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Full Length Research

Impact of *Tetrapleura tetraptera* fruit meal on the growth performance and economic evaluation of laying chickens

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ABSTRACT: *Tetrapleura tetraptera* is a medium sized deciduous forest tree with fern-like foliage and highly characteristic fruit. It belongs to the family of *Minosaceae* and is a rich source of phytochemicals and has been reported to have several applications as medicine, spice and preservative. One hundred and fifty (150) pullets at point of lay were used to determine the impact of *Tetrapleura tetraptera* fruit meal on the growth performance and economic evaluation of laying chickens. The birds were randomly selected into five (5) treatment groups in a completely randomized design (CRD) with thirty birds per replicate. Five diets were formulated such that *Tetrapleura tetraptera* fruit meal was added at the rate of 0.0, 0.5, 1.0, 1.5 and 2.0% in treatments 1, 2, 3, 4 and 5 respectively. Feed and water were given *ad-libitum* throughout the research period. Proximate analysis of *Tetrapleura tetraptera* was carried out. Data obtained from the research work showed that growth performance parameters were significant ($p<0.05$) in body weight gain, feed conversion ratio and hen day egg production; while the values for final body weight, daily feed intake, egg weight and average egg number were not significantly ($p>0.05$) affected across the treatment group studied. It can be concluded that the inclusion of *Tetrapleura tetraptera* fruit meal in the diet of laying birds in the first trimester (3 months) of laying did not impact negatively on the bird's overall performance and can be used in laying birds up to the level of 2.0 kg/100kg of diet in laying birds.

Keywords: Economic evaluation, fruit meal, growth performance, laying birds, *Tetrapleura tetraptera*.

INTRODUCTION

Poultry production remains the fastest means to provide animal protein to a protein hungry nation like Nigeria. Poultry meat and egg are still widely consumed with little or no religious or social constraints. Egg has been described as nature's convenience food since it comes in a hygienic pack and can easily be stored and readily opened and cooked. Also, eggs are valuable and acceptable in the diets of younger and older people whose caloric needs are lower and who sometimes have difficulty in chewing certain types of food (Oluyemi and Robert, 2007). Egg is a good source of low-cost high-quality protein providing 6.3 grams of protein (13% of the daily value for protein) in one egg for a caloric cost of only 68 calories (Oluyemi and Robert, 2007).

The average Nigerian does not consume enough protein of animal origin that is needed for nourishing the body, tissue development, repairs and healthy living. This is because animal production in Nigeria has not been able to meet the protein need of increasing Nigeria's population (Jiya *et al.,* 2016). This results in malnutrition experienced among vulnerable groups (children, low income earners, and the poor) who constitute majority in the society at large. The current trend in the cost of feed as well as irregular supply of feed poses a threat to the future of the livestock and poultry industry. The Food and Agricultural Organization (FAO, 2007) reported that feed prices have jumped to a high record and may further increase due to diminishing supply and increasing demand. The cost of

Table 1. Composition of experimental diet.

Ingredients	Treatments				
	T1	T2	T3	T4	T5
Wheat offal	7.50	7.50	7.00	7.00	6.50
Palm kernel cake	12.00	11.50	11.50	11.00	11.00
TFM	0.00	0.50	1.00	1.50	2.00
Total	100	100	100	100	100

*Other feed ingredients had the same value across treatment group: Maize-49.00; Soyabean meal-16.50; Groundnut cake-2.60; Fishmeal-1.00; Limestone-6.50; Bonemeal-4.00; Methionine-0.15; Lysine-0.10; Vitamin premix-0.35; Salt-0.30. *TFM= *Tetrapleura tetraptera* fruit meal.

feeding alone, represents approximately 75% of the cost of poultry production. It therefore becomes very imperative to intensify the search for cheaper, abundant and locally available alternatives that have no dietary value to man for sustainable production (Odunsi *et al.,* 2007). Exploring cheap feed resources for animal production would lower the market price and therefore increase intake of animal protein by the general populace in under-developed countries such as Nigeria.

Tetrapleura tetraptera is a medium sized deciduous forest tree with fern-like foliage and highly characteristic fruit. It belongs to the family of *Minosaceae*. It is locally known in all parts of Nigeria (Nwaeze *et al.,* 2011). It is called by several names by various Nigerian ethnics' groups Nupe, Ikoho, Yoruba, Aridan, Bini, Ighimiakia, Ijaw, Apapa, Ibo, Oshosho, (Uhiokruhio). It is found throughout the high forest zone, in riverine forest, in the southern savannah woodland and in the forest outliers in the African plains. It is a plant of the moist tropical lowlands, where it is found at elevations up to 600 meters. It grows best in areas where annual daytime temperature falls within the range of 25-30°C, but can tolerate 20-35°C. It prefers a mean annual rainfall in the range of 1,700-3,000 mm, tolerating 1,200-5,000 mm (Nweze *et al.,* 2011). It requires a sunny position. It possesses a fragrant and characteristically pungent aromatic odour which is attributed to its insect repellent property. The fruits are green when tender and dark brown when fully ripped. The fruit has both nutritional and therapeutic attributes to man. The fruit measures 15-25cm long. The fruit is distinguished by its four longitudinal ridges that are slightly curved. Two of the ridges are woody while the other two contains soft aromatic pulp. The pod or fruit contains tiny hard seeds that measures approximately 8 mm long (Aladesanmi, 2007).

Terapleura tetraptera as a popular additive in Western and South East Nigeria food has been reported to have several applications as medicine, spice and preservative. The fruits are used for the management of convulsion, leprosy, inflammation, rheumatism, flatulence jaundice and fever. Aladesanmi (2009) reported that *Tetrapleura tetraptera* is a rich source of phytochemicals which contributes its biological and pharmacological activities including cardiovascular, anti-inflammatory, hypoglycemic, hypotensive, neuromuscular, molluscidal and control of intestinal parasites. *Tetrapleura tetraptera* is reported to contain some bioactive substances such as saponin, phenolic compounds, alkaloids, steroid and flavonoids which are responsible for its varied biological and pharmacological activities (Aladesanmi, 2007).

MATERIALS AND METHODS

The research work was conducted at the poultry unit of Teaching and Research farm of Abia State University, Umuahia campus. Fruits of *Tetrapleura tetraptera* were sourced at Eke market in Ishiagu Local Government of Ebonyi State. The fruits were sliced and air-dried for a week after which they were exposed to sunlight for about two hours. They were then ground into meal and incorporated into the compounded diets of the laying birds at the rate of 0.5, 1.0, 1.5 and 2.0% corresponding to treatments 2, 3, 4 and 5; while treatment 1 served as the control without the inclusion of *Tetrapleura tetraptera* fruit meal (Table 1). The complete randomized design (CRD) was used for the research work. A total of one hundred and fifty (150) point of lay birds were randomly selected into five treatment group, each replicated three times with ten birds per replicate. Feed and water were given *ad-libitum* and vaccinations and drugs were administered as at when due. Proximate analysis of *Tetrapleura tetraptera* fruit meal was carried out according to the procedure of AOAC (2005) (Table 2). Data were collected on growth performance parameters and economics of production respectively. Data collected from the research work was subjected to analysis of variance and significant difference means were separated according to the method of Duncan Multiple Range Test as outlined by Obi (2002).

RESULTS

Results obtained for growth performance and economic of production of laying birds for the first 3 months was shown in Table 3. Birds on diet 1 (control) consumed an amount

Table 2. Chemical composition of *Tetrapleura tetraptera* fruit meal.

Ingredients	Content (%)
Dry matter	81.90
Moisture	18.10
Crude protein	7.55
Ether extract	14.50
Crude fibre	18.70
Ash	3.80
Nitrogen free extract	37.35

Table 3. Performance characteristics and Economics of production.

Parameters	Treatments					SEM
	T1	T2	T3	T4	T5	
Initial body weight (g)	1226.67	1216.67	1236.67	1250.00	1283.33	15.85
Final body weight (g)	1488.33	1536.67	1501.67	1546.67	1536.67	11.99
Body weight gain (g)	261.66^{c}	320.00^{a}	265.00^{c}	296.67^{b}	253.34^{d}	6.85
Daily feed intake (g)	126.01	115.76	121.72	117.74	116.26	37.38
Egg weight	63.86	63.42	64.00	62.87	63.03	0.34
Feed conversion ratio	1.97^{a}	1.83^{bc}	1.90^{b}	1.87^{b}	1.85^{b}	0.02
Avg. Egg number	29.94	29.53	27.61	27.94	24.03	1.04
Hen day egg production	85.54^{a}	84.37^{a}	78.89^{b}	79.83^{b}	68.66^{c}	1.65
Cost per kg feed	292.88^{a}	290.99^{a}	292.50^{a}	292.15^{a}	284.05^{b}	1.09
Cost per dozen egg produced	576.97a	532.51d	555.75b	546.32c	525.49^{e}	4.76
Cost of feed consumed/bird	3100.09^{a}	2829.54^{c}	2990.66^{b}	2889.41^{c}	2773.99^{cd}	31.68
Feed cost per kg egg wt.	48.55^{a}	44.62^{b}	46.73^{a}	45.96^{ab}	44.01^{b}	0.50
Cost differential per kg egg	-	3.93^{b}	1.82^{d}	2.59^{c}	4.54^{a}	0.42

^{abc}Means on the same row with different superscripts are significantly ($p<0.05$) different.

of 126.01 g which did not differ ($p>0.05$) from the rest of the birds on diets fortified with the test ingredient. Birds on diets 2, 3, 4 and 5 had daily feed intake values of 115.76, 121.72, 117.74 and 116.26 g respectively. Results showed that birds fed the experimental diet had better body weight gain when compared to the control diet, except those on diet 5. Body weight gain of birds on diet 2 had the highest ($p<0.05$) value of 320.00 g, while the lowest value of 253.34 g was observed for those on diet 5. The effect of dietary treatments on hen day egg production showed that there was significant ($p<0.05$) difference in the values obtained for hen day egg production across the diet groups. Birds on diet 1 and 2 with values of 85.54% and 84.37% had superior ($p<0.05$) values, while the least value of 68.66% hen day egg production can be seen in birds on diet 5. Birds fed diet 3 and 4 had similar ($p>0.05$) values 0f 78.89% and 79.83% respectively. Results showed that birds on diet 1 had the highest feed conversion ratio of 1.97, which differed from the remaining birds on diets fortified with the test ingredient. Feed conversion ratio was least for birds on diet 2 with 1.83 which differed ($p<0.05$) from the values of 1.90, 1.87 and 1.85 observed for birds on diets 3, 4 and 5 which were also similar ($p>0.05$) to each other statistically.

DISCUSSION

The result of the average daily feed intake of layers fed graded levels *Tetrapleura tetraptera* fruit meals showed declining feed intake with increasing levels of inclusion. The average feed intake of birds in the control (diet 1) was significantly ($p<0.05$) higher than the average feed intake of birds on the other diets. This could be due to the high fiber content of the *T. tetraptera* and also due to the stringent strong odour posed by the fruit meal in the diet of the laying birds as poultry birds cannot utilize fibre diet to a large extent. This result was in line with the report of Kana *et al*. (2017) who working with broiler chickens fed diet supplemented with *T. tetraptera* fruit powder as substitute to antibiotics growth promoters reported reduction in feed intake in treatments fortified

with *T. tetraptera* fruit meal. Also, Nweze and Nawankwagu (2011) reported that the inclusion of 4 g/l of aqueous extract and 0.04% of fruit powder of *T. tetraptera* in water and food respectively induced a reduction of feed intake in broiler chickens. They suggested that the decreased feed intake observed could be due to its strong odour which might have negatively affected their appetite. Effect of diets on average daily body weight gain differed significantly ($p<0.05$) among the dietary groups. Higher daily body weight gain was observed in treatments fortified with *T. tetraptera* fruit meal. This could be due to the bioactive substances embedded in the *T. tetraptera* fruit meal (namely; saponin, alkaloid and flavonoids) and also due to the rich mineral and vitamin content in the fruit meal. This enhance weight gain was in line with the observations of Perin *et al*. (2019) who reported that tannin and phenol at low level in chickens usually enhance body weight gain and egg production. Dietary effect on feed conversion ratio showed that there was significant ($p<0.05$) decrease in the feed utilization as the level of *T. tetraptera* increased in the diet of the birds. This contradicts the results obtained by Uchechi *et al*. (2010) where they obtained higher feed conversion ratio in diets supplemented with *T. tetraptera*. They suggested that feeding birds with antimicrobial feed additives can disturb the installation of the digestive microbiota leading to a negative effect on the development of the digestive tract and consequently on overall digestion of the feed. Effect of diet on percentage egg production revealed that there were significant ($p<0.05$) differences among the dietary group, with the highest value of 85.54% recorded for birds fed diet 1. The results showed that there was relatively decrease in percentage hen day egg production as the level of *T. tetraptera* increased in the diets. This could be as a result of the influence of some of the active ingredients present in the *T. tetraptera* which could have decrease blood flow to the ovaries thereby restricting ovarian follicle formation which could have resulted in the decreased egg lay by the birds placed on diets incorporated with *T. tetraptera* fruit meal. The values for hen day egg production in the present study was higher than the values of 54.5-64.3% reported by Aro *et al*. (2009), but similar to the values of 75-79% reported by Dey *et al*. (2011) who worked on laying pullets using neem leaf meal as a hypocholesteromic dietary additive. The result obtained for cost per kg of feed, cost per dozen egg produced, cost of feed consumed/bird and feed cost per kg egg weight showed declining effect as the level of *T. tetraptera* increased in the diet of the birds. This could be partly due to low cost attached to the test ingredient used in the research work since it was readily available within the town where the experiment was carried out which readily cut down the cost of production. This result agrees with the report by Kana *et al*. (2017) who observed similar results of low cost of production in ration supplemented with 0.2% *T. tetraptera*. These results contradict the finding of Nweze and Nawankwagu (2011) who reported high production cost with diet supplemented with phytobiotic. Also, similar result was obtained by Olabode (2015) where he observed relatively better cost advantage in birds fed with neem leaf meal inclusion at the levels of 0, 5, 10 and 15% over the control.

Conclusion

From the research work, it can be concluded that *Tetrapleura tetraptera* fruit meal can be added into the diet of laying birds up to the level of 2.0% (2.0 kg/100kg of diet) without any negative impact or downward trend in the performance and economic of production.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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