Haematology, growth and performance of broiler finishers fed rations supplemented with Indian almond (*Terminalia catappa*) husk and kernel meal

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Abstract

Sixty four Anak 2000 broiler finishers were randomly allocated to four experimental rations of sixteen birds each. The first ration was the standard (basal) finisher ration and served as control. The other rations contained 5 %, 10 % and 15 % Indian almond (husk and kernel) meal respectively as graded replacement (w/w) for wheat offal. The study investigated the performance, organ development, nutrient metabolism and haematological responses of the birds to the diets. Almond meal supplementation improved performance characteristics over basal diets and significantly (P<0.05) enhanced feed intake, growth rate, feed conversion, crude protein and fat retention while haematological parameters were largely unaffected except for an increase in the haemoglobin concentration of almond meal fed broilers. On the whole, almond meal supplementation at 10% was more effective and produced better growth indices than 5 % and 15 % supplementation. Almond seed is therefore a promising feed ingredient that could be cheaply incorporated into poultry rations at 10 % level.

Introduction

The increasingly high cost of livestock production in the tropics demands that alternative sources of feed ingredients be investigated to reduce the current dependence on conventional ingredients. Indian almond (*Taminalia catappa*), is a widely growing shade plant in Nigeria and other higher rainfall areas of West Africa.(Burkill, 1988). The tree is more of an ornamental plant than a feed or food source but provides seasonal fruits that may be more useful for human consumption . The plant fruits twice a year and it is estimated that only about 20 % of the fruit is consumed and the remaining 80 % largely wasted (Burkill, 1988). The fruit however is a good source of nutrients and of industrial importance. The kernel contains between 51 and 65 % of a sweet flavoured oil, a crude protein content of 23.1 % and crude fibre of 9.3 %, (Burkill, 1988). Due to the difficulty in separating the kernel from the husk, the dried husk with the enclosed kernel is usually ground whole to yield a husk/kernel meal containing about 8.3 % crude protein (CP), 30.64% crude fibre (CF) and 3 % fat. This makes the meal a useful alternative to corn and other carbohydrate supplements as it compares favourably well to cocoa husks (Adeyanju and Ilori, 1979), wheat offal and rice bran (Oyenuga, 1968). However, the presence of tannins, cyanogenic glycosides, allergenic substances, and high fibre content (Burkill,1988), limit its incorporation into poultry rations. The need to establish feeding standards for poultry based on experiments performed on the tropics utilizing local feed ingredients has been well emphasized (Olomu, 1979) and in view of the growing awareness of the nutritive values of local plants, herbs and fruits as alternative sources of feed ingredients, studies are needed to provide useful data to complement the scanty information on potentials of local feed materials. As reported by Oluyemi and Roberts (1979), the nutrient needs of starter birds from 0-4 weeks of age are higher in terms of protein and energy ranging between 24 % and 20 % CP decreasing to 16 -19 % CP from 4 - 8 weeks (Ichporari and Ahuja 1974, Virk and Lodli 1979, Hullan and Proudfoot,1981). This study therefore, examines the utilisation of Indian almond meal as a replacement for wheat offal in broiler finisher rations.

Materials and Methods

64 Anak 2000 broilers raised together on the same starter rations, were, at the finishing phase (4 weeks) randomly allocated to 4 experimental rations of 16 birds each. The first ration (A) was the standard (basal) finisher ration and served as control. Rations B, C, and D contained 5 %, 10 % and 15 % Indian almond husk and kernel meal respectively as graded replacement for wheat offal. The Indian almond meal was obtained by sun drying the seeds after removing the pulp and subsequently grinding the dried seeds to a course meal. The proximate composition as determined by the analytical methods of AOAC (1990) is presented in Table1. All the birds were weighed at the beginning of the experiment and feed intake, growth rate and performance evaluated. In the last week (Week 3) of the study, 8 birds from each treatment were transferred into metabolic cages for nutrient retention studies The birds were allowed a 4-day preliminary period for adaptation in the metabolic cages after which weighed quantities of feed based on mean daily feed intake determined earlier was supplied to the animals every day to ensure complete and constant intake of the ration. The study lasted 3 days. The wet faeces were collected every day, oven dried for 24 hours at 85°C and bulked for chemical analysis (AOAC, 1990) and calculation of nutrient digestibility coefficients. The study was terminated at the 8th week of age after which the animals were exsanguinated by decapitation and bled into EDTA (anticoagulant) treated bottles for plasma collection and analysis. The carcasses were dressed, eviscerated and the liver, heart and gizzard dissected out, freed of adhering adipose and membranous tissues and weighed. Packed cell volume (PCV), red blood cell count (RBC), white blood cell (WBC) and haemoglobin were determined by Wintrobe's microhaematocrit, improved Neubauer haemocytometer and cyanometaemogblobin methods respectively. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated as described by Jain, (1986).

All data were subjected to statistical analysis using analysis of variance (ANOVA) and treatment means compared by the Duncan's Multiple range Test (Daniel, 1995)

Results

Tables 1 and 2 show the details of the nutrient composition and proximate analysis of all the rations. The rations were similar in proximate analysis and the CP and energy adequate for birds at that stage of growth. Not unexpectedly, ration D had higher ether extract than other rations. The effect on the feed intake is shown in Table 3 where 15 % almond meal inclusion resulted in significantly lower feed intake than 10 %. The lowest feed intake was recorded with the control diet while almond meal supplementation significantly ($P<0.05$) improved feed consumption with the optimum consumption rate attained at the 10 % level of almond meal inclusion. Table 3 also summarizes the results of the performance and organ weights of the birds on the various rations. The results further showed that birds on the 10 % Indian almond supplemented ration (C) had the highest growth rate ($P<0.05$), followed by the birds on the 15 % inclusion and the lowest growth rate was recorded in the 5 % almond meal supplemented ration. Following the same trend, rate of gain, feed conversion of the birds on ration C (10 % almond meal) was significantly ($P<0.05$) superior to the other diets which were similar to each other. While liver and heart weights were unaffected by the diets, the gizzards of the birds on the control and 5% almond meal supplementation were significantly heavier than birds on the other diets.

In Table 4, Values recorded for the nutrient metabolism analysis showed higher fat and CP retention ($P<0.05$) in almond meal supplemented diets at all levels of inclusion over the control.

Most of the haematological parameters investigated were similar and unaffected by almond meal supplementation except in the haemoglobin concentration where the 5 % and 10 % almond meal supplementation yielded higher haemoglobin counts ($P<0.05$) than the other rations. Almond meal supplementation at all levels also significantly elevated white blood cell count in the broilers on the diets than in the birds on the control diet.

Table 1: Gross composition of the diets for broilers

Ingredients	A	B	C	D
Maize	45.0	45.0	45.0	45.0
Soya bean meal	32.0	32.0	32.0	32.0
Fish meal	2.0	2.0	2.0	2.0
Oyster shell	2.0	2.0	2.0	2.0
Bone meal	2.0	2.0	2.0	2.0
Palm oil	1.0	1.0	1.0	1.0
Salt	.025	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Vitamin/mineral premix	0.25	0.25	0.25	0.25
Wheat offal	15	10.0	5.0	0.0
Indian almond (husk & kernel	0.0	5.0	10.0	15.0
Total	100	100	100	100
Crude protein (%)	21.29	21.83	21.88	21.92
Gross energy(Kcal / kg)	2954.5	2940.96	2953.94	2920.4

Table 2: Proximate composition of the diets fed to broilers

Proximate Analysis	A Control	B 5% Almond	C 10% Almond	D 15% Almond
Dry matter	89.59	90.06	89.86	89.97
Moisture %	10.41	9.94	10.14	10.03
Crude Protein %	20.07	19.91	19.81	20.78
Ether extract %	7.25	8.32	8.65	10.31
Crude Fibre %	6.96	7.12	7.46	8.12

Table 3: Performance indices and organ weights of broilers fed rations supplemented with Indian almond husk and kernel meal

Performance Indices	A Control	B 5% Almond	C 10% Almond	D 15% Almond
Mean weekly consumption (g)	597.5±22.41^{b}	560.7±12.09^{c}	665.1±10.09^{a}	617.4±15.4^{b}
Mean weekly weight gain (g)	215.3±11.02^{b}	109.6±6.24^{b}	388.5±7.01^{a}	258.9±5.35^{ab}
Mean weekly feed conversion	2.05±0.16^{b}	2.30±0.12^{b}	4.83±0.08^{a}	2.92±0.23^{b}
Mean liver Weight (g)	3.69±0.08	3.33±0.06	2.63±0.16	2.60±0.44
Mean gizzard weight (g)	5.50±0.92^{a}	5.53±0.45^{a}	2.63±0.32^{b}	3.43±0.33^{ab}
Mean heart weight (g)	3.1±0.63	1.89±0.04	2.28±0.42	3.60±0.79

Values are means ± SEM

Means across the same row differently superscripted differ significantly (P<0.05)

Table 4: Nutrient metabolism of broilers fed rations supplemented with Indian almond husk and kernel meal

Metabolic Indices	A Control	B 5% Almond	C 10% Almond	D 15% Almond	SEM
Mean Faecal dry matter %	90.99	89.79	90.22	89.08	0.055
Mean Faecal moisture %	9.05	10.26	9.78	10.85	0.24
Mean Faecal Crude Protein %	22.21	23.22	23.77	24.64	0.006
Mean Faecal crude fibre %	6.18^{b}	6.05^{b}	10.46^{a}	8.88^{b}	1.15
Mean Crude protein retention %	5.5^{b}	16.62^{a}	19.99^{a}	18.57^{a}	2.28
Mean fat retention %	63.66^{b}	73.08^{a}	74.32^{a}	80.21^{a}	3.63

Values are means ± SEM

Means across the same row differently superscripted differ significantly (P<0.05)

Table 5: Haematological parameters of broilers fed rations supplemented with Indian almond husk and kernel meal.

Haematological Analysis	A Control	B 5% Almond	C 10% Almond	D 15% Almond
Haemoglobin (Hg) %	6.95±0.22[b]	9.81±0.14[a]	8.75±1.11[a]	7.30±1.02[ab]
Packed Cell Volume (%)	21.0±1.81[b]	30.50±0.35[a]	36.00±0.22[a]	22.50±3.52[b]
Red Blood Cell Count ($X10^6$)	1.985±0.4	2.89±0.15	2.25±0.09	2.14±0.38
White Blood Cell Count ($X10^3$)	15.95±0.354[b]	19.25±0.145[a]	20.15±0.883[a]	20.475±0.224[a]
Mean Corpuscular Volume (fl)	108.66±7.2	105.97±2.53	116.23±6.99	105.37±8.45
Mean Corpuscular Haemoglobin Concentration (%)	33.165±0.26	32.15±0.83	32.16±1.47	32.19±0.72
Mean Corpuscular Haemoglobin (pg)	36.67±3.68	34.14±2.24	39.07±1.28	33.91±1.22

Values are means ± SEM
Means across the same row differently superscripted differ significantly ($P<0.05$)

Discussion

Table 2 presents the proximate composition of the rations. All the rations had adequate CP, CF and energy as recommended by earlier workers but the fat content of the almond meal diets were higher than levels in conventional diets (Faniyi, 2002, Babatunde and Oluyemi, 2000). Although literature on the utilisation of Indian almond meal (AM) is scanty, the results of this study justify its incorporation into livestock diets as the performance of the birds do not reveal any decline in performance and organ weights due to AM supplementation. While birds must necessarily increase their feed consumption as they grow older, the higher feed intake, feed efficiency and performance observed in birds on almond meal supplemented diets might be due to the improved acceptability of the diets due to the chemical properties of AM. The 10 % level of AM inclusion appears to be better than 15 % level of inclusion. This may be due to the higher fibre and fat content of the 15 % AM supplementation. High fibre in poultry diets promotes easy passage of materials and reduce feed intake (Weber and Thompson, 1981). While oils and fats are good sources of essential fatty acids and boost growth in poultry, high fat content also depresses feed intake and nutrient utilization (Weber and Reid, 1975).

The similar organ weights recorded (except in the gizzards) recorded in the birds on the dietary rations provide further proof of the suitability of AM in poultry diets. The higher crude protein retention and fat retention show the contribution of AM to the nutritional quality of the diets.

The haematological values recorded for the birds on all the rations though statistically different in haemoglobin and white blood cell count are within normal range recorded for poultry (Gupta and Paul, 1972, Jain 1986). This is not unexpected as Adejumo and Akpokodje (1990) have noted that many haematological parameters have a positive correlation with each other. The higher haemoglobin concentrations in the AM supplemented meals may suggest improved iron or mineral profile in those rations but this and the high white blood cell count in the AM diets would need further investigation to determine mineral levels and possibly microbial counts in the sun-dried meal before incorporation into the diets.

Summarily, this study suggests that Indian almond husk and kernel meal could be safely incorporated into poultry finisher rations up to 15 % inclusion level without adverse effects. However from the data presented here, an inclusion level of 10 % appears to be adequate.

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