted. Fast-growing  
55 birds, such as guinea fowl, have several advantages that may be explored in smallholder subsistence farms.  
56 Jackfruit seedmeal (JSM) is a promising alternative feedstuff for poultry. It is a by-product of jackfruit intake  
57 in which the fleshy half of the fruit is consumed but the seeds are discarded as garbage (Odukwe et al., 2017).  
58 The seeds of the jackfruit tree are high in both fiber (3.19%) and starch (22%) by (Hettiaratchi et al., 2011).  
59 Even though some people roast and consume the seeds from jackfruits, there is not much demand from  
60 humans or livestock for the seeds themselves. (Akinmutimi, 2006; Ravindran et al., 1996) have both  
61 confirmed the presence of antinutrients in Jackfruit seed, however, studies looking at methods for eliminating  
62 these compounds are still in their infancy. The jackfruit un-used feed resources both the leaves as fodder and  
63 pulp are available for livestock feeding. Regardless of the availability of Jackfruit seed and its anti-nutritional  
64 components, minimal or no research work has been carried out to include the seed meal in poultry diets.  
65 Hence, the optimal amount of processed and raw Jackfruit seedmeal inclusion in poultry diets has not been  
66 well investigated. More unconventional feedstuff must be assessed to close the gap between the high cost of

67 feed components and the lack of non-conventional feedstuff availability, as well as to promote food security  
68 and sustainable farming. (El-Saadany et al., 2022) conducted a study on the use of pumpkin (PK) and garden  
69 cress (GC) seed oil in poultry diets, and they discovered that adding PK and GC seed oils to the diets of laying  
70 birds as natural feed additives, either independently (0.5%) or in combination (0.25%+0.25%), improved  
71 several physiological functions and productive traits of birds. Further study into the use of non-  
72 conventional feedstuff in livestock and poultry nutrition and production is essential, both to lessen  
73 competition between poultry and people for conventional feedstuff and for economic purposes. Consequently,  
74 the purpose of this study was to ascertain the impact of raw Jackfruit seed meal on the growth performance of  
75 the birds, the carcass features, the internal organs of the birds, and the economics of production of feeding  
76 guinea fowl keets using Jackfruit.

## 77 **2. 0 MATERIALS AND METHODS**

### 78 **2.1. LOCATION OF THE EXPERIMENT**

79 The research was conducted at the poultry unit of the teaching and research farm of Michael Okpara  
80 University of Agriculture, Umudike, Umuahia, Abia state, Nigeria. Umudike is located within latitude 5<sup>0</sup>29<sup>1</sup>  
81 North and longitude 7<sup>0</sup>32<sup>1</sup> East in the tropical rainforest zone of Umuahia, Abia state, which is characterized  
82 by an annual rainfall of about 2169.8mm in 155-228 raindrops and lies at an altitude of 122meters above sea  
83 level and has an as the ambient temperature of 26 with a maximum of 36<sup>0</sup>C and minimum of 27<sup>0</sup>C with a  
84 relative humidity of 57 to 91<sup>0</sup>C (N.C.R.I, 2018).

### 85 **2.2. MATERIALS**

#### 86 **2.2.1 Jackfruit**

87 Jack fruit seeds were obtained from Southern Nigeria, namely Ogidi in Idemili North Local Government of  
88 Anambra State, where they could be easily picked, processed, distributed, and purchased. After drying, the  
89 seeds were dehusked and winnowed with a tray and a sieve before being ground to the correct proportion with  
90 a hammer mill.

#### 91 **2.2.2 Experimental Birds and Equipment**

92 206-day-old pearl guinea fowl keets, a dual-type breed for both egg and meat production, were procured in  
93 Northern Nigeria (Kaduna) where there is a significant distribution and acquisition of these birds. Prior to the  
94 arrival of the chicks, the brooding chamber underwent cleaning. The keets were then placed in the room for a  
95 three-week brooding period. Vaccinations and medications used throughout the experiment, from brooding  
96 until the end, were obtained from the National Root and Crop Research Institutes (NCRI) in Umudike and  
97 Animal World on Bende Road in Umuahia, Nigeria.

#### 98 **2.3. Management of the keets**

99 The Department of Animal Welfare and Nutrition Committee at Michael Okpara University of Agriculture,  
100 Umudike, Nigeria, reviewed and approved the feeding trial. The experiment followed the guidelines provided  
101 by this committee. It involved 120 unsexed guinea fowl keets and lasted for 56 days. After three weeks of  
102 brooding (on the 21st day), the birds were weighed and randomly distributed into four treatments. Each  
103 treatment consisted of 30 birds, replicated three times with ten birds in each replicate. Treatments 2, 3, and 4  
104 included jackfruit seed meals at 10%, 15%, and 20% respectively (JSM 10, 15, and 20%). Treatment one  
105 served as the control group and received a JSM-free diet.

106 **2.4 EXPERIMENTAL DESIGN**

107 A completely randomized design was used in the designing of the experiment with the model;  $Y_{ij} = \mu + T_i + e_{ij}$

108 **Where;**

109  $Y_{ij}$ = Single Observation; the  $j^{\text{th}}$  observation in the  $i^{\text{th}}$  treatment

110  $\mu$ = Overall mean

111  $T_i$ = Effect of treatment

112  $e_{ij}$ = Random error;  $\square$ iind0,6<sup>2</sup>(Independently, Identically, Normally, Distributed with Zero mean and Constant  
113 Variance).

114 **2.5 EXPERIMENTAL DIET AND ANALYSIS**

115 The diets used in this study all had a consistent crude protein content of 24%. However, they varied in terms  
116 of metabolizable energy densities (ME Kcal/kg), ranging from 2,749 to 2,797 as outlined in Table 1. The diets  
117 were formulated with different quantities of milled jackfruit seeds, specifically 0%, 10%, 15%, and 20%,  
118 which corresponded to distinct treatment groups. The proximate analysis of both the diets and jackfruit was  
119 conducted using the (Horwitz, 2010) method, and the results can be found in Tables 1 and 2. To evaluate the  
120 daily feed intake, feed conversion ratio, and production economics of the guinea fowl keets, SPSS software  
121 was utilized at the conclusion of the experiment.

122 **2.6 DATA COLLECTION AND PARAMETERS**

123 Data were collected weekly for growth performance, and measurement of daily feed was done daily, whereas,  
124 carcass evaluation parameters were measured at the end of the experiment.

125 **2.6.1 GROWTH PERFORMANCE PARAMETERS**

126 The following data were collected weekly:

127 ➤ **Final weight:** This was obtained from the final weight of the keets in the last week of the experiment.  
128 It is measured using a 5kg manual weighing scale.

129 ➤ **Daily weight gain:** This was obtained using the formulae

130 
$$DWG = \frac{\text{Final weight} - \text{initial weight}}{\text{Number of birds} \times \text{number of days}}$$

132 ➤ **Daily feed intake (DFI):** This was calculated as follows:

$$\text{DFI} = \frac{\text{Quantity of feed given} - \text{leftover}}{\text{Number of birds} \times \text{number of days}}$$

- **Feed conversion ratio:** This was computed as the ratio of daily feed intake to daily weight gain.

$$\text{FRC} = \frac{\text{Quantity of feed consumed (g)}}{\text{Weight gain}}$$

## 2.6.2 Carcass Evaluation and Parameters Measured

After the experiment, a total of thirty-six guinea fowls were randomly chosen, with three birds selected from each replication in all treatment groups, for the purpose of evaluating their carcasses. Following the feeding trial, the birds were individually slaughtered to examine their carcass features. To empty their gastrointestinal tracts, the birds underwent a 24-hour fasting period prior to slaughter, although they had continuous access to water. Slaughtering involved making a clean incision across the jugular vein of each bird, allowing them to bleed for a minimum of two minutes. The weights of the birds were measured both before and after slaughter. Each bird was then immersed in hot water at a temperature of approximately 60°C for around one minute to facilitate feather removal. After de-feathering, the weights of the birds were measured again. The carcass was subsequently divided into various pieces using the techniques specified by (Ojewole & Longe, 1999). These included sections such as the neck, thighs, wings, and other body parts, and their weights were recorded and expressed as a percentage of the dress weight.

$$\text{Carcass evaluation} = \frac{\text{Cut parts}}{\text{Dressed weight}} \times 100$$

## 2.7 Economics parameters

Economic analysis was evaluated using the following parameters:

- **Cost per kg feed (₦)**

This was obtained by dividing the total cost of a 100 kg diet by 100.

- **Cost of feed consumed (₦/bird)**

This was obtained by multiplying total feed intake by cost/kg feed.

- **Feed cost per kg weight gain (₦/bird)**

This was obtained by multiplying the feed conversion ratio by cost/kg feed.

- **Cost of production (₦/bird)**

This was computed as a summation of the cost of feed consumed and other costs.

- **Price per kg (₦/bird)**

This arbitrarily arrived based on the prevailing price of a bird on a per kg basis.

- **Revenue (₦/bird)**

This was computed by multiplying price/kg live weight by mean weight per guinea fowl.

- **Gross margin (₦/bird)**

This was computed by deducting feed per kg weight gain from revenue.

## **2.8 STATISTICAL ANALYSIS**

Data collected were analyzed using a completely randomized design and subjected to analysis of variance (ANOVA) according to (d Steel & Torrie, 1986). Significant differences among treatments were separated using Duncan's Multiple Range Test (Duncan, 1955).

## **3.1 DISCUSSION**

### **3.1. Proximate Analysis of Jackfruit Seedmeal**

The composition of diets containing raw jackfruit seed meal is presented in Table 3. Significant differences ( $P<0.05$ ) were observed in the levels of crude protein, ether extract, ash, and metabolizable energy. However, no significant difference ( $P>0.05$ ) was found in the parameters of dry matter, moisture content, crude fiber, and nitrogen-free extract, indicating that the inclusion levels of raw jackfruit seed meal did not affect these variables. T1 exhibited the most significant ( $P<0.05$ ) values for crude protein, ether extract, and ash, while T2 had the highest ( $P<0.05$ ) values for crude protein and metabolizable energy. Notably, all significant parameters showed a gradual decline as the level of raw jackfruit seed meal increased. The presence of anti-nutritional factors in raw jackfruit seed is well-known, and these factors likely contributed to the decrease in the values of beneficial nutrients. Consequently, diets with lower levels of raw jackfruit seed meal contained higher levels of protein, fat (ether extract), and mineral matter (ash). The metabolizable energy was significantly improved in T2, which contained 10% raw jackfruit seed meal, compared to the control diet. However, a more pronounced reduction in metabolizable energy was observed in T4, which contained 20% raw jackfruit seed meal. In terms of crude protein, diets T1 and T2 had higher values ( $p>0.05$ ) at 24.50% each, compared to diets T3 and T4, which had values of 21.50% and 21.88%, respectively. (Dei & Karbo, 2004) provided nutritional recommendations for keets aged 0-3 weeks and 4-8 weeks. For the 0-3 week age group, they suggested an energy range of 2900-3000 kcal/kg, crude protein between 23% and 24%, calcium at 1.1%, phosphorus at 0.6%, and a vitamin/trace mineral premix at 0.50%. For keets aged 4-8 weeks, the recommended diet consisted of 2700-2800 kcal/kg of energy, crude protein at 38-1.1%, calcium at 0.5%, phosphorus at 0.5%, and a vitamin/trace mineral premix at 0.5%. The crude protein and metabolizable energy values used in this study align with these recommendations. (Odukwe et al., 2017) reported a crude protein value of 22.60% in raw jackfruit seed 10% inclusion in feed, which is lower than the value obtained in this study. (Ocloo et al., 2010) also reported a crude protein value of 13.50%, which is lower than the values obtained in this study. On the other hand, (Bobbio et al., 1978) obtained a higher crude protein value of 31.90% in raw jackfruit seed meal compared to this study. (Tulyathan et al., 2002) reported a crude protein content of 11% in jackfruit seed meal, which is lower than the protein content found in this study. Jackfruit seed meal exhibited a higher protein content compared to other non-traditional feedstuffs in this study, including bakery cracker residue (9.41%), cassava husk (2.90%), and sweet potato (4.37%). The crude protein

201 in this study even surpassed the protein contents of cooled sword bean, cooked Bambara groundnut, and  
202 cooked lima bean, which were reported by (Arijeniwa, 2004) to be 19.50%, 18.85%, and 21.50% respectively.  
203 The ether extract content of 2.70% in this study is lower than the value of 4.10% reported by (Odukwe et al.,  
204 2017), while (Ocloo et al., 2010) reported a fat content of 1.27% lower than the figures found in this study.  
205 The control diet in this study had higher ash content compared to the JSM-containing diets, and as the amount  
206 of JSM in the diet increased, the ash content also increased. The ash contents obtained in this study were  
207 higher than those reported by (Akinmutimi, 2006; Ocloo et al., 2010), which were 2.70% and 4% respectively.  
208 Although the crude fiber in this study did not show statistical significance, there was a trend of decreasing  
209 fiber content from T4 to the control group, making T4 have the highest fiber content. (Akinmutimi, 2006)  
210 reported lower crude fiber levels of 4.03% and 3.19% in raw jackfruit seed meal, while (Odukwe et al., 2017)  
211 reported a higher crude fiber value of 13.80% compared to the value of 12.10% obtained in this study. The  
212 differences between this study and previous works could be attributed to variations in other ingredients used  
213 in diet formulation, processing methods, and the maturity stage of the jackfruit seed meal (young, ripe).

### 214 **3.2 Growth performance of guinea fowl keets fed raw jackfruit seedmeal (JSM)**

215 Table 4 displays the growth performance outcomes of young guinea fowls that were fed raw jackfruit seed  
216 meal (JSM). While there were no significant differences observed in the initial weights of the guinea fowls,  
217 notable variations ( $P < 0.05$ ) were found in their final weight, daily weight gain, daily feed consumption, and  
218 feed conversion ratio. As the quantity of raw JSM in the diets increased, there was a substantial ( $P < 0.05$ )  
219 improvement in the final weight and daily weight gain. The highest final weight (745g) and daily weight gain  
220 were achieved with T4, which contained 20% raw JSM (15g). The daily feed consumption of the diets  
221 containing JSM (T2, T3, and T4) was similar to that of the control diet (T1), and it was higher ( $P < 0.05$ ),  
222 indicating that raw JSM enhanced the intake of feed. However, when comparing only the diets with JSM, the  
223 varied levels of raw JSM did not have a significant impact on intake. The Feed Conversion Ratio (FCR) value  
224 in T1 (3.57) was considerably lower ( $P > 0.05$ ), suggesting that the guinea fowls fed the control diet were more  
225 efficient in converting feed into meat. As the amount of raw JSM in the diets increased, the FCR values of the  
226 JSM-containing diets decreased. Despite the anti-nutritional properties of raw JSM, the diet with a higher  
227 percentage of raw JSM (20%) in T4 exhibited better feed conversion compared to the diet with 10% raw JSM  
228 in T2. The results indicated that the inclusion of 20% raw JSM in the guinea fowl keets' diet led to improved  
229 performance, as evidenced by better final weight, daily weight gain, and increased intake compared to the  
230 control diet. With increasing proportions of raw jackfruit seed meal in the diets, both the final weight and  
231 daily weight gain increased significantly ( $P > 0.05$ ). Therefore, T4, which contained 20% raw jackfruit seed  
232 meal, achieved the highest significant final weight (745.00g) and daily weight gain (15g). This suggests that  
233 the intake of JSM improved at inclusion levels of 10%, 15%, and 20%. The daily feed intake of the diets  
234 containing JSM (T2, T3, and T4) was consistently higher ( $P > 0.05$ ) than that of the control diet, indicating that

235 raw JSM did not have variable effects on the daily feed intake of the birds. The Feed Conversion Ratio (FCR)  
236 in this study was significantly lower ( $P>0.05$ ) in T1 (3.57%), indicating that the keets fed the control diet had  
237 a more efficient conversion of feed to meat. A lower FCR value signifies better meat production. As the level  
238 of raw Jackfruit seed meal increased in the diets, the FCR values of the diets containing JSM decreased. The  
239 inferior FCR of the JSM-containing diets suggested the potential effects of anti-nutritional factors like trypsin  
240 inhibitors. This finding supports the idea that raw JSM had no significant impact on the daily feed intake of  
241 the birds, which aligns with the study conducted by (Odukwe et al., 2017), where a 10% inclusion level of  
242 JSM did not affect the daily feed intake of the birds. The FCR in this study was substantially lower ( $P>0.05$ )  
243 in T1 (3.57%), indicating that the keets fed the control diet had a better conversion of feed to meat. Other anti-  
244 nutritional factors such as lectins, oxalates, phytates, and alkaloids, even after processing techniques, may  
245 have contributed to the lower FCR (Akinmutimi, 2006; Ravindran et al., 1996). Another possible reason for  
246 the low FCR is feed wastage by the keets. Although processing reduced tannins and oxalates in raw jackfruit  
247 seed meal by over 85% as shown in broiler research by (Ndyomugenyi & Ebong, 2016), it resulted in  
248 decreased growth and feed conversion. Furthermore, (Ndyomugenyi & Ebong, 2016) reported that soaking,  
249 boiling, and fermenting treatments did not appear to effectively enhance the nutritional content of jackfruit  
250 seeds for broiler chickens. Additionally, (Akinmutimi, 2006) found that boiling, roasting, soaking, or  
251 fermentation decreased the protein content and increased the carbohydrate content of jackfruit seeds.  
252 Therefore, jackfruit seed meal can be used as an energy source. Anti-nutritional factors in diets containing  
253 unconventional feedstuffs like jackfruit have been associated with adverse effects in chickens, including  
254 reduced feed intake, poor nutrient utilization, and growth depression (Akinmutimi, 2006). The high feed  
255 conversion ratio reported by (Odukwe et al., 2017) at a 10% JSM inclusion level in their diets differed from  
256 the findings of this study. Despite the presence of anti-nutritional elements in raw jackfruit seed meal, diet T4  
257 had a higher FCR value compared to diet T2, which contained 10% JSM.

### 258 **3.3 Carcass characteristics of guinea fowl keets fed raw jackfruit seedmeal (JSM)**

259 The carcass characteristics of guinea fowl keets fed raw jackfruit seed meal are presented in Table 5. Apart  
260 from the relative gizzard weight, there were no significant differences ( $P>0.05$ ) observed in any of the other  
261 parameters. Comparing the diets containing JSM to the control diet, the gizzard weights of the test diets  
262 showed significant improvement with the inclusion of raw JSM. T4, which contained 20% raw JSM, recorded  
263 the highest significant value (3.95%), while the control diet had the lowest significant value (2.83%). The  
264 similarity in gizzard contents between T2 and T3 suggests that the increased gizzard weight in treatment four  
265 may be attributed to its high fiber content. Despite the presence of anti-nutritional factors, their negative  
266 impact was not significant when considering the similarities in other parameters. Although there was a non-  
267 significant increasing trend among the diets with JSM as the level of raw JSM increased, Table 3.1 did not  
268 indicate any notable effect on crude fiber. The lack of substantial differences in many carcass parameters

269 suggests that, to a large extent, the control treatment performed similarly to the diets containing JSM.  
270 Consequently, variations in the concentration of raw JSM had minimal to no impact on the carcass features of  
271 guinea fowl keets. It is worth noting that a healthy gizzard plays a role in preventing harmful bacteria from  
272 entering the small intestine, thereby reducing the risk of developing coccidiosis and other enteric disorders  
273 (Bjerrum et al., 2005). The increased rate of gizzard contraction facilitated by the presence of JSM may have  
274 contributed to the higher gizzard weights observed at higher JSM levels. Similar results were found when  
275 whole grains were incorporated into poultry diets (Engberg et al., 2004).

### 276 **3.4 Economics of production of guinea fowl keets fed raw jackfruit seedmeal (JSM)**

277 Table 6 presents the economic aspects of guinea fowl keet production when fed raw jackfruit seed meal. The  
278 price of the bird per kilogram was the only parameter where significant changes ( $P < 0.05$ ) were not observed  
279 as expected. In comparison to the control diet, the total feed intake of the JSM-containing diets was  
280 significantly higher ( $P < 0.05$ ). When comparing the weight gain in this study, the control and T2, T3 diets  
281 showed significantly greater weight gain ( $P < 0.05$ ). Therefore, it can be inferred that higher levels of raw JSM  
282 incorporation led to increased intake and weight gain. The significant change in cost per kilogram of feed  
283 reveals that including raw JSM in the diets reduces feed costs. This indicates that the cost of feed consumed  
284 was higher in the JSM-containing diets, with the highest cost observed in T2 compared to the control diet. The  
285 lower concentration of JSM (10%), which is a significantly cheaper source of protein and energy compared to  
286 maize and soybean, may be the reason for the higher value of ₦271.55 reported in treatment two. The two  
287 main indicators for assessing production economics are feed cost per weight gain and gross margin, which  
288 measures profitability. A much lower feed cost per weight gain value indicates better performance. Higher  
289 quantities of raw JSM in T3 and T4 resulted in the lowest significant ( $P < 0.05$ ) feed cost per weight gain  
290 values, ₦527.84 and ₦513.29, respectively. Treatment two had the highest feed cost per kilogram gain  
291 (₦616.38), making it less favorable for recommendations. Treatment four had the highest gross margin and  
292 revenue ( $P < 0.05$ ), ₦142.96 and ₦656.25, respectively, followed closely by T3 containing 15% raw JSM. T1  
293 and T2 had the lowest revenues, ₦554.17 and ₦550.00, respectively. Treatment two suffered a loss of -  
294 ₦66.38, followed by T1 with -₦10.04. Gross margin is considered one of the most important economic  
295 criteria for determining profitability, as noted by (Ojewola, 2002; Olomu, 1976; Rajaguru et al., 1966).  
296 Treatment four yielded the highest profit among all dietary treatments. Therefore, T4 containing 20% raw  
297 jackfruit seed meal demonstrated the best performance, suggesting that incorporating 20% raw jackfruit seed  
298 meal in the diets of guinea fowl keets may be more cost effective and economical.

## 299 **4.0 CONCLUSION AND RECOMMENDATION**

### 300 **4.1 Conclusion**

301 Based on the study's results, incorporating higher levels of raw jackfruit seed meal tends to decrease the  
302 nutritional composition of the meals, including crude protein, ether extract, ash, and metabolizable energy.

303 The meal containing 20% raw JSM showed superior performance, with the highest final weight (745g) and  
304 daily weight gain (15g/bird). Except for the gizzard, raw JSM did not have any significant effect on carcass  
305 performance parameters. Among the dietary treatments, T4, which contained 20% raw JSM, generated the  
306 highest profit and had the lowest feed cost per weight gain. T4 outperformed the other treatments across all  
307 indicators, despite its higher content of anti-nutritional components. Therefore, guinea fowl keets can tolerate  
308 the inclusion of 20% raw JSM without experiencing negative effects on performance and can adapt to the  
309 higher fiber content in the T4 diet (12.10%). Additionally, no mortality was observed due to the inclusion of  
310 JSM in the keets' diets.

#### 311 **4.2 Recommendation**

312 Farmers are recommended to incorporate a diet with 20% raw jackfruit seed meal (T4) in guinea fowl keets'  
313 diets as it offers several advantages, including significantly higher final weight and gross margin. However, it  
314 is important to note that the response to raw jackfruit seed meal may vary among different poultry species, so  
315 further research on higher levels of JSM inclusion is warranted. Additionally, it would be valuable to  
316 investigate the effects of feeding processed jackfruit seed meals compared to raw jackfruit seed meals.

317

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**TABLES**437 **TABLE 1: GROSS COMPOSITION OF EXPERIMENTAL DIETS**

<b>Items</b>	<b>Control <sup>(T1)</sup></b>	<b>JSM 10% <sup>(T2)</sup></b>	<b>JSM 15% <sup>(T3)</sup></b>	<b>JSM 20% <sup>(T4)</sup></b>
<b>Ingredients (%)</b>				
Yellow maize	45.78	39.80	36.82	33.80
Soya bean	40.42	36.40	34.38	32.40
Jack fruit Meal	-	10	15	20
PKC	10	10	10	10
Bone meal	3.00	3.00	3.00	3.00
Salt (NaCl)	0.25	0.25	0.25	0.25
L-Lysine	0.10	0.10	0.10	0.10
DI-Methionine	0.20	0.20	0.20	0.20
Vitamin/mineral premix*	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Nutrient composition *****</b>				

Metabolizable energy (Kcal/kg)	2749.06	2773.28	2,785.50	2,797.28
Protein (%)	24.01	24.00	24.00	24.00
Ether extract (%)	2.96	2.88	2.75	2.70
Fibre (%)	10.15	10.90	11.05	12.10
Nitrogen-free extract (%)	42.99	43.12	45.72	45.30

438 \*Vitamin/mineral premix (1.2kg) contained: Vitamin A (15,000 i.u); Vit. D3 (3,500,000 i.u); Vit. E (30,000mg); Vit. K3 (3,000mg); Folic acid  
439 (1,000mg); Niacin (30,000mg); Calpan (10,000mg); Vit. B2 (8,000mg); Vit. B12 (20mg); Vit. B1 (3,000mg); Vit. B6 (4,000mg); Biotin (30mg);  
440 Antioxidant (125,000mg); Cobalt (240mg); Selenium (300mg); Iodine (1,400mg); Iron (46,000mg), Manganese (96,000mg), Copper (6,000mg);  
441 Zinc (80,000mg), Choline Chloride (500,000mg).

442 \*\*Dry-matter basis

443 \*\*\* A.O.A.C (2005) method

444

445 **TABLE 2: PROXIMATE COMPOSITION OF JACKFRUIT**

Parameter	Composition
<b>Nutrient compositions ** &amp; ***</b>	
Dry matter (%)	87.70
Moisture content (%)	12.30
Crude protein (%)	12.25

Ether extract (%)	0.85
Crude fibre (%)	5.50
Ash (%)	5.00
Nitrogen Free Extract (%)	64.10
Metabolizable energy (Kcal/kg)	3,103.23 (kcal/kg)

446 \*\*Dry-matter basis

447 \*\*\* A.O.A.C (2005) method

448

449 **TABLE 3: CHEMICAL COMPOSITIONS OF EXPERIMENTAL DIETS**

Parameter	Control <sup>(T1)</sup>	JSM 10% <sup>(T2)</sup>	JSM 15% <sup>(T3)</sup>	JSM 20% <sup>(T4)</sup>	SEM
Dry matter (%)	90.70	90.10	89.70	89.10	0.76
Moisture content (%)	9.30	9.90	10.30	10.90	0.30
Crude protein (%)	24.50 <sup>a</sup>	24.50 <sup>a</sup>	21.88 <sup>b</sup>	21.00 <sup>b</sup>	0.53
Ether extract (%)	2.96 <sup>a</sup>	2.88 <sup>ab</sup>	2.75 <sup>b</sup>	2.70 <sup>b</sup>	0.04
Crude fibre (%)	10.15	10.90	11.05	12.10	0.32
Ash (%)	10.10 <sup>a</sup>	8.70 <sup>ab</sup>	8.30 <sup>ab</sup>	8.00 <sup>b</sup>	0.35
Nitrogen Free Extract (%)	42.99	43.12	45.72	45.30	0.83

Metabolizable energy (Kcal/kg)	3259.95 <sup>b</sup>	3286.84 <sup>a</sup>	3255.63 <sup>b</sup>	3237.24 <sup>c</sup>	5.40
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450 <sup>abc</sup> Means within the rows with different superscripts differ significantly (P<0.05)

451 SEM pooled standard error of the mean

452

453

454 **TABLE 4: PERFORMANCE OF GUINEA FOWL KEETS FED DIETS CONTAINING VARIED PERCENTAGES OF RAW**  
 455 **JACKFRUIT SEEDMEAL**

Parameter	Control <sup>(T1)</sup>	JSM 10% <sup>(T2)</sup>	JSM 15% <sup>(T3)</sup>	JSM 20% <sup>(T4)</sup>	SEM
Initial weight (g)	218.33	210.00	210.00	220.00	1.41
Final weight (g)	661.67 <sup>c</sup>	650.00 <sup>d</sup>	703.33 <sup>b</sup>	745.00 <sup>a</sup>	11.29
Daily weight (g/bird)	12.67 <sup>b</sup>	12.57 <sup>b</sup>	14.10 <sup>ab</sup>	15.00 <sup>a</sup>	0.39
Daily feed intake (g/bird)	45.20 <sup>b</sup>	57.36 <sup>a</sup>	58.37 <sup>a</sup>	60.32 <sup>a</sup>	1.94
Feed Conversion Ratio	3.57 <sup>b</sup>	4.56 <sup>a</sup>	4.14 <sup>ab</sup>	4.02 <sup>ab</sup>	0.13

456 <sup>abcd</sup> Means within the rows with different superscripts differ significantly (P>0.05);

457 SEM pooled standard error of the mean

458

459 **TABLE 5: CARCASS ANALYSIS OF GUINEA FOWL KEETS FED VARIED PERCENTAGES OF RAW JACKFRUIT SEED**  
 460 **MEALS (JSM)**

<b>Parameter</b>	<b>Control <sup>(T1)</sup></b>	<b>JSM 10% <sup>(T2)</sup></b>	<b>JSM 15% <sup>(T3)</sup></b>	<b>JSM 20% <sup>(T4)</sup></b>	<b>SEM</b>
Live weight (g)	808.33	716.67	800.00	766.67	29.43
Slaughter weight (g)	788.00	693.33	777.00	743.67	29.40
De-feathered weight (g)	747.00	666.67	750.00	716.67	28.47
Dressed weight (g)	680.33	597.33	682.00	636.00	27.90
<b>CUT-PARTS</b>					
Wings (%)	13.14	13.94	13.52	14.17	0.38
Chest muscle (%)	24.13	22.75	23.85	25.13	0.59
Back cut (%)	16.56	17.19	17.56	18.17	0.63
<b>INTERNAL ORGANS</b>					
Heart (%)	0.46	0.51	0.50	0.61	0.03
Kidney (%)	0.37	0.42	0.38	0.39	0.03
Liver (%)	1.75	2.00	1.94	2.01	0.10

Gizzard (%)	2.83 <sup>b</sup>	3.31 <sup>ab</sup>	2.87 <sup>ab</sup>	3.95 <sup>a</sup>	0.19
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**OTHERS**

Neck (%)	4.88	5.79	5.25	6.38	0.29
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461 <sup>abcd</sup> Means within the rows with different superscripts differ significantly (P>0.05);

462 SEM pooled standard error of the mean

463

464 **TABLE 6: ECONOMIC ANALYSIS OF GUINEA FOWL KEETS FED VARIED PERCENTAGES OF RAW JACKFRUIT SEED**

465 **MEALS (JSM)**

Parameter	Control <sup>(T1)</sup>	JSM 10% <sup>(T2)</sup>	JSM 15% <sup>(T3)</sup>	JSM 20% <sup>(T4)</sup>	SEM
Total feed intake (kg/bird)	1.58 <sup>b</sup>	2.01 <sup>a</sup>	2.04 <sup>a</sup>	2.11 <sup>a</sup>	0.07
Weight gain (kg/bird)	0.44 <sup>c</sup>	0.44 <sup>c</sup>	0.49 <sup>b</sup>	0.53 <sup>a</sup>	0.01
Cost/kg feed (₦)	158.11 <sup>a</sup>	135.10 <sup>b</sup>	127.46 <sup>b</sup>	127.65 <sup>b</sup>	3.97
Cost of feed consumed (₦/bird)	250.13 <sup>c</sup>	271.55 <sup>a</sup>	260.40 <sup>b</sup>	269.34 <sup>ab</sup>	2.83
Feed cost per weight gain (₦/bird)	564.20 <sup>b</sup>	616.38 <sup>a</sup>	527.84 <sup>c</sup>	513.29 <sup>c</sup>	12.24
Price of bird ((₦/kg)	1300.00	1300.00	1300.00	1300.00	0.00
Revenue (₦/bird)	554.17 <sup>c</sup>	550.00 <sup>c</sup>	616.67 <sup>b</sup>	656.25 <sup>a</sup>	13.63

Gross margin (₦/bird)	-10.04 <sup>c</sup>	-66.38 <sup>d</sup>	88.83 <sup>b</sup>	142.96 <sup>a</sup>	24.69
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466 <sup>abcd</sup> Means within the rows with different superscripts differ significantly (P>0.05);

467 SEM pooled standard error of the mean

468

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472 The data that support this study will be shared upon reasonable request to the corresponding author.

473 **Author contributions**

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475 **Competing interest**

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482