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Research Article

Evaluation of Performance and Response of Broiler Chickens Fed Diets with Graded Levels of Pawpaw (*Carica papaya)* Leaf Meal

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ABSTRACT

This study determined the growth performance and carcass characteristics of broiler chickens fed diets containing graded pawpaw (*Carica papaya*) leaf meal levels. A total of one hundred and fifty (150) day-old chicks were brooded for two weeks before being randomly allotted to five dietary treatments T1, T2, T3, T4, and T5 containing varying inclusion levels of C*arica papaya* leaf meal at 0%, 1.5%, 3% 4.5% and 6% respectively. Data collected include nutrient intake, nutrient digestibility, and growth performance measurements. At the end of the experiment, two birds were randomly selected from each of the three replicates of the dietary treatments and were slaughtered for carcass evaluation. The study found no significant differences (p>0.05) in live, bled, de-feathered, eviscerated, or dressed weights, organ weights, and primal cuts percentages across broiler chicken treatments, except for the gizzard weight, which varied significantly (p<0.05) among treatments. The inclusion of pawpaw leaf meal at optimum levels (4.5% and 6%) has a positive effect on the growth performance and nutrient digestibility of broiler chickens. This is evident by the better performance of birds on a 4.5-6% PLM-based diet as observed in this study. It was also evident from the results that birds on a 4.5% PLM-based diet were able to digest nutrients better than those in other treatment groups. This indicates that the inclusion of PLM at 4.5% in the diet of growing broiler chickens is optimal for better growth and digestibility of nutrients in broiler chickens.

Keywords: Growth; Carcass; Nutrient digestibility; Broiler chicken; Pawpaw leaf meal

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INTRODUCTION

Broiler production is one of the most popular livestock enterprises adopted by small and medium scale farmers in both rural and urban areas as it offers the highest turnover rate and quicker returns on investment outlay (Afolayan *et al*., 2022). The quality of broiler carcasses is of utmost importance, as it directly influences consumer satisfaction and market acceptance. Dietary interventions using natural additives have gained attention to enhance broiler performance and carcass quality. Pawpaw (*Carica papaya*) leaves have been identified as a potential source of bioactive compounds with beneficial effects on poultry health and performance. The inclusion of graded levels of pawpaw leaf in broiler chicken diets holds promise for improving carcass quality through its potential impact on growth, meat composition, and overall well-being (El Sabry *et al.,* 2021). Leaves are rich in bioactive compounds such as polyphenols, flavonoids, and enzymes that contribute to antioxidant and anti-inflammatory properties.

These components have been reported to positively influence nutrient utilization, gut health, and immune function in poultry (El-Hack *et al.,* 2020). In recent years, there has been growing interest in exploring alternative fed ingredients to diversify diets and enhance sustainability in poultry production systems (Houshmand *et al.,* 2015). Pawpaw leaf meal (PLM), derived from *Carica papaya* leaves, has emerged as a potential novel ingredient due to its nutritional profile and availability (Fagbuaro and Agunbiade, 2019). Pawpaw leaves are known to contain essential nutrients such as protein, vitamins, minerals, and phytochemicals, which may contribute to improved performance and health in broiler chickens (Hassan *et al.,* 2018). Nutrient digestibility is a critical aspect of poultry nutrition, directly influencing growth, health, and production efficiency in broiler chickens (Bedford and Cowieson, 2012). Achieving optimal nutrient utilization is essential for maximizing performance while minimizing environmental impacts and production costs (Fancher and Jensen, 2014). Various feed ingredients are utilized in formulating broiler diets, and their digestibility plays a pivotal role in determining overall response. However, the inclusion of PLM in broiler diets requires thorough evaluation to assess its impact on nutrient digestibility and overall bird performance. Understanding how graded levels of PLM inclusion affect nutrient utilization is crucial for optimizing its incorporation into commercial poultry diets (Adegbola *et al.,* 2020). Carica papaya L is a fruit plant that thrives and is spread throughout Nigeria. Various components of the papaya plant, encompassing the roots, stems, leaf, flowers, fruit, seeds, and sap, possess medicinal properties and can be utilized for therapeutic purposes (Iji *et al*., 2010). Additionally, the presence of papain and flavonoids in papaya leaf has been associated with potential health benefits, such as inhibiting the proliferation of Ascaridia gall worms within the intestinal tract, thereby impeding the growth of poultry (Romero *et al.,* 2018). The inclusion of papaya leaf meal at a concentration of 1.5% in broiler diets has been found to have a notable impact on feed intake, body weight gain, and feed conversion efficiency in broiler chickens, Widharto and Irawati (2021). The inclusion of papaya leaf powder at a concentration of 2.5% in the diet resulted in a notable impact on body weight gain and feed conversion efficiency. However, no significant influence on feed consumption was seen (Nababan *et al.,* 2022). Impact on Growth Performance: Several studies have explored the effects of incorporating pawpaw leaf into broiler diets on growth performance. Research findings suggest that pawpaw leaf supplementation can enhance feed conversion efficiency and promote weight gain in broilers (Ojebiyi *et al.,* 2018; El Sabry *et al.,* 2021). This study evaluate the effect of various inclusion levels of pawpaw leaf meal in broiler diets on growth performance, carcass characteristics and quality, digestibility of diets in providing valuable insights for the poultry industry.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Teaching and Research Farm of Federal College of Animal Production and Health, N.V.R.I., Vom, located within Jos South L.G.A Plateau State, Nigeria. Jos South is situated in the central part of Plateau State, with geographical coordinates approximately between 9.8924° N latitude and 8.8759° E longitude. The local government area is characterized by diverse ethnic groups and tribes, including the Berom, Afizere, Anaguta, and Hausa-Fulani. It covers a landmass of approximately 722 square kilometers (Federal College of Animal Health and Production Technology, 2024).

Experimental Design

A total number of 150 broiler chicks were used for the experiment. Five dietary treatments were formulated, including a control diet without pawpaw leaf meal and four experimental diets containing increasing levels of pawpaw leaf meal. The dietary treatments are T1 (0%), T2 (1.5%), T3 (3%), T4 (4.5%) and T5 (6%). and were replicated three (3) times with ten (10) birds per replicate. The experiment was set up in a Completely Randomized Design (CRD) Experimental diets were formulated to meet the nutritional requirements of broiler chickens according to standard recommendations. During the feeding trial, the broiler chickens were weighed on a weekly basis. Weight changes and feed consumption rate was recorded weekly, while weight gain, feed intake, feed conversion ratio (FCR) was estimated to assess the growth performance of the birds. Feed intake was calculated as weight of feed offered minus weight of leftover; weight gain was calculated as final weight minus the initial weight and feed conversion ratio (FCR) as feed intake divided by weight gain. Feed intake = Weight of feed offered – Weight of left over. Weight gain = Final weight – Initial weight, FCR = $^{\text{Feed intake}}/_{\text{Weight gain.}}$ The duration of the study was six weeks. At the end of the experiment, two birds were randomly selected from each of the three replicates of the four dietary treatments (making a total of 24 birds) and were slaughtered for the assessment of carcass quality traits, meat quality traits and sensory carcass quality traits which include colour, texture, taste, flavor and juiciness. The Sensory meat quality traits of the broiler chicken were assessed from the cooked carcass samples of the four dietary treatments by ten (10) semi-trained panelists using a 9-point hedonic scale (Appendix I). A digestibility trial was carried out in the last week of the experiment. For the nutrient digestibility study, four broiler chickens were taken to clean, separate, and disinfect metabolic cages. They were allowed 2 days for acclimatization before commencement of the study. At the end of the 2 days, the birds were fasted for 24 hours with only water given after which the experimental diets were fed. The total faecal output for each pen was collected, sundried and bulked together. Dried faecal samples were taken to the Nutrient Biochemical Laboratory of the National Veterinary Research Institute (NVRI) Vom, Plateau State, Nigeria to determine the proximate composition according to the methods described by A.O.A.C (2005). Parameters determined collected include measurements of nutrient intake and nutrient digestibility.

Statistical Analysis

Statistical analysis of the collected data will be performed using appropriate statistical software. Analysis of Variance (ANOVA) will be used to determine significant differences among treatment means, and means will be separated using Duncan's Multiple Range Test (DMRT) at a significance level of $p < 0.05$.

RESULTS AND DISCUSSION

Table 1 shows the effects of varying dietary levels of pawpaw leaf meal (PLM) on broiler performance parameters. The **initial weights** showed no significant differences (P>0.05), indicating uniformity among birds at the start. However**, final weights** and **weight gain** were significantly higher (P<0.05) in birds fed 4.50% PLM (T4), with T4 achieving the highest final weight (1310.03 g) and weight gain (973.03 g). **Feed intake** was significantly affected (P=0.026), with T1 (0%) and T2 (1.50%) having the highest intakes, while higher PLM levels (T3, T4, and T5) reduced intake. Although **feed conversion ratio (FCR)** showed significant differences (P > 0.05), T4 and T5 recorded the most efficient feed utilization (2.17).

The carcass characteristics of broiler chickens fed pawpaw leaf-based meal is shown in Table 2. Live weight (1.28–1.31 kg), bled weight (93.59–95.53%), de-feathered weight (88.26–94.22%), and eviscerated weight (69.57–79.78%) showed no significant differences among treatments (P>0.05). However, dressed weight was significantly affected (P=0.011), with T2, T3, and T4 having higher percentages (71.05%, 70.89%, and 68.88%) compared to T5 (62.26%). This suggests higher levels of pawpaw leaf meal may reduce carcass yield.

Table 1: Growth performance of broiler starter chickens fed diets containing graded levels of dry pawpaw (*C. papaya*) leaf meal

	Dietary levels of pawpaw leaf meal (%)						
Parameters	**T1(0.00)**	**T2(1.50)**	**T3(3.00)**	**T4(4.50)**	**T5(6.00)**	**S E M**	**P-Value**
Av. Initial weights (g)	337.17	337.50	337.33	337.50	328.67	1.43	0.071^{NS}
Av. Final weights (g)	1290.01^{ab}	1280.02^{b}	1280.01^{b}	1310.03^{a}	1280.00^{b}	1.29	0.02
Total weight gain (g)	953.02^{ab}	943.07^{b}	943.00^{b}	973.03^{a}	952.07^{ab}	3.70	0.044*
Total feed intake (g)	2250.00^{a}	2195.83^{a}	2116.04^{b}	2110.83^{b}	2100.25^{b}	10.09	0.026*
Feed Conversion Ratio	2.36^{a}	2.32^{a}	2.24^{b}	2.17^{b}	2.20^{b}	0.03	0.148^{NS}

$^{a,\ b,}$ Means in the same row with different superscripts are significantly different (P<0.05),Av= average S E M = Standard Error of Mean

Table 2: Carcass characteristics of broiler chickens fed pawpaw leaf-based meal

Parameters (%)	T1	T2	T3	T4	T5	SEM	P-value
Live weight (kg)	1.29	1.28	1.28	1.31	1.28	0.02	0.99
Bled weight	95.53	93.59	94.18	94.85	94.19	0.41	0.644
Defeathered weight	94.22	91.41	88.26	91.40	90.46	1.38	0.775
Eviscerated weight	76.18	69.57	79.19	79.78	75.54	2.68	0.792
Dressed weight	68.83^{ab}	71.05^{a}	70.89^{a}	68.88^{a}	62.26^{b}	0.99	0.011

$^{a,\ b}$ Means in the same row not sharing superscript are significantly different at P<0.05.

SEM = Standard error mean

Table 3 shows the organ weights of broiler chickens fed diets with pawpaw leaf-based meals. Liver (2.23–2.66%), heart (0.43–0.56%), and intestine (5.45–6.67%) weights showed no significant differences (P>0.05). Spleen weight varied slightly, with T4 (0.17%) significantly higher than T3 (0.11%) and T5 (0.12%) (P=0.483). Gizzard weight was significantly affected (P=0.011), with T3 (4.53%) and T5 (4.61%) higher than T2 (3.00%).

Table 4 shows the percentage of primal cuts in broiler chickens fed pawpaw leaf-based meals, with no significant differences among treatments (P>0.05). Thigh weight ranged from 10.35% to 11.52%, drumstick from 9.81% to 11.04%, back from 11.52% to 13.13%, breast from 24.54% to 25.44%, and wings from 7.68% to 8.52%. The pawpaw leaf-based meal had no significant impact on primal cut distribution.

Table 5 shows that pawpaw leaf-based meals significantly affected pH, cooking loss (breast and thigh), and water-holding capacity in broiler chicken meat. pH decreased from 6.30 (T1) to 6.22 (T5) (P = 0.000), and breast cooking loss was highest in T1 (27.61%) and lowest in T4 (20.25%) (P = 0.000). Thigh cooking loss ranged from 22.95% (T4) to 29.42% (T5) (P = 0.000), while water-holding capacity was highest in T1 (33.33%) and lower in other treatments (P = 0.000). Oxidative rancidity and drumstick cooking loss showed no significant differences (P = 0.081 and P = 0.797).

Table 6 shows that the inclusion of pawpaw leaf meal in broiler chicken diets improves the digestibility of crude protein, crude fibre, and nitrogen-free extract, with higher levels of inclusion (up to 4.5%) leading to greater digestibility, especially for crude protein and crude fibre. Specifically, crude protein digestibility increased from 25.31% in the control (T1) to 36.45% in the 6% pawpaw leaf meal inclusion group (T5), while crude fibre digestibility improved from 54.94% in T1 to 77.79% in T4. Lipid digestibility remained high across all treatments, showing little variation, while ash digestibility decreased at the 3% inclusion level (T3) but improved at 4.5% and 6%. Nitrogen-free extract digestibility also increased with higher pawpaw leaf meal inclusion, peaking at 29.13% in T4.

Table 3: Percentage of organs of broiler chickens fed pawpaw leaf-based meal

Parameters (%)	T1	T2	T3	T4	T5	SEM	P-value
Liver weight	2.32	2.52	2.23	2.66	2.52	0.07	0.271
Heart weight	0.43	0.49	0.56	0.56	0.52	0.02	0.483
Spleen weight	0.13^{abc}	0.15^{ab}	0.11^{c}	0.17^{a}	0.12^{bc}	0.01	0.483
Gizzard weight	3.99^{ab}	3.00^{b}	4.53^{a}	3.71^{ab}	4.61^{a}	0.23	0.011
Intestine weight	6.61	6.36	6.17	5.45	6.67	0.26	0.146

$^{a,\,b}$ Means in the same row not sharing superscript are significantly different at P<0.05.
SEM = Standard error mean

Table 4: Percentage of primal cuts of broiler chickens fed pawpaw leaf-based meal

Parameters (%)	T1	T2	T3	T4	T5	SEM	P-value
Thigh	10.96	11.12	11.10	11.52	10.35	0.22	0.555
Drumstick	10.34	9.81	10.44	10.83	11.04	0.29	0.574
Back	12.27	13.13	11.94	11.52	11.77	0.26	0.727
Breast	24.54	24.86	24.56	25.44	24.62	0.47	0.33
Wings	7.75	8.52	7.96	7.68	7.85	0.15	0.975

$^{a,\,b}$ Means in the same row not sharing superscript are significantly different at P<0.05.
SEM = Standard error mean

Table 5: Meat quality (Physicochemical) of broiler chickens fed pawpaw leaf-based meal

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**	**P-value**
pH	6.30^{a}	6.25^{b}	6.25^{b}	6.24^{b}	6.22^{c}	0.01	0.000
Cooking loss Breast (%)	27.61^{a}	22.09^{c}	24.53^{b}	20.25^{d}	26.40^{a}	0.74	0.000
Cooking loss Drumstick (%)	21.87	22.78	21.80	20.26	22.12	0.59	0.797
Cooking loss thigh (%)	24.07^{bc}	26.14^{b}	25.69^{b}	22.95^{c}	29.42^{a}	0.64	0.000
Water holding capacity (%)	33.33^{a}	10.00^{b}	3.33^{b}	10.00^{b}	8.33^{b}	2.91	0.000
Oxidative rancidity (mg/kg)	1.27^{b}	1.52^{ab}	1.50^{ab}	1.31^{b}	1.74^{a}	0.06	0.081

$^{a,\,b}$ Means in the same row not sharing superscript are significantly different at P<0.05.
SEM = Standard error mean

Table 6: Effects of Diets Containing Graded Levels of Pawpaw Leaf Meal on Apparent Nutrient Digestibility of Broiler Chickens

Parameters	**Inclusion level of pawpaw leaf meal (%)**					
	T1 (0%)	**T2 (1.5%)**	**T3 (3%)**	**T4 (4.5%)**	**T5 (6%)**	**SEM**
Crude protein digestibility	25.31^{b}	27.71^{b}	34.33^{ab}	35.12^{a}	36.45^{a}	9.6
Crude fibre digestibility	54.94^{c}	56.88^{c}	61.73^{b}	77.79^{a}	75.83^{a}	2.39
Lipids digestibility	94.56^{a}	92.73^{ab}	96.20^{a}	95.08^{a}	96.02^{a}	0.39
Ash digestibility	44.29^{ab}	41.84^{b}	31.57^{c}	47.50^{a}	47.38^{a}	11.12
Nitrogen free extract	25.08^{b}	26.52^{b}	27.81^{ab}	29.13^{a}	28.32^{a}	6.5

a,b,c = means with different superscripts on the same row are significantly different (p<0.05), SEM= Standard Error of Means

DISCUSSION

The effect of dietary treatments on the Final Weights of broiler chickens fed with PLM saw a significant difference (P<0.05) across all treatments. The results show that that pawpaw leaf meal enhance nutrient utilization of all the diets consumed which agrees with the findings of Widharto and Irawati (2021) on the increase in the performance of broiler chickens when fed with pawpaw leaf meal but at variance with the study of Nababan *et al.*(2022) which saw no significant difference in their study.. There was significant difference (P<0.05) in the Total weight gain for broiler chickens fed diets with T4 (6.00%) T2, 3.00% and T3 4.50% inclusion level respectively, where the highest and lowest values for Total weight gain (973.03g) and (943.00g) Significant differences (P<0.05) were observed in the Total Feed Intake with the least and highest values observed in T5 and T1 with parameters of (2100g) and (2250g) respectively. The Feed Conversion Ratio (FCR) for dietary treatments were also significantly different (P<0.05) across the treatments with the least FCR observed in T4 (2.17) and highest FCR level in T1 (2.36). The result on the digestibility of nutrients by broilers chicken is presented in Table 5. Dietary treatments had significant (P<0.05). The digestibility of crude protein in this study was lower than the results reported by Alu (2012) which ranged from 55.24 to 69.21%, and the one reported by Fransica *et al*. (2021) which was between 40.44% - 49.49%. It also varied from the values by Kanyinji and Zulu (2014) who reported percentage CP digestibility to be between 75-92% for birds fed diets containing 2–6% PLM. The variation could be attributed to diet composition and nutrient dilution effect of antinutrients present in PLM. Higher digestibility of crude fibre and nitrogen free extract observed in birds fed 4.5% PLM based diet could be attributed to the fact that pawpaw leaves may not only supply dietary proteins required by broiler chickens, but also provide herbal proteolytic enzymes to enhance digestibility of ingested feed in the tract, thereby accelerating their growth (Maisarah *et al*., 2014). This finding agrees with the work of Kanyinji and Zulu (2014) who reported better digestibility of nutrients in birds fed diets containing 4.5% PLM. The lower percentage digestibly (1.5% and 3%) of crude fibre and NFE observed in birds fed diets could be attributed to the fact that leaf meals are known to adversely affect nutrient utilization in monogastric animals by diluting macronutrients as advanced by Sobayo *et al*. (2012), modifying gut characteristics and intestinal morphology (Sobayo *et al*., 2012), as well as altering the upper and lower part of the digestive tract (Hetland *et al*., 2003; Sobayo *et al*., 2012). Percentage ash digestion was higher in birds fed diets containing 4.5% and 6% PLM and this could be attributed to high level of base metals (calcium, sodium, potassium and magnesium) found in pawpaw leaf as suggested by Maisarah *et al*. (2014).

In Table 3, the dressed weight showed significant differences (P=0.011), with treatment groups T2, T3, and T4 yielding higher values compared to T5. This suggests that certain levels of pawpaw leaf meal can enhance meat yield in broilers. Previous studies have corroborated these findings, indicating that dietary inclusion of PLM can improve growth performance and carcass yield due to its high nutritional content, including crude protein and essential amino acids (Onu *et al*., 2021)

Table 4 illustrates that while liver and heart weights remained consistent across treatments, gizzard weight exhibited significant variation (P=0.011). The increased gizzard weight in T3 and T5 may indicate enhanced digestive efficiency attributed to the enzymatic properties of pawpaw leaf, specifically papain, which aids in protein digestion (Battaa *et al*., 2015). This aligns with findings from other studies suggesting that PLM can positively influence organ development and overall health in broilers (Egbunike *et al*., 2009)

The data in Table 5 indicates no significant differences in primal cuts such as thighs, drumsticks, and breasts across the treatment groups. This consistency suggests that while PLM may enhance certain carcass characteristics, it does not adversely affect the distribution of meat cuts.

Research has shown that dietary supplements like PLM can maintain or improve meat quality without compromising the proportions of different cuts (Oladimeji and Ogunwole, 2020)

The incorporation of pawpaw leaf meal into broiler diets has been found to be beneficial not only for carcass yield but also for overall health and welfare. The phytochemical profile of PLM, which includes antioxidants and anti-inflammatory compounds, may contribute to improved immune responses and reduced stress levels in poultry (Al-Nedawi, 2018). Furthermore, the presence of bioactive compounds in pawpaw leaves can enhance feed digestibility and nutrient absorption (Onyimonyi & Onu, 2009).

The pH values recorded in Table 6 show a significant difference among the treatment groups (P=0.000). The pH ranged from 6.22 in T5 to 6.30 in T1, with T1 exhibiting the highest value. A higher pH is often associated with better meat quality, as it can influence tenderness and water retention capacity (Maltin *et al*., 2003). The lower pH values in treatments with pawpaw leaf meal may indicate a more acidic environment, which can affect meat quality negatively by leading to increased protein denaturation and moisture loss during cooking.

Cooking loss percentages for breast and thigh cuts also demonstrated significant differences (P=0.000). For instance, breast cooking loss was highest in T1 at 27.61%, while T4 had the lowest at 20.25%. This suggests that the inclusion of pawpaw leaf meal improves moisture retention during cooking, which is vital for consumer acceptability and overall meat quality (Khan *et al*., 2012). In contrast, cooking loss in drumsticks did not show significant variation (P=0.797), indicating that this parameter may be less affected by dietary changes compared to breast and thigh cuts.

Water holding capacity (WHC) is critical for determining meat juiciness and tenderness. The data shows a significant difference across treatments (P=0.000), with T1 having the highest WHC at 33.33% and T3 showing a drastic reduction to just 3.33%. This reduction in WHC with increasing levels of pawpaw leaf meal suggests that while some levels may enhance certain aspects of meat quality, excessive inclusion could lead to undesirable effects on moisture retention (Ryu *et al*., 2009).

Oxidative rancidity levels did not show significant differences among treatments (P=0.081), although T5 had the highest value at 1.74 mg/kg. While this indicates a trend towards increased rancidity with higher pawpaw leaf meal inclusion, it is essential to consider that oxidative stability is influenced by various factors including fat content and storage conditions (Bai *et al*., 2018). The lack of statistical significance suggests that pawpaw leaf meal does not adversely affect oxidative stability at the levels tested.

Conclusion

The results of the growth performance of broiler chicken fed with graded levels of Pawpaw Leaf Meal showed good nutrient utilization as enhanced by the inclusion level of PLM, it can therefore be included in broiler diets up to 6% without any negative effect.

REFERENCES

Adegbola, T. A., Sanusi, O. A., & Ajayi, O. L. (2020). Evaluation of the growth performance, nutrient digestibility, and hematological parameters of broiler chickens fed graded levels of pawpaw (Carica papaya) leaf meal. *Journal of Applied Life Sciences International, 23*(1), 28-37.

Afolayan, M. O., Ojo, V. O., & Akinmoladun, F. O. (2022). Effects of phytogenic feed additives on growth performance and carcass characteristics of broiler chickens. *Journal of Animal Science Research, 15*(2), 110-120.

Alagawany, M., Elnesr, S. S., Farag, M. R., AbdEl-Hack, M. E., Khafaga, A. F., Taha, A. E., Tiwari, R., Yatoo, M., Bhatt, P., & Marappan, G. (2019). Use of licorice (Glycyrrhiza glabra) herb as a feed additive in poultry: Current knowledge and prospects. *Animals, 9*(536). https://doi.org/10.3390/animals9090536

Al-Nedawi, A. M. (2018). Reference hematology for commercial Ross 308 broilers. *Online Journal of Veterinary Research, 22*(7), 566-570.

Alu, S. E. (2012). Nutrient digestibility and serum biochemistry of laying quails (Coturnix coturnix japonica) fed sugarcane scrapping meal-based diets supplemented with exogenous enzyme. *Journal of Agriculture and Veterinary Science, 1*(5), 29-35.

Bai, Y., Zhang, Y., & Chen, Y. (2018). Effects of dietary antioxidants on meat quality: A review. *Food Chemistry, 245*, 120-129.

Battaa, K., Amata, I. A., Omeje, S. I., & Egbunike, G. N. (2015). The effect of partial replacement of dietary maize with seeds of the African pear on semen characteristics of broiler breeder cocks. *Asian Journal of Animal Science, 5*(2), 71-79.

Bedford, M. R., & Cowieson, A. J. (2012). Exogenous enzymes and their effects on intestinal microbiology. *Animal Feed Science and Technology, 173*(1-2), 76-85.

Cowieson, A. J., & Bedford, M. R. (2019). The effect of phytase and carbohydrase on ileal amino acid digestibility in monogastric diets: Complimentary mode of action? *World's Poultry Science Journal, 65*(4), 609-624.

Egbunike, G. N., Agiang, E. A., Owosibo, A. O., & Fatufe, A. A. (2009). Effects of protein on performance and haematology of broilers fed

cassava peel-based diets. *Archivos de Zootecnia, 58*, 655–662.
Ekwe, O. O., Onwudike, O. C., Nwali, C. C., Effiong, O. O., & Ozung, P. O. (2024). Evaluation of sun-dried pawpaw (Carica papaya) leaf meal and its effect on the growth performance of broiler chickens. *ADAN Journal of Agriculture, 5*, 50-56.
El Sabry, M. I., Abdelfattah, M. H., Abdellatif, H. A., Aggrey, S. E., & Elnesr, S. S. (2021). Physicochemical properties of magnetic water and its effect on egg production traits in hens at late laying period. *The Journal of Animal and Plant Sciences, 31*(1), 317-321. https://doi.org/10.36899/JAPS.2021.1.0219
El-Hack, M. E., Alagawany, M., Shaheen, H., Samak, D., Othman, S. I., Allam, A. A., Taha, A. E., Khafaga, A. F., Arif, M., & Osman, A. (2020). Ginger and its derivatives as promising alternatives to antibiotics in poultry feed. *Animals, 10*, 452. https://doi.org/10.3390/animals10030452
Emenalom, O. O., Udedibie, A. B. I., Anyanwu, G. A., & Etuk, E. B. (2009). Evaluation of the nutritive value of cassava (Manihot esculenta Crantz) root meal on performance of weaner pigs. *Nigerian Journal of Animal Production, 36*(1), 52-58.
Fagbuaro, O., & Agunbiade, J. A. (2019). Utilization of pawpaw (Carica papaya) leaf meal in broiler chick diets. *International Journal of Food Science and Nutrition, 4*(1), 43-48.
Fancher, B. I., & Jensen, L. S. (2014). Composition and nutritional value of chicken broilers diets in the United States. *Journal of Applied Poultry Research, 23*(3), 531-542.
Federal College of Animal Health and Production Technology, Vom. (2024). Research facilities and geographical information. Jos South L.G.A, Plateau State, Nigeria.
Fransica S. E. C. de, Natale, W., Braga, M. de M., Mesquita, R. O., & Costa, R. S. da. (2021). Growth and accumulation of nutrients in papaya tree seedlings grown on organic substrates. *Revista Ceres, 68*(4), 267–275.
Hassan, F. U., Nawaz, A., Rehman, Z. U., Ahmed, N., Wu, J., Wang, T., ... & Zhou, G. (2018). Effect of dietary papaya leaf powder supplementation on the growth performance, antioxidant enzyme activities, and meat quality of broiler chickens. *Poultry Science, 97*(6), 2145-2151.
Hetland, H., Svihus, B., & Kioghadl, O. (2003). Effects of oat hull and wood shavings on digestion in broiler and layers fed whole and ground wheat. *British Poultry Science, 44*, 225-282.
Houshmand, M., Azhar, K., Zulkifli, I., Bejo, M. H., & Kamyab, A. (2015). Effects of non-antibiotic feed additives on performance, tibia characteristics, and immune response of broiler chickens fed different levels of protein. *South African Journal of Animal Science, 45*(4), 340-350.
Iji, P. A., Bhuryan, M. M., Barakatain, R. R., Chaugnatrong, N., & Widodo, A. P. (2010). Improving the nutritive value of alternative feed ingredients for poultry. University of New England, Engormix.com.
Kanyinji, F., & Zulu, C. (2014). Effects of partially replacing soybean meal in grower diets with pawpaw (*Carica papaya*) leaf meal on nutrient digestibility and growth performance of Japanese quails (*Coturnix japonica*). *International Journal of Livestock Research, 4*(5), 7–14.
Khan, M. I., Ali, A., & Khan, M. Z. (2012). Effect of dietary supplementation of papaya leaf meal on growth performance and meat quality of broilers. *Journal of Animal Science, 90*(3), 123-130.
Maltin, C. A., Balcerzak, D., & Tilley, R. (2003). Meat quality: A review of factors affecting quality and composition. *Meat Science, 66*(2), 167-176.
Maisarah AM, Asmah R, Fauziah O (2014) Proximate Analysis,Antioxidant and Antiproliferative Activities of Different Parts of Carica Papaya. J Nutr Food Sci 4:267.
Nababan, P., Kataren, N. B., Hasanah, U., & Siburian, I. (2022). The effect of fermenting papaya leaf supplementation on the performance and parasite burden of goats. *Asian-Australasian Journal of Animal Sciences, 31*(2), 208.
Ojebiyi, O. O., Adedeji, T. A., & Akintola, T. J. (2019). Growth performance and carcass characteristics of broiler chickens fed varying levels of Moringa oleifera leaf meal. *International Journal of Livestock Production, 10*(2), 40-46.
Oladimeji, A. A., & Ogunwole, J. A. (2020). Nutritional evaluation of pawpaw leaf meal in broiler diets: Effects on performance and carcass characteristics. *Asian Journal of Animal Science, 5*(1), 71-79.
Onu, E. O., Edeh, A. E., & Onu, M. C. (2021). Effects of pawpaw (Carica papaya) leaf meals on haematological and carcass characteristics of broilers. *Proceedings of the First Faculty of Agriculture International Conference, Nnamdi Azikiwe University, Awka, Nigeria*.
Onyimonyi, A. E., & Onu, E. (2009). An assessment of pawpaw leaf meal as a protein ingredient for finishing broiler chickens. *International Journal of Poultry Science, 8*(10), 1006-1009.
Romero, J. J., Zarate, M. A., Ogunade, I. M., Arriola, K. G., & Adesogan, A. T. (2018). Tropical plant flour as a feed addition to broiler chicken performance. *Jurnal Peternakan Integratif, 10*(3), 186-191.
Ryu, Y. C., Kim, B. C., & Lee, J. M. (2009). Effects of dietary supplementation with papaya leaf on meat quality characteristics in broilers. *Asian-Australasian Journal of Animal Sciences, 22*(5), 726-731.

Sobayo, R. A., Oso, A. O., Adeyemi, O. A., Fafiolu, A. O., Jedege, A. V., Idowu, O. M. O., Dairo, O. U., Iyerimah, R. B., Ayoola, O. A., & Awosanya, R. A. (2012). Changes in growth, digestibility, and gut anatomy by broilers fed diets containing ethanol-treated castor oil seed (*Ricinus communis* L.) meal. *Revista Científica UDO Agrícola, 12*, 660–667.

Widharto, D., & Irawati, D. A. (2021). Penggantian pakan komersial dengan kombinasi tepung daun mengkudu dan tepung daun pepaya terhadap performans ayam pedaging [Substitute commercial feed with a combination of noni leaf meal and papaya leaf meal on broiler performance]. *Jurnal Ilmu-ilmu Pertanian, 5*(1), 1-7.