ADAN J. Agric. 2024, 5: 50-56 **DOI:10.36108/adanja/4202.50.0160**

ISSN 2736-0385

Evaluation of sun-dried pawpaw (*Carica papaya*) leaf meal and Its effect on the growth performance of broiler chickens

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Abstract

Indigenous leafy vegetables are underutilized source of minerals and vitamins in sub-South Africa. However, they could play a vital role in addressing household food insecurity and malnutrition challenges. Paw-paw leave is a highly nutritious but underutilized. It is consumed by some communities in Africa. This study was undertaken to evaluate the nutritive profile of paw- paw leaf meal (PLM) and its effects on the growth performance of broiler chickens. Nutrients profile analysis of the leaf meal was carried out and the nutrients profile established. Ninety six (96) - two weeks-old (Anak) chickens with average initial weight of 205. 12 ± 2.28g were used in a 56 days feeding trial. The chickens were randomly allocated to four dietary treatments in a completely randomized design (CRD). Each treatment was replicated three times having eight chickens per replicate. T^1 (Control) contained 0% PLM while T_2, T_3 and T_4 contained 5, 10 and 15% PLM, respectively. Data were generated on feed intake, weight gain and feed conversion ratio. All data generated were subjected to One-way analysis of variance (ANOVA).Mean values were separated using Least significant difference (LSD).The result showed that PLM contain crude protein (25.30%). Crude fiber (8.86%), ether extracts (0.81%), ash (8.88%), Nitrogen- free extract (43. 82%) and moisture (12.33%).There was no significantly (P>0.05) difference in all the parameters studied except total and daily feed intake. It is concluded that the supplementation of PLM up to 15% optimal level is quite adequate to enhance growth without any deleterious effect on the chickens and therefore recommended for poultry farmers.

Keywords: *Paw- paw leaf meal, nutrient profile, growth performance, broiler chickens.*

Introduction

The high cost of poultry feed today in Nigeria is occasioned by the high cost of feed ingredients that supply the required protein and energy and exacerbated by the keen contest between man and animal for the same ingredients like Maize, Soybeans, Fish etc. there is therefore, need to combat this acut shortage of poultry feed ingredients by exploiting the potentials in non – conventional feed materials such as leaf meals that have high nutritional values such as paw – paw leaf meal which was used as a supplement into the diets of poultry as a means of reducing cost of conventional protein sources. (Iheukwumere *et al*., 2008; Adewolu, 2008; Mmereole, 2009; Emenalom *et al.*, 2011). Presently, most of the poultry farms located all over Nigeria and some other low- income, food deficit countries have shut down due to high cost of poultry feeds (Ekenyem, 2007), thereby escalating the animal protein deficiency crisis existing in such countries(Sonaiya *et al*.,1997)

In the past decades, studies have been carried out to identify alternative and non – conventional feed resources which are cheap and easily available for poultry production (Aduku, 1993; Esonu *et al.*, 2003; Ekenyem. 2007). Recently attention has been dran to paw – paw leaves as alternative protein source for livestock feed (Ebenebe *et al.*, 2011; Onyimonyi and Onu, 2009; Adewolu, 2008; Antia, *et al.*, 2006).Vegetable – based feed are rich sources of essential plant amino acids, vitamins, minerals and antioxidants. Further to the rich contents mentioned, it has been established that green vegetable leaves are the cheapest and most abundant sources of protein because of their ability to synthesize amino acids (Omenka and Anyansor, 2010). Paw-paw is a plant native to tropical America. It is known as "Okwuru Bekee" in Igbo " Gonad " in Hausa and "Ibepe" in Yoruba speaking parts of Nigeria (Onyimonyi and Onu,2009). It is popular in the tropics and sub- tropics because of its easy cultivation, rapid growth, quick economic returns and easy adaptation to different soils and climates (Harkness,1967; Campbell, 1984). The fruit is high in vitamins (A, B1 B2, C) and minerals (Ca, P, K, Fe), low in sodium, fat and calories and contains practically no starch (IHR,1979). Paw-paw latex contains proteolytic enzymes papain, chymo-papain A and B, and papaya peptidase and class 11 *chitinase* enzyme (Mohamed *et al.*, 1997).This study therefore, investigated the nutritive profile of paw-paw leaf and its effect on the growth performance of broiler chickens.

Materials and Methods

Management of the experimental animals

The experiment was conducted at the Poultry unit of the Research Farm of Ebonyi State University, Abakaliki. The paw-paw leaves were harvested from paw–paw trees around the University environment, Abakaliki. The leaves were separated from the stalk, washed, and cut into short lengths (2-5cm) and air-dried at room temperature. The sample was dried to a constant weight while still retaining the green colour. The crispy leaves were milled into powder, packaged in air-tight container till when they will be used. The leaves were subjected to proximate analysis in accordance with standard methods of AOAC (1990).

Experimental Animals, Design, Diets, Duration and Management

Ninety six (96) broiler chickens (Anak strain) were purchased from a chicken dealer in Abakaliki. The chickens were randomly allotted to four treatment groups in a completely randomized deign. Each treatment was replicated three times with eight chickens per replicate. The test ingredient (paw-paw leaf meal) was distributed in the following order:
T_1 = (0% - without paw- paw leaf meal) which served as control, T_2 = (5% PLM), T_3 = (10% PLM) and T_4 = (15% PLM).

The poultry house was cleaned, washed and disinfected using Isol ^{TM,} (cresol) and diazintol ^{TM}, and allowed to rest (without stocking) for 2 weeks. The house (brooder) was covered with black polythene in preparation for brooding. On the day of arrival, the chickens were received and placed with glucose and Vitalyte ^{TM} in their drinking water to serve as anti–stress. The chickens were randomly assigned to all the treatment and their replicates. However, the chickens were placed with commercial chick starter mash during the acclimatization period of two weeks. The birds were fed *ad-libitum* with a weighed quantity (50- 80g) of the experimental diets every morning with clean drinking water offered a*d-libitum*. All routine vaccinations and bio-security measures were carried out following routine management practices. Litter materials were replaced with fresh ones whenever wet litter was observed to prevent ammonia built up and incubation of microorganisms. The feeding trial lasted for 56 days.

Data Collection and Statistical Analysis

Feed intake: This was obtained daily through weigh-back mechanism by subtracting left- over feed from feed offered.

Weekly body weight Gain: This was obtained using weekly weigh-back mechanism by subtracting the previous week weight from that of the present week.

Feed conversion ratio: This was obtained by dividing the total feed intake by the total body weight gain.

Data analysis: All data collected were subjected to analysis of variance (Steel and Torrie, 2000). Significant differences between treatments means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

Results and Discussion

Proximate composition of paw-paw leaf meal

The result of the proximate analysis of paw –paw leaves is presented in Table 3. The result showed that the crude protein (CP) is 25.30% which is less than the reports of 30.12% (Onyimonyi and Onu, 2009) and 28.20% (Ebenebe *et al.*, 2011) for the same leaves. This could be as a result of differences in soil, season, geographical location and probably the processing method used. It is however higher in CP than *Microdesmis puberula* (17.30%), (Esonu *et al.*, 2003), cassava leaves (25.10%) (Iheukwumere *et al.*, 2008), sweet potato (25%) (23.57% and 24.85% for sweet potato leaves as reported by Adewolu, (2008) and Antia *et al.*, (2006), repectively are higher than 22.34% for *mucuna* leaves (Emenalom *et al.*, 2009) and 20.59% for *Amaranthus caudatus* (Etuk *et al.*, 1998; Akindahunsi and Salawu, 2005). The high protein content of PLM suggests its utilization as a protein supplement in diets of broiler chickens (Onyimonyi and Onu, 2009).The crude fiber (CF) content of 8.86% is high when compared to 7.20% by Anita *et al.*, (2006) reports of sweet potato leaves, 6.20% , *Talinum triangulare,* 6.40% of *Piper guineenses*, 7.0%, *Cenchorus olitorius* and 6.50% of *Vernonia amydalina* (bitter leaves), (Akindahunsi and Salawu, 2005) but lower than 24.8%, 11.40%, 12.00% and 12.93% observed for *Microdesmis puberula,* cassava, neem and *mucuna* leaves (Esonu *et al.*, 2002: Iheukwumere *et al.,* 2008 Onyimonyi *et al*,.2009 and Emenalom *et al.*,2009), respectively. The ash content of 8.88% is however lower than some leaves in Nigeria such as 11% of sweet potato (Anita *et al.*, 2006; Adewolu, 2008). It is however higher than some other vegetables like *Occimum graticumum* (8%) and *Hibiscus esculentus* (8%) (Antia, *et al.*, 2006). (Akindahunsi and Salawu, 2005).

The relatively high protein and minerals content is a reflection of its deposit of mineral elements (Antia *et al.*, 2006). Non starchy vegetables are the richest sources of dietary fiber (Gastoni *et al.*, 1995) and are employed in the management of gastro-intestinal disorders. Table 4 showed the performance characteristics of boilers fed diets supplemented with graded levels of paw-paw leaves. The result showed that there was no significant difference (P>0.05) among all the treatments with respect to initial body weight, final body weight, daily body weight gain and feed to gain ratio. However, in respect to final body weight, the performance was increasing as the supplementation levels of paw-paw leaf meal (PLM) increased from T_2 (5%) (1825. 94g), T_3 (10%) (1826.67g) and T_4 (15%) (1829 .33g) while the T_1 (0%) (0%) had 1823. 33g) body weights.

Similar trend characterized the average total body weight gain of T_1 (16204.55g) and T4 (1684. 67g). This trend did not agree with the findings of Iheukwumere *et al.*, (2008) who reported gradual decrease in average weight gains as the levels of supplementation of PLM increased progressively from 1% through 1.5% to 2%. However, this is in agreement with the work of Onyimonyi and Onu (2009) who reported a progressive increase in weight gain as the PLM was increased between 0.5% and 2% other than the control (3.92) T4 (4.01) which demonstrated the best feed to gain ratio followed by T2 (4.11) and T2 (4.12).This trend could be ascribed to the high nutritional value in terms of protein and minerals/ vitamins supplied by PLM particularly when increased to 20% value. It is most probable that the better feed to gain ratio in the control was due to lower crude fiber compared to the rest of the chickens on higher fiber supplied by the PLM since high fibre diets are not well digested by monogastrics (Onyimonyi and Onu, 2009).

It could also be attributed to the papain in the PLM which aid protein digestion and as such enhanced the release of free amino acids necessary to boost growth (Onyimonyi and Onu, 2009).This is in agreement with the earlier work of Arun and Vinay (2016) which reported that papain is an effective element which breaks down protein and cleanses the digestive tract. This finding agrees with the work of Mohamed *et al.* (1997) who reported that the latex of tropical paw-paw plants is a rich source of class 11 *chitinase*. These finding corroborate the work of Ebenebe *et al*. (2011) who observed increased weight gain associated with supplementation of PLM in the diets from T1 (115.40g), T2 (119.24g) T3 (119.27g) and to T4 (120.69g). The T1 differed significantly ($P<0.05$) when compared with T2, T3 and T4. The possible reason why there was a progressive increase in feed intake with increasing PLM could be due to increasing fiber content of the feed(decrease in energy) since animals eat to satisfy their energy requirements (Coop and Kyriazakis, 2001).

Table 1: Percentage composition of experimental starter diets

Ingredients (%)	**T1**	**T2**	**T3**	**T4**
PLM	-	5	10	15
Maize	47	45	45	45
GNC	25	25	25	25
Fish meal	3	3	3	3
Wheat offal	21.15	19.15	15.15	11.15
Bone meal	2	2	2	2
Lysine	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15
Premix	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30
Lime Stone	0.80	0.80	0.80	0.80
Microfix	0.10	0.10	0.10	0.10
Total	**100**	**100**	**100**	**100**
Crude Protein (%)	21.45	22.33	22.76	23.18
ME(Kcal/Kg)	3232	2995.11	2851.81	2708.5

PLM= paw –paw leaf meal, GNC = Groundnut cake, ME = Metabolizable energy

Table 2: Percentage composition of experimental finisher diets

INGREDIENTS (%)	T1	T2	T3	T4
Pawpaw leaf meal	-	5	10	15
Maize	40	40	40	40
Ground nut cake	22	21	20	19
Fish meal	2.5	2.5	2.5	2.5
Wheat offal	14	10	6	2
Palm kernel cake	17.65	17.65	17.65	17.65
Bone meal	2	2	2	2
Lysine	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15
Premix	0.25	0.25	0.25	0.25
Salt (Nacl)	0.3	0.3	0.3	0.3
Lime Stone	0.8	0.8	0.8	0.8
Microfix	0.1	0.1	0.1	0.1
TOTAL	**100**	**100**	**100**	**100**
Crude Protein (%)	22.63	22.68	22.73	22.79
ME (Kcal/Kg)	3479.59	3353.71	3227.83	3101.95

Table 3: Nutrient composition of pawpaw leaves

Crude protein (%)	25.30
Crude fibre (%)	8.86
Ether extract (%)	0.81
Ash (%)	8.88
Nitrogen-free extract (%)	43.82
Moisture (%)	12.33

Table 4: Performance characteristics of broiler chickens fed pawpaw leaf meal-based diets

PARAMATERS	T1	T2	T3	T4	SEM
Initial body weight (g)	205.37	201. 39	202.02	203. 66	1.95
Final body weight(g)	1853.33	1821.94	1826.67	1873.33	61.46
Total body weight. gain (g)	1648.96	1620.55	1624.65	1684.67	56.83
Daily body weight gain (g)	29.45	28.94	29.01	30.08	1.23
Total feed intake (g)	6462.63^{c}	6677.20^{b}	6679.30^{b}	675840^{a}	12.05
Daily feed intake (g)	115.40^{0}	119.24^{b}	119.27^{b}	120.69^{a}	1.87
Feed conversion ratio	3.92	4.12	4.11	4.01	1.07

^{abc} = means in the same row with different superscripts are statistically different (P>0.05).

Conclusion

The results obtained from this study shows that paw-paw leaf meal supplemented at 15% level in the diet of finishing broiler chickens improved performance without any adverse effect. At this level of supplementation, economic returns to the farmer would increase as indicated by the feed to gain ratio of chickens.

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