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Research Paper

The Nutritive Profile of Sun-Dried Paw-Paw (C*arica Papaya*) Leaf Meal and its Effect on the Growth Performance of Broiler Chickens

C.R. Unigwe[1,*], U.P. Okorafor[1], U.M. Ogbu[1] and O.C. Nwufoh[1]

[1] Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Oyo State, Nigeria

* Corresponding author, e-mail: (robinsonunigwe@gmail.com)

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Abstract: *Feeding trial was conducted on sixty day-old Anak broiler chicks of average weight of 204.11±3.29g for eight weeks to evaluate the effect of sun-dried paw-paw leaf meal (PLM) on their growth performance as well as proximate composition analysis on the PLM. The birds were assigned to four treatment diets comprising T_1 (0% PLM), T_2 (5% PLM), T_3 (10% PLM) and T_4 (15% PLM) in a completely randomized design. They were replicated thrice with 5 chicks per replicate. All data collected were subjected to analysis of variance and difference in means separated using Duncan's New Multiple Range Test. The results showed that PLM contains crude protein (25.30%), crude fibre (8.86%), ether extract (0.81%), ash (8.88%), nitrogen-free extract (43.82%) and moisture (12.33%). The average daily weight gains and feed conversion ratios (FCR) were not significantly different ($P>0.05$) among all the treatments although demonstrated progressive numerical increase in weight gains as the PLM increased in the diets. Similar trend was also observed in the FCR where T_4(4.01) was better than T_3 (4.11) and T_2 (4.12) but not T_1 (3.92). The average daily feed intake showed a significant difference ($P<0.05$) when T_4 (120.69g) was compared with T_3 (119.27g), T_2 (119.24g) and T_1 (115.40g). Similarly, T_1Showed a statistical difference ($P<0.05$) when compared with other treatments but no significant difference ($P>0.05$) when T_2 and T_3 were compared in this respect. Therefore, inclusion of PLM up to 15% in broilers' diet is recommended for improvement in weight gain.*

Keywords: Broiler, paw-paw leaf meal, proximate composition, growth performance.

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, soybean, fish etc. There is, therefore, need to combat this ugly scenario by exploiting the potentials in non-conventional feed ingredients such as leaf meals that have high nutritional values and at the same time, most times wasted, such as paw-paw leaf. Leaf meal supplementation have been included into the diets of poultry as means of reducing cost of conventional protein sources and to improve protein margin (Odunsi *et al*., 1999; Iheukwumere *et al*., 2008; Adewolu, 2008; Nworgu *et al*., 2007; Mmereole, 2009; Wude and Berhan, 2009; Emenalom *et al*., 2009; Fasuyi and Nonyerem, 2007; Onyimonyi *et al*., 2009; Omenka and Anyasor, 2010; Ebenebe *et al*., 2011).

Presently, most of the poultry farms dotted all over Nigeria and some other low-income, food-deficit countries (LIFDC) have shut down due to high costs of poultry feeds (Ekenyem, 2007), thereby escalating the animal protein deficiency crisis existing in such countries (Sonnaiya *et al*., 1997). In the past decades, studies have been carried out to identify alternative and non-conventionalfeed resources which are cheap and easily available for poultry production (Aduku, 1993; Esonu *et al*., 2003; Ekenyem, 2007). Recently, attention has been drawn 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 feeds are rich sources of essential plant amino acids, vitamins, minerals, and antioxidants (Omenka and Anyasor, 2010). 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 from a wide range of available primary materials such as water, carbon dioxide and atmospheric nitrogen (Fasuyi, 2006).

Paw-paw is a plant native to tropical America. It is known as ‘’*okwuru bekee*’’ in Igbo, ‘’*gonda*’’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 diverse soils and climates (Harkness, 1967; Campbell, 1984). The fruit is high in vitamins (A, B1, B_2, C) and minerals (Ca, P, K, Fe), low in sodium, fat and calories and contains practically no starch (Yadava *et al*., 1990; IIHR, 1979). Paw-paw latex contains proteolytic enzymes-papain, chymopapain A and B, and papaya peptidase A (Yadava *et al*., 1990) and class 11 chitinase enzyme (Mohamed *et al*., 1997). This study, therefore, investigated the proximate composition of paw-paw leaf and its effect on the growth performance of broiler chickens.

Materials and Methods:

Experimental Site, Source, Processing and Proximate Composition of Paw-Paw Leaf

The experiment was conducted at the poultry unit of The Research Farm of Ebonyi State University, Abakaliki. The paw-paw leaves were got from paw-paw trees around the University’s Residential Quarters and Ugwu-Achara, both in Abakaliki. The leaves were separated from the stalk, washed, drained, chopped and sun-dried for 4-6 days, till they were crispy at constant weight while still retaining the green colour. The crispy leaves were ground and used for compounding of the diets. The ground and sun-dried leaves was subjected to proximate analysis in accordance with standard methods of AOAC (1990).

Experimental Animals, Design, Diets, Duration and Management

Sixty (60) day-old Anak broiler chicks were purchased from a commercial hatchery in Abakaliki. The birds were randomly allotted to four treatments in a completely randomized design. Each treatment was replicated thrice, having five chicks each. The treatments were as below:-

T_1 =Diet without paw-paw leaf meal (PLM) (control),

T_2= Diet with 5% PLM,

T_3= Diet with 10% PLM and,

$T_{4=}$ Diet with 15% PLM.

The above feeding trial lasted for 8 weeks (56 days). The poultry house was cleaned, washed and disinfected using Isol™ (cresol) and diazintol™, allowed without stocking for 2 weeks. It was then walled with black polythene in preparation for brooding. On arrival, the day-old-chicks (DOCs) were served with a solution of glucose and vitalyte™ to serve as anti-stress after which they were served ‘’Top Feed’’ commercial starter diet for one week which served as acclimatization period. Then the DOCs were randomly assigned to all the treatments and replicates. All routine vaccinations and bio-security measures were carried out as prescribed by the Veterinary Doctor of the University. The birds were fed twice daily *ad-libitum* by 7.30am and 5.30pm. Clean drinking water from the bore-hole was also offered to them *ad-libitum*. Between starter and finisher phases, the litter materials were replaced with fresh ones.

Data Collection and Statistical Analysis

Feed In-take: This was got daily via weigh-back mechanism by subtracting left-over feed from feed served.

Weekly Body Weight Gain: This was also measured using weekly weigh-back mechanism by subtracting the present week’s weight from that of the previous week.

Feed Conversion Ratio: This was got by dividing the average total feed intake by the average total body weight gain.

All the data were subjected to analysis of variance (Steel and Torrie, 1980). Significant difference between treatments means were separated using Duncan’s New Multiple Range Test (Duncan, 1955).

Results and Discussion:

The result of the proximate analysis of paw-paw leaf is presented in table 3. The result shows 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 leaf. This could be as a result of difference in soil, season and geographical location. It is however higher in CP than *Microdesmis puberula* (17.30%) (Esonu *et al*., 2003), cassava leaf (25.10%) (Iheukwumere *et al*., 2008), neem leaf (24.06%) (Onyimonyi *et al*., 2009), sweet potato (25%) (Wude and Berhan, 2009; Teguia *et al*., 1997), 23.57% and 24.85% for sweet potato leaf as reported by Adewolu, (2008) and Antia *et al*., (2006) respectively, as well as higher than 22.34% for mucuna leaf (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 for broilers (Onyimonyi and Onu, 2009). The crude fibre (CF) content of 8.86% is high when compared to 5.60% by Onyimonyi and Onu (2009) and 7.20%by Antia *et al*. (2006) of sweet potato leaf, 6.20% of *Talinum triangulare*, 6.40% of *Piper guineenses*, 7.0% of *Corchorus olitorius* and 6.50% of *Vernonia amygdalina* (bitter leaf)

(Akindahunsi and Salawu, 2005) but lower than 24.80%, 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 relative low CF makes this leaf a potential feed stuff for monogastrics(Onyimonyi and Onu, 2009). The ash content of 8.88%is however lower than some leaves in Nigeria such as 11% of sweet potato (Antia *et al*., 2006; Adewolu, 2008). It is however higher than some other vegetables like *Occimum graticimum* (8%) and *Hibiscus esculentus* (8%) (Akindahunsi and Salawu, 2005). The relatively high content is a reflection of its deposit of mineral elements (Antia *et al*., 2006). Non starchy vegetables are the richest sources of dietary fibre (Agostoni *et al.*, 1995) and are employed in the management of diseases such as obesity, diabetes, cancer and gastro-intestinal disorders (Saldanha, 1995).

Table 4 shows the performance characteristics of broilers fed diets compounded 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 average initial body weight, average final body weight, average daily body weight gain and feed conversion ratio (FCR). However, in respect to final body weight, the performance was numerically increasing as the inclusion levels of paw-paw leaf meal (PLM) increased from T_2(5% PLM) (1821.94g bwt), T_3(10% PLM) (1826.67g bwt) and T_4(15% PLM) (1893.33g bwt) while the T_1(0% PLM) had 1853.33g bwt. Similar trend characterised the average total body weight gain of T_1 (1648.96g), T_2 (1620.55g), T_3 (1624.65g) and T_4 (1684.67g). This trend is in contradiction with the findings of Opara (1996) and Iheukwumere *et al*. (2008) who found gradual decrease in average weight gains as the levels of inclusion of PLM increased progressively from 1% through 1.5% to 2%. However, this is in tandem with the work of Onyimonyi and Onu (2009) who found progressive increase in weight gain as the PLM was increased between 0.5% and 2%. Other than the control (3.92), T_4 (4.01) demonstrated the best conversion of feed to meat followed by T_3 (4.11) and T_2 (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 also most probable that the better FCR shown by control was due to lower crude fibre compared to the rest of the birds on higher fibre supplied by the PLM since fibrous 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 thus enhancing the release of free amino acids necessary to enhance growth (Onyimonyi and Onu, 2009). This is in agreement with the earlier work of Poulter and Caygill (1985) that papain is an effective natural digestive aid which breaks down protein and cleanses the digestive tract. This also absolves the works of Mohamed *et al*. (1997) who reported that the latex of tropical paw-paw plants is a rich source of class 11 chitinase. These findings also corroborate the work of Ebenebe *et al*. (2011) who found increased weight gain associated with supplementation of PLM in the diet of broiler chicks. The daily feed intake also increased as the PLM progressed in percentage in the diets from T_1 (115.40g), T_2 (119.24g), T_3 (119.27g) and to T_4 (120.69g). The T_1 differed significantly ($P<0.05$) when compared with T_2, T_3 and T_4 but not ($P>0.05$) between T_2 and T_3. When T_4 was compared to others, there was statistical difference ($P<0.05$). The probable reason why there was a progressive increase in feed intake with increasing PLM could be due to increasing fibre content of the feed since animals eat to satisfy their energy requirements (Sahlotaut, 1987; Blaxter, 1989; Coop and Kyriazakis, 2001).

Table 1: Percentage Composition of the Starter Diet

Ingredients (%)	T1	T2	T3	T4
Plm	-	5	10	15
Maize	47	45	45	45
Gnc	25	24	23	22
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

Key: PLM = Paw-paw leaf meal, GNC = Groundnut cake, ME = Metabolisable energy

Table 2: Percentage Composition of the Finisher Diet

INGREDIENTS (%)	T1	T2	T3	T4
PLM	-	5	10	15
MAIZE	40	40	40	40
GNC	22	21	20	19
FISH MEAL	2.5	2.5	2.5	2.5
WHEAT OFFAL	14	10	6	2
PKC	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	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 (%)	22.62	22.68	22.73	22.79
ME (Kcal/Kg)	3479.59	3353.71	3227.83	3101.95

Table 3: Proximate Composition of Paw-Paw Leaf Meal

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 Fed Plm

PARAMETERS	T1	T2	T3	T4	SEM
Av. initial body wt (g)	204.37	201.39	202.02	208.66	1.95
Av. final body wt (g)	1853.33	1821.94	1826.67	1893.33	61.46
Av. total body wt gain (g)	1648.96	1620.55	1624.65	1684.67	56.83
Av. daily body wt gain (g)	29.45	28.94	29.01	30.08	1.23
Av. total feed intake (g)	6462.63^{c}	6677.20^{b}	6679.30^{b}	6758.40^{a}	12.05
Av. daily feed intake (g)	115.40^{c}	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= figures in the same row with different superscripts are statistically different (P>0.05)

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