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Effects of Using Cassava Leaf Meal on Quail Growth Performance at National University of Cheasim Kamchaymear, Cambodia

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Abstract

This study aimed to evaluate the effectiveness of using cassava leaf meal as feed on the growth of quails. The experiment was conducted in Thnal Keun village, Smoung Cheung commune, Kamchay Mear district, Prey Veng province. For the methods of this study, 180 healthy 4-day-old quails with an average weight of 10.20 g were selected and divided into 4 treatments (T0, T1, T2, and T3). Each treatment was divided into 3 replicates with 15 quails per replicate, following a Completely Randomized Design (CRD) experimental model. In these treatments, T0 was given 100% mixed feed (control), T1 was given 5% cassava leaf meal and 95% mixed feed, T2 was given 10% cassava leaf meal and 90% mixed feed, and T3 was given 15% cassava leaf meal and 85% mixed feed. In this experiment, all quails were weighed at the beginning of the study and then weekly from week 1 to week 6. The results showed that the average daily feed intake was statistically different at a 99% confidence level ($P<0.01$). The T2 treatment had the highest average daily feed intake (15.75 g). The average daily weight gain across all weeks was statistically different at a 99% confidence level ($P<0.01$). The highest average daily weight gain was in the T1 treatment (3.83 g). The average feed conversion ratio (FCR) of each treatment was statistically different at a 99% confidence level ($P<0.01$). The treatment with the lowest feed conversion ratio was the T1 treatment (4.15). Based on the results of this study, it can be concluded that using 5% cassava leaf meal in feed has a positive effect on daily feed intake, weight gain, and feed conversion ratio.

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INTRODUCTION

Poultry farming is practiced in almost all regions of the world due to its relatively low capital investment compared to other forms of livestock production. It offers a fast production cycle and high yields, making it an attractive option for both small-scale and commercial producers (Biosecurity measures for the development of commercial poultry farming technologies, 2020) . In recent decades, many developing countries have adopted industrial poultry farming systems to

meet the growing demand for meat and animal protein, driven by rapid population growth and urbanization.

In the Kingdom of Cambodia, poultry - including chickens, ducks, quails, and geese - is raised commercially and categorized into two main types: medium-scale and large-scale commercial farming operations. Medium-scale poultry production has seen significant development in recent years, encompassing meat, egg, and breeding purposes. Poultry meat and eggs are rich sources of protein, minerals, and essential vitamins, playing a vital role in the daily diet of people across Cambodia. Moreover, poultry farming contributes significantly to rural household incomes, aligning with national efforts to reduce poverty and improve food security (Biosafety Regulations on the Development of Commercial Poultry Farming Technologies, 2020). Among various poultry species, quail—particularly the Japanese quail (Coturnix japonica) - has gained popularity as a domestic breed due to its ease of management, rapid growth rate, high egg production, and strong resistance to diseases (Famer DNA, 2021) . Quail farming has emerged as a promising business opportunity for Cambodian farmers, with quail meat being increasingly recognized as a nutritious and popular food item in local markets. The bird's short production cycle, minimal space requirements, disease resistance, and flavorful meat containing approximately 20.66% protein make it an ideal candidate for smallholder farming systems (Sreng Sotheara, 2017) . However, one of the challenges in quail farming is feed cost, which constitutes a significant portion of total production expenses. High-quality feed is essential for optimal growth performance, but expensive commercial feed can severely limit profitability. Therefore, exploring alternative, locally available, and cost-effective feed ingredients is crucial for sustainable quail production.

Cassava leaf are abundant in Cambodia and are known for their nutritional value, including high protein content and essential amino acids, making them a promising supplement for animal feed. Utilizing cassava leaf meal in quail diets not only reduces feed costs but also supports sustainable agricultural practices by repurposing agricultural by-products. The study by (Júnior, 2017) suggested that use of cassava leaf meal at a level of 10 percent was recommended in the quail diet, showing comparable growth performance to commercial feeds while potentially reducing feed costs by up to 15%. However, previous studies often utilized cassava varieties grown in different environments or focused on older bird stages. Our research uniquely focuses on a locally prevalent Cambodian cassava variety and evaluates its impact on the growth performance of young, fast-growing quails (0-42 days of age), providing essential, regionally specific quantitative data to confirm the optimal and safe inclusion level. This targeted approach is crucial for establishing the leaf meal's true potential in local poultry systems. To evaluate the potential benefits of this approach, this study was conducted to investigate the "Effects of Using Cassava leaf meal on Quail Growth Performance."

This study aims to evaluate the effect of cassava leaf meal as a feed on the quail's growth performance. Specifically, the research will investigate how incorporating varying levels of cassava leaf meal into the quails' diet influences key performance indicators such as body weight gain, feed intake, and feed conversion ratio. The findings are expected to provide valuable insights into the potential of cassava leaf meal as a sustainable and cost-effective alternative protein and energy source in quail production, which could ultimately benefit small-scale farmers and the poultry industry.

MATERIALS AND METHODS

This experiment was conducted at Thnalkaeng village, Smaongcheung commune, Kamchaymear district, Prey Veng province, of over 42 days, from April 7 to May 18, 2025. For this study's methods, 180 healthy 4-day-old quails, with an average weight of 10.20 grams, the quail were distributed into four treatments (CLM inclusion levels: 0.0, 5.0, 10.0, and 15.0%) in a completely randomized design (CRD) Each treatment comprised three replicates, with 15 quail per replicate, following a completely randomized design (CRD) experimental model. All quail were weighed at the beginning of the week and then weekly from the first to the sixth week, respectively.

The experimental cages were 0.80 m long x 3 m wide, 0.50 m high from the ground, with three floors, each floor having a height of 0.45 m and 4 blocks per floor. Thus, the 4 floors had 12 blocks, each block measuring 0.80 m x 0.75 m and surrounded by a plastic net. The bottom of the cage was covered with straw mats from the first week to the third week. In the following week, the straw mats were removed, leaving the quails directly on the cage net.

For data collection in this experiment, the feed was provided freely to the quail from 7 am to 6 pm, but the feeding times were set three times a day: morning, noon, and afternoon, with clear records of the feeding and the remaining feed. For the remaining feed provided or spilled around the trough, the feed was dried, and the husks were removed before weighing. Before weighing, the quail were deprived of food and water for one hour before weighing to ensure accuracy. The quails were weighed by an electronic wall and were carried out at 6 am, one hour before feeding, and were weighed every week, starting with one weighing until they were exhausted. All quails that died during the experiment were accurately recorded according to the date of death to facilitate the calculation of the average amount of food consumed by quails for each experiment. Temperatures and relative humidity were recorded three times a day: at 8 A.M., 12 PM., and 5 PM.

All data on the amount of feed consumed by the quail, weight gain, temperature, and mortality were extracted into Microsoft Office Excel 2021 and analyzed statistically using one-way ANOVA in SPSS 2000 (Statistical Package for Social Science).

Table 1. Nutritional components contained in each raw material

Ingredient	DM%	CP%	ME%	CA%	P%
Cassava leaf meal	88	24	4626	1.24	0.45
Corn	84.70	7.87	3300	0.09	0.14
Rice bran	86.91	6.81	2527	0.17	0.65
Soybean meal	91.3	46.88	3300	0.25	0.56
Meat meal	93.8	51.78	1920	10	5
DCP	97.94	0	0	23.00	28.00
Premix	99.9	0	0	0	0
Common salt	98.86	0	0	0	0

(a) (RUA, Laboratory2019)

(b) (Mnisi, 2023)

The centesimal and nutritional composition of experiments diets showed in table 2.

Table 2. Centesimal and nutritional composition of experiment diets.

Ingredient	Cassava leaf meal inclusion level (%)			
	T0(CLM0.0)	T1(CLM5.0)	T2(CLM10.0)	T3(CLM15.0)
Cassava leaf meal	-	5	10	15
Corn	30	30	30	25
Rice bran	25	23	20	21
Soybean meal	33	30	28	27
Meat meal	10	10	10	10
DCP	0.50	0.50	0.50	0.50
Premix	1	1	1	1
Common salt	0.50	0.50	0.50	0.50
Total	100	100	100	100

Source : Processed data, 2025

RESULTS AND DISCUSSION

Daily Feed intake of quail/g per chick

According to Figure 1, the result shows that the daily feed intake across all weeks was statistically different at a 99% confidence level (P<0.01), while the daily feed intake in week 2 was statistically different at a 95% confidence level (P<0.05). Based on these results, the average daily feed intake per week showed a statistically significant difference at a 99% confidence level (P<0.01). The use of 10% cassava leaf meal (T2) resulted in a higher average daily feed intake than the control treatment, which did not use cassava leaf meal (T0). This was followed by the 15% cassava leaf meal treatment (T3). The lowest feed intake was observed in the treatment that used 5% cassava leaf meal (T1). Specifically, the average daily feed intakes were: T2 (15.75 g), T3 (15.35 g), T0 (14.79 g), and T1 (14.59 g). Therefore, we can conclude that the T2, using 10% cassava leaf meal, had the highest average daily intake, and the T1, using 5% cassava leaf meal, had the lowest.

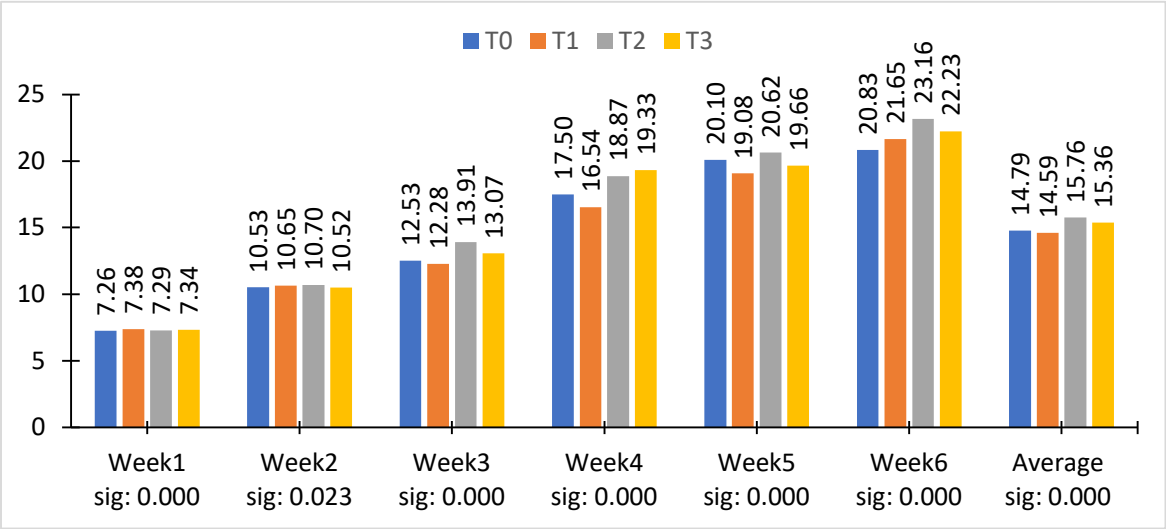

Figure 1. Daily feed intake of quail (g) per chick

Similar studies have explored the use of plant-based supplements in poultry diets. For example, (Ali, 2018) reported that the inclusion of cassava leaf meal (CLM) in broiler diets up to 10% did not significantly affect feed intake. This aligns with the current study's finding that cassava leaf meal does not drastically alter feed consumption patterns. However, the slight increase in feed intake observed in T2 (10% cassava leaf meal) could be attributed to a combination of palatability and the nutritional profile of cassava leaf. From a palatability standpoint, cassava leaves are rich in carotenoids and xanthophylls, which can impart a deeper yellow color to the feed, potentially making it visually more appealing to poultry. Furthermore, the presence of various phytochemicals (like flavonoids and phenolics) may introduce a unique taste or aroma that is palatable to quails at low inclusion levels. It is hypothesized that at this 10% level, the beneficial sensory and compensatory effects outweigh any depressive effects from anti-nutritional factors (such as the low levels of cyanogenic glycosides remaining after processing), thereby stimulating a marginal but noticeable increase in appetite.

Weekly Feed intake of quail/g per chick

According to Figure 2, the weekly feed intake across all weeks was statistically different at the 99% confidence level ($P<0.01$), while the weekly feed intake in week 2 was statistically different at the 95% confidence level ($P<0.05$). From these results, the average weekly feed intake for each week was statistically different at the 99% confidence level ($P<0.01$). The treatment using 10% cassava leaf meal (T2) had a higher average weekly intake than the control treatment that did not use any cassava leaf meal (T0). This was followed by the treatment that used 15% cassava leaf meal (T3). The treatment with the lowest weekly intake was the one that used 5% cassava leaf meal (T1). Specifically, the average weekly feed intakes were: T2 (110.31 g), T3 (107.50 g), T0 (103.53 g), and T1 (102.16 g). Therefore, we can conclude that the T2 treatment, which used 10% cassava leaf meal, had the highest average weekly intake, and the T1 treatment, which used 5% cassava leaf meal, had the lowest.

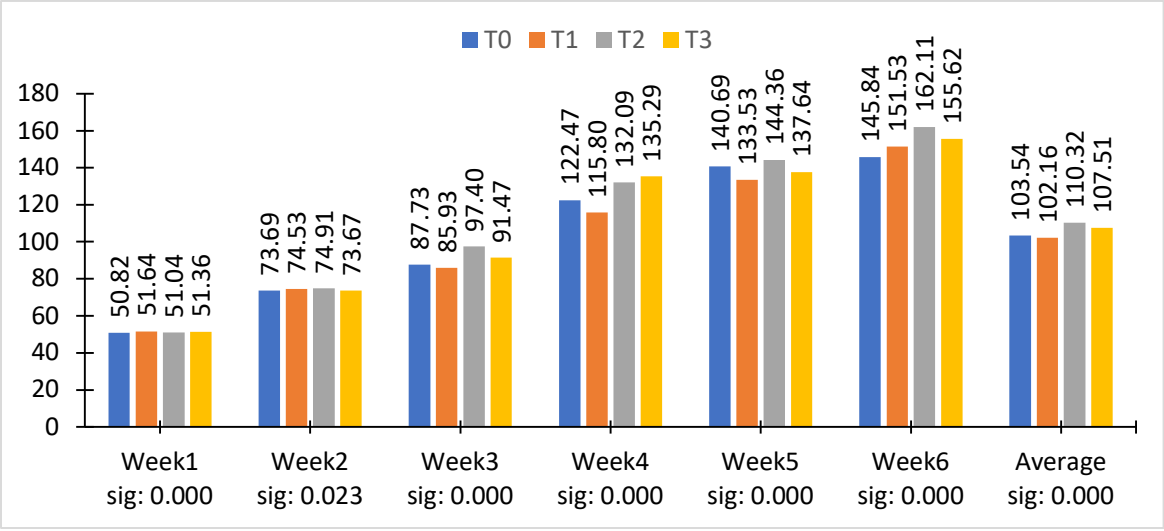

Figure 2. Weekly Feed intake of quail/g per chick

(Chen, 2020) found that incorporating 5–10% cassava leaf meal into chicken diets improved weight gain compared to higher inclusion levels. This supports the idea that moderate levels of

cassava leaf meal (10%) are beneficial for growth, potentially due to better nutrient availability and reduced anti-nutritional effects. The authors hypothesized that excessive inclusion of cassava leaf meal might reduce nutrient availability due to anti-nutritional factors like tannins and cyanogenic glycosides, which could explain why T3 (15% cassava leaf meal) showed slightly lower feed intake.

Daily Weight gain of quail/g per chick

According to Figure 3, the daily weight gain in weeks 1, 2, 3, 4, 5, and 6 was statistically significant at a 99% confidence level ($P<0.01$). Regarding the average daily weight gain of quails in the final week, the T1 treatment (5% cassava leaf meal) showed a higher weight gain than the T2 treatment (10% cassava leaf meal). This was followed by the T3 treatment (15% cassava leaf meal), while the T0 treatment (no cassava leaf meal) had the lowest weight gain. The specific values were: T1 (2.73 g), T2 (2.66 g), T3 (2.52 g), and T0 (1.97 g). Similarly, the average daily weight gain per week was also statistically significant at the 99% confidence level ($P<0.01$). The use of 5% cassava leaf meal led to a higher average daily weight gain compared to the treatment that used 10% cassava leaf meal. This was followed by the treatment that did not use cassava leaf meal, and the treatment with the lowest weight gain used 15% cassava leaf meal. The specific values for these treatments were: T1 (3.83 g), T2 (3.70 g), T0 (3.66 g), and T3 (3.47 g). This dose-dependent effect, where 5% CLM optimizes performance and 15% CLM depresses it, is strongly supported by previous research. Lower CLM inclusion likely provides a beneficial boost of essential nutrients and bioactive compounds without adverse effects. CLM is a known source of high-quality crude protein (up to 29% in dried leaf meal) and is rich in carotenes, B vitamins, and minerals (Ravindran, 1995) (Phuc, 2001), all of which enhance metabolic functions and nutrient supply. Conversely, the performance depression observed at the 15% inclusion level (T3) is consistent with the limitations imposed by anti-nutritional factors and high fiber. The increased level of dietary crude fiber (often >15% in CLM) in the 15% diet reduces overall nutrient and energy utilization, as poultry have limited capacity to digest fiber (Tewe, 1992). More critically, while processing reduces toxicity, the higher inclusion rate increases the total dietary load of residual cyanogenic glycosides (HCN). Even at low concentrations, chronic consumption of HCN metabolites can interfere with iodine metabolism and lead to impaired thyroid function, ultimately reducing growth rate (Tewe, 1992). Thus, 5% represents the optimal level where the nutrient-boosting effect outweighs the anti-nutritional and high-fiber constraints.

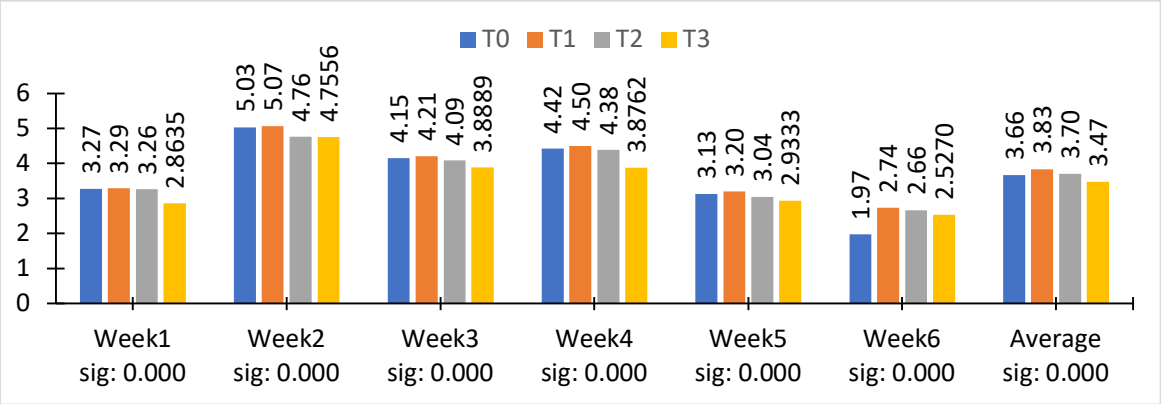

Figure 3. Daily Weight gain of quail/g per chick

Weekly body weight of quail/g per chick

According to Figure 4, the weights at the beginning of each week of the treatment were not statistically different, with P>0.05. The weights during weeks 1, 2, 3, 4, 5, and 6 were all statistically different at a 99% confidence level (P<0.01). At the final week, the treatment using 5% cassava leaf meal (T1) had the highest observed weight (171.13 g). This was followed by the control treatment (T0) which did not use cassava leaf meal, then the treatment with 10% cassava leaf meal (T2), and finally the treatment with 15% cassava leaf meal (T3) which had the lowest weight. The weights were T1 (171.13 g), T2 (165.51 g), T0 (164.06 g), and T3 (156.06 g). The average weekly weights were also statistically different at a 99% confidence level (P<0.01). The treatment consuming 5% cassava leaf meal (T1) had a higher average weekly weight than the other treatment, followed by the control treatment (T0), and the treatment with 10% cassava leaf meal (T2). The treatment with 15% cassava leaf meal (T3) had the lowest average weekly weight. The average weights were T1 (94.70 g), T0 (93.13 g), T2 (91.78 g), and T3 (86.69 g).

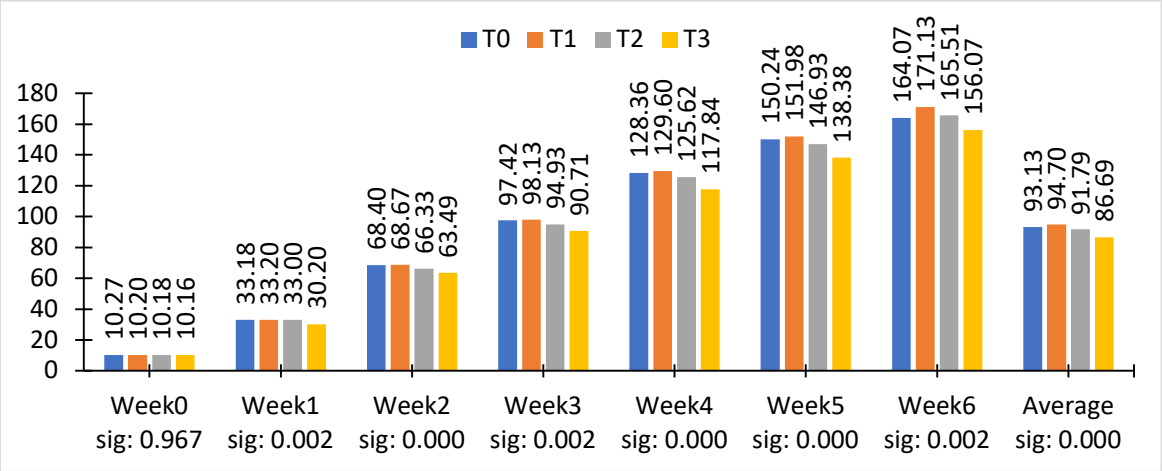

Figure 4. Weight gain per week of quail/g per chick

The findings are consistent with previous studies on the use of cassava leaf meal in quail and broiler diets: (Ali, 2018) reported that moderate levels of cassava leaf meal (up to 10%) improved weight gain in broilers, but excessive inclusion (>10%) reduced growth performance. This aligns with the current study's observation that T3 (15% cassava leaf meal) exhibited the lowest weight gain. (Chen, 2020) found that incorporating 5–10% cassava leaf meal into chicken diets enhanced weight gain compared to higher inclusion levels. This supports the idea that moderate levels of cassava leaf meal (5%) are optimal for growth. (Nguyen, 2019) observed that duck diets supplemented with 5% cassava leaf meal showed better weight gain than those with higher inclusion levels. This further validates the current study's finding that excessive cassava leaf meal may negatively impact growth due to anti-nutritional factors such as tannins and cyanogenic glycosides.

Weekly Feed conversion ratio (FCR) of quail/g per chick

According to Figure 5, the feed conversion ratio of quails in each treatment was statistically different at the 99% confidence level (P<0.01). The treatment that did not use cassava leaf meal had a higher feed conversion ratio than the treatments that did. Specifically, the treatment with no

cassava leaf meal (T0) had the highest conversion ratio (4.92 g), followed by the treatment using 15% cassava leaf meal (T3) at 4.85 g, the treatment using 10% cassava leaf meal (T2) at 4.62 g, and finally, the treatment using 5% cassava leaf meal (T1) had the lowest feed conversion ratio at 4.15 g. In conclusion, the treatment that did not use cassava leaf meal (T0) had the highest feed conversion ratio, while the treatment that used 5% cassava leaf meal (T1) had the lowest. This finding—that a low inclusion rate of 5% CLM significantly improves FCR—is robustly supported by studies highlighting the mechanism of action for leaf meals in poultry. The superior efficiency at 5% CLM is primarily attributed to the intake of bioactive compounds that optimize digestion and metabolism. CLM is a rich source of xanthophylls and carotenoids which, beyond improving yolk color, act as powerful antioxidants that reduce metabolic stress and enhance cellular efficiency (Oloruntola, 2018). Furthermore, the presence of these phytochemicals (flavonoids, phenolics) is documented to stimulate endogenous enzyme activity, particularly proteases, thereby boosting overall protein and nutrient digestibility (Beski, 2015). This increased bioavailability allows the quails to derive more energy and amino acids per unit of feed, directly resulting in a lower FCR. The observed increase in FCR at the higher 15% inclusion (T3) is consistent with research showing that the high fiber content (crude fiber ≈15−20% in leaf meal) and residual anti-nutritional factors (ANFs) at this level become detrimental (Tewe, 1992). High fiber increases the rate of feed passage and limits the contact time for nutrient absorption, thus increasing FCR. Moreover, the higher load of residual cyanogenic glycosides and tannins at 15% can damage the gut lining and inhibit digestive enzymes, further compromising the feed utilization efficiency (Panigrahi, 1996) (Ravindran, 1995). Therefore, the 5% level represents a strategic inclusion point where the pro-nutritional and anti-oxidant benefits outweigh the anti-nutritional and bulk effects.

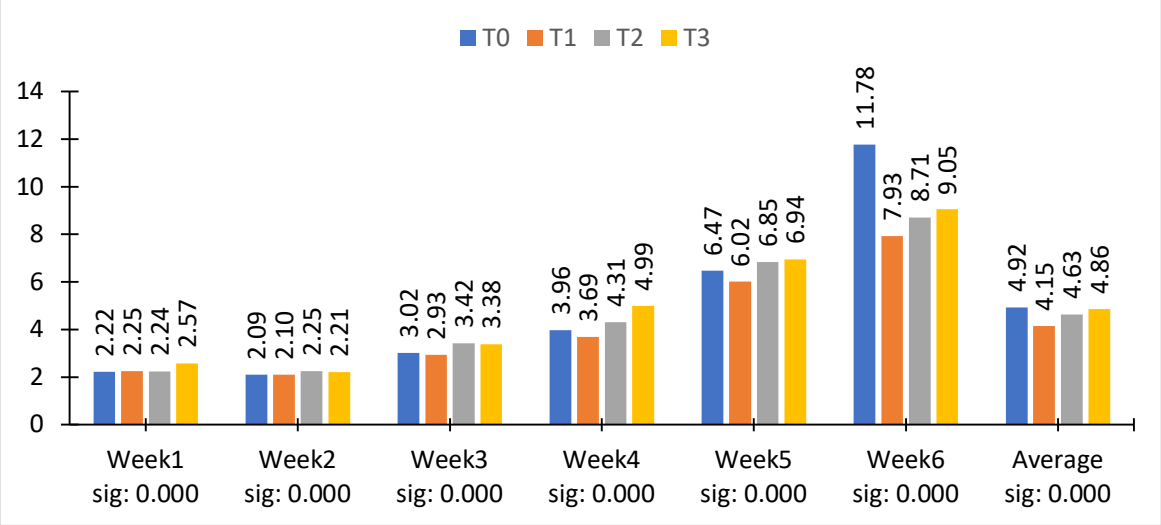

Figure 5. Weekly Feed conversion ratio of quail/g per chick

Studies suggest that including cassava meal at low to moderate levels can be a positive and cost-effective alternative to more expensive ingredients like maize (corn). At these levels, some research has shown that cassava meal can have a similar or even improved FCR compared to control diets. This is often because cassava is a more affordable and readily available energy source (Mnisi, 2023).

CONCLUSION AND RECOMMENDATION

Conclusion

The study investigated the effects of using cassava leaf meal in quail feed on growth performance, including daily feed intake, weight gain, and feed conversion ratio (FCR). The key findings are as follows:

Daily feed intake: There was statistically significant at the 99% confidence level ($P < 0.01$). The treatment receiving 10% cassava leaf meal had a higher average daily feed intake than the treatment that did not receive any. This was followed by the treatment that received 15% cassava leaf meal. The treatment with the lowest feed intake was the one that received 5% cassava leaf meal (T2: 15.75 g, T3: 15.35 g, T0: 14.79 g, T1: 14.59 g).

Daily Weight gain: A statistically significantly different at the 99% confidence level ($P<0.01$). The use of 5% cassava leaf meal resulted in a higher average daily weight gain than the treatment using 10% cassava leaf meal. This was followed by the treatment that did not use cassava leaf meal, and the treatment with the lowest weight gain were those that used 15% cassava leaf meal in their compound feed. The specific weights were: T1 (3.83 g), T2 (3.70 g), T0 (3.66 g), and T3 (3.47 g)..

Feed conversion ratio (FCR): The average feed conversion ratio of quails in each diet was statistically different at a 99% confidence level ($P<0.01$). The diet that did not use cassava leaf meal had a higher feed consumption index than the diet that used 15% cassava leaf meal. This was followed by the diet that used 10% cassava leaf meal. The diet with the lowest feed consumption index was the one that used 5% cassava leaf meal (T0 = 4.92 grams, T3 = 4.85 grams, T2 = 4.62 grams, T1 = 4.15 grams).

Based on the results of this study, we can conclude that using 5% cassava leaf meal in the diet has a positive effect on daily feed intake and weight gain and also improves the feed conversion ratio.

Recommendations

1. Adopt 5% cassava leaf meal in quail feed: Given the positive impact of 5% cassava leaf meal on weight gain and FCR, it is recommended that poultry farmers incorporate this level into their quail diets to enhance growth performance without compromising feed efficiency.
2. Further research on nutritional composition: Future studies should analyze the nutritional composition of cassava leaf meal, particularly its protein content and digestibility, to better understand its role in improving quail growth.
3. Evaluate long-term effects: Additional research is needed to assess the long-term health and productivity impacts of using cassava leaf meal in quail diets, including reproductive performance and disease resistance.
4. Explore other inclusion levels: While 5% showed promising results, testing intermediate levels (e.g., 7.5%) could help identify an optimal balance between cost-effectiveness and performance enhancement.
5. Assess economic viability: An economic analysis should be conducted to determine the cost-benefit ratio of using cassava leaf meal in quail feed, considering local availability, processing costs, and potential gains in productivity.
6. Promote sustainable feeding practices: Given the abundance of cassava leaves in Cambodia and their potential as a feed resource, promoting the use of cassava leaf meal aligns with

sustainable agricultural practices and contributes to reducing feed costs for small-scale poultry producers.

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