Response of broiler chicks to diets containing varying levels of cashew nut oil and palm oil

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SUMMARY

Chemical characterization of palm oil (PO) and cashew nut oil (CNO) involving saponification value, iodine number and degree of acidity were carried out. Both oils were included in diets of starting broilers (0 - 4 weeks) at three levels (10, 25 and 50 g/kg) as energy supplements in replacement of the maize in a basal control diet. At the finisher phase (5 - 8 weeks), the birds were fed a common broiler finisher diet to investigate the carry-over effects of starter dietary treatments on finishing broiler performance. Results indicated that birds fed PO gave comparable performance with those on control diet while increasing levels of CNO resulted in a consistent decrease (P <0.05) in feed intake and weight gain. Mortality and feed efficiency were adversely affected at levels more than 10 g/kg CNO. At the finisher phase, birds on 10 and 25 g/kg CNO had a rapid performance recovery rate which was not markedly evident with the 50 g/kg CNO. It appears that CNO should be neutralized before incorporation in broiler starter diets at levels more than 10 g/kg.

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RÉSUMÉ

ODUNSI, A. A. & OYEWOLE, S. O. : *La réaction de poussins à rôtir aux régimes contenant les niveaux variables de l'huile de noix de cajou et l'huile de palme.* La caractérisation chimique d' huile de palme (PO) et d' huile de noix de cajou (CNO) entraînant la valeur de saponification, le numéro d' iode et le degré d' acidité étaient effectués. Les deux huiles étaient inclu dans les régimes des rôtisseries de départ (0-4 semaines) à 3 niveaux (10, 25 et 50 g/kg) comme les suppléments d' énergie en remplacement du maïs dans un régime de contrôle basal. A la phase finale (5-8 semaines) les oiseaux étaient nourris avec le régime terminal d' une rôtisserie commune pour enquêter les effets traversants des traitements de régime de départ sur la performance de rôtisserie de finalité. Les résultats indiquaient que les oiseaux nourris avec PO donnaient une performance comparable avec ceux du régime de contrôle alors que l' accroissement des niveaux de CNO a abouti en une diminution logique (P<0.05) dans la consommation de régime et le gain de poids. La mortalité et l' efficacité de régime étaient défavorablement affectées à des niveaux plus que 10 g/kg CNO. A la phase finale, les oiseaux sur 10 et 25 g/kg CNO avaient une performance rapide de la proportion de récupération qui n' était pas évident d' une façon marquée avec le 50 g/kg CNO. Il paraît que CNO devait être neutralisé avant l' incorporation dans les régimes de rôtisserie du départ aux niveaux plus que 10 g/kg.

Introduction

Various oils and fats from both plant and animal sources have been incorporated in poultry diets to boost the energy content (Fajimi *et al.*, 1993; Shen, Summers & Leeson, 1985). Such diets have been found to enhance growth, feed efficiency and improved the physical appearance of feeds which encourages consumption (Summers, 1984).

The cashew tree (*Anarcadium occidentala*) is an oilseed which grows abundantly in Nigeria. The fruit consists mainly of the apple which is consumed and the cashew nut that is grossly under-utilized (Ojeh, 1986). Serres (1992) observed that there are few experimental results available on the use of cashew fruits or its by-products. During the processing of raw cashew

nuts, about 60-65 per cent are of commercial value while 35-40 per cent are discarded as broken nuts or as nuts scorched during roasting (Olujobi, 1994). Products of raw cashew nuts include kernels used for domestic consumption after frying or roasting; shells for board making or as source of fuel, and cashew nut shell liquid commonly called cashew nut oil which has various chemical industrial and medicinal uses (Wilson, 1975; Haendler & Duverneuil, 1970). There is, however, a dearth of information on the value of cashew nut oil to livestock.

Palm oil is commonly used in poultry diets (Fajimi *et al.*, 1993; Ogunmodede & Ogunlela, 1971) and as it is becoming scarce and expensive, it was the aim of this study to assess the utilization of cashew nut oil in comparison with palm oil in broiler chick diets.

Materials and methods

The study was conducted during the months of September and October when the mean monthly rainfall was 233.5 mm and average daily temperature was 27.9 °C. The cashew nut shell liquid referred to as cashew nut oil (CNO) was supplied by Cashew nut Processing Industries, Eleyeile, Ibadan while other ingredients were obtained from Farmers' Depot, Ijebu-Ode. Palm oil was bought from the open market.

Two hundred and eighty, day-old unsexed Anak 2000 broiler chicks were randomly assigned to seven dietary treatment groups each consisting of 40 birds and each group subdivided into two replicates of 20 birds each. A control diet (230 g/kg crude protein and 12.34 ME MJ/kg with no oil was formulated as in Table 1. Three levels (10, 25 or 50 g/kg) of either PO or CNO were added

TABLE 1

Composition of Diets (g/kg)[1] fed during the Starter and Finisher Phases

Component	*Control*	*Diets*						*Broiler finisher*
		PO(g/kg)			*CNO(g/kg)*			
		10	*25*	*50*	*10*	*25*	*50*	
Maize	594.0	584.0	569.0	544.0	584.0	569.0	544.0	590.0
Palm oil	-	10.0	25.0	50.0	-	-	-	-
Cashew nut oil	-	-			10.0	25.0	50.0	-
Groundnut cake	328.0	328.0	328.0	328.0	328.0	328.0	328.0	287.0
Fish meal (72%)	40.0	40.0	40.0	40.0	40.0	40.0	40.0	20.0
Rice husk	-	-	-	-	-	-	-	65.0
Fixed	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Total	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0
Determined analysis (g/kg)								
Crude protein	230.0	229.5	228.4	226.8	229.0	228.8	225.6	203.4
Crude fibre	57.7	57.5	57.2	56.7	57.4	57.0	56.5	60.1
Ether extract	50.1	59.7	74.1	98.1	56.5	68.4	98.2	51.4
Ash	30.7	30.6	30.4	30.0	30.4	30.3	30.0	32.6
ME[2](MJ/kg)	12.33	12.54	12.83	13.29	12.50	12.75	13.13	11.79

[1]Feed ingredients providing g/kg diet: bone meal, 20; oyster shell, 10; salt, 255; methionine, 200; lysine, 1.0 and vitamin-mineral, 2.5 supplying per kg of diet; vitamin A, 9000 iu; vitamin D3, 1.250 iu; vitamin E, 71 i.u.; riboflavin, 6mg; vitamin B3, 22 mg; vitamin B5, 14 mg; lysine, 120 mg; methionine, 64 mg; choline chloride, 24 mg; Mn, 60 mg; Fe, 35 mg; Cu, 5 mg; Iodine, 1 mg; Se, 0.1 mg; antioxidant, 125 mg.

[2] Calculated.

to the control diet to partially replace maize and fed to the broiler chicks during the starter phase (0 - 4 weeks). At the finisher stage (5 - 8 weeks), all the birds were fed a common broiler finisher diet (200 g/kg crude protein and 11.79 ME MJ/kg). Feed and water were provided *ad libitum*. Weekly weight gain, feed consumption and records of mortality were kept. All vaccinations and medications were administered when necessary.

Diets were analyzed for proximate contents and chemical constants (iodine number, saponification value and degree of acidity) of CNO and PO were determined (AOAC, 1990). Data collected were evaluated by analysis of variance (Steel & Torrie, 1980) and the Duncan's multiple range test (Gomez & Gomez, 1985) was used to separate means at 5 per cent level of probability.

Results and discussion

The iodine number, saponification value and degree of acidity of cashew nut oil (CNO) compared with palm oil (PO) are 197 vs 64.7; 288 vs 215 and 48 vs 0.64 respectively. The saponification value of CNO showed that it contains short-chain fatty acids of low molecular weight while the high degree of acidity is an indication of the 90 per cent anarcadic acid and 10 per cent cadol that it contains (Kochhar, 1986). CNO have higher iodine number and saponification value than rubber seed or melon seed oils (Uzu *et al.*, 1986) and palm kernel or coconut oils (Young, 1983). It will, therefore, be less saturated and relatively unstable against oxidation, thereby leading to rapid rancidity when added to diets.

Productive performances during the starter,

TABLE 2

Performance of Broiler Chicks on Different Dietary Treatments during 0-4, 5-8 and 0-8 week Periods

		PO(g/kg)			*CNO(g/kg)*			
Parameters	*Control*	*10*	*25*	*50*	*10*	*25*	*50*	*SEM*
Feed intake, g								
0 - 4	48.66^{a}	50.05^{a}	50.19^{a}	50.70^{a}	49.82^{a}	39.42^{b}	30.24^{c}	7.65
5 - 8	88.16	87.20	87.08	86.70	87.84	90.86	86.47	7.20
0 - 8	68.41	68.63	68.64	68.70	68.63	66.64	59.35	6.72
Weight gain, g								
0 - 4	32.39^{a}	32.90^{a}	35.84^{a}	33.40^{a}	32.37^{a}	21.87^{b}	13.70^{c}	6.82
5 - 8	39.68	38.97	37.90	40.07	41.00	42.75	41.64	8.53
0 - 8	36.04^{a}	35.93^{a}	36.87^{a}	36.73^{a}	36.65^{a}	32.74^{a}	27.98^{b}	11.53
Feed efficiency; g/g								
0 - 4	1.50^{c}	1.52^{c}	1.40^{c}	1.52^{c}	1.54^{c}	1.80^{b}	2.21^{a}	0.14
5 - 8	2.21	2.24	2.30	2.16	2.14	2.13	2.08	0.63
0 - 8	1.90^{a}	1.91^{a}	1.86^{a}	1.87^{a}	1.87^{a}	2.04^{b}	2.12^{b}	0.15
Mortality, per cent								
0 - 4	10.0^{c}	7.50^{c}	5.00^{c}	2.50^{c}	10.00^{c}	20.0^{b}	45.0^{a}	8.10
5 - 8[1]	-	-	-	-	2.78^{b}	8.40^{b}	19.17^{a}	2.41
0 - 8	10.0^{a}	7.5^{a}	5.0^{a}	2.5^{a}	12.5^{a}	27.5^{b}	55.0^{c}	6.89

a,b,c - Means bearing different superscripts on the same row are significantly different ($P<0.05$).

[1]Percentage mortality based on number of chicks started with at the 5th week.

finisher and combined starter/finisher phases are shown in Table 2. At the starter phase, feed intake and weight gains were not significantly different among control, PO-supplemented and 10 g/kg CNO based diets. Consumption and weight gain, however, progressively declined at 25 and 50 g/kg CNO levels. Dietary fat which results in a higher energy diet will reduce intake which may also cause a reduction in weight gain. Apparently, the higher metabolizable energy at 25 or 50 g/kg CNO diets could not have solely accounted for the 19 or 38 per cent decrease in consumption relative to the control diet when the opposite was observed with PO-supplemented diets. Possibly, the utilization of other dietary components were altered at higher levels of CNO; the presence of unsaturated fatty acids in CNO, which on auto-oxidation complex with vitamin A, may render it unavailable and the acidic nature of the oil (Kochhar, 1986) makes it unacceptable to birds ultimately affecting absorption of feed nutrients.

The feed consumed appeared hardly adequate for maintenance hence the 33 and 58 per cent weight depression recorded by 25 g/kg and 50 g/kg CNO-fed birds respectively. Birds on 25 g/kg PO had the best value for feed efficiency while the poorest value was recorded on the 50 g/kg CNO diet. Mortality decreased with increase in PO but increased with CNO. Higher mortality was recorded for birds fed the control (fat-free) diet than PO diets. These observations may be related to the increasing level of vitamin A as dietary PO increased and a decreasing level as CNO increased. Chicks on CNO diets showed symptoms like weakness, uncoordinated movements, ruffled feathers, conjuctivities, occulonasal discharge, sticking of eyelids which are suspected to be those of vitamin A deficiency, wasting and, eventually, death.

At the finisher phase, there was a compensatory growth for chicks started on CNO diets. They gained weight much more rapidly even though the differences were not significant. Those fed 25 g/kg CNO diet were able to recover and had similar appearance with control birds corroborating the observations of Pokniak, Avaria & Cornejo (1984) that broilers have a remarkable capacity to overcome severe posthatching nutritional stress even if they are subjected to a period of intense feed restriction for 25 and 50 per cent of their commercial life span. Birds on 50 g/kg CNO diet did not fully recover and would need a longer time before attainment of normal weight suggesting a prolonged influence of the harmful effects of CNO. The overall feeding period (0 - 8 weeks) revealed only a significant reduction in feed intake and weight gain for the 50 g/kg CNO diet while feed efficiency was depressed at 25 and 50 g/kg CNO levels.

The findings in this trial suggests that CNO is inferior to PO in absorbability, nutritive and energy values apart from its highly depressive attributes at levels more than 10 g/kg. Supplementation with vitamin A and neutralization of oil are possible areas of future investigations.

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