Effect of Graded Dietary Levels of Neem (*Azadirachta indica*) Seed Kernel Cake on Carcass Characteristics of Broiler Rabbits

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ABSTRACT : Rabbits (48) of Soviet chinchilla (24) and White giant (24) were fed from 6 weeks to 12 weeks of age intensively on either of four isonitrogenous - isocaloric diets containing 0 (D_1), 5 (D_2), 10 (D_3) and 20 (D_4) percent raw neem seed kernel cake (NSKC), respectively as per NRC (1977) requirements in a Randomized block design and slaughtered at the end to find out differences in their carcass traits due to NSKC feeding. Dietary treatment had no significant effect on weight of edibles and inedibles and their percentages and dressing percentage in terms of carcass, carcass with pluck and carcass with pluck and head. Similarly, the meat-bone ratio of various primal cuts and overall carcass, yield of edibles per unit of inedibles and eye muscle area were not influenced due to the dietary variations. Chemical composition of fresh meat, and organoleptic evaluation of cooked meat with and without salt did not vary significantly due to incorporation of NSKC in the diets. The rabbits fed 20% NSKC (D_4) though consumed more ($p<0.05$) DM and DE per kg meat production, the intake of crude protein and total digestible nutrients was similar with other dietary treatments. Feed cost per unit meat production was, however, lower on 5 and 10% NSKC containing diets by 7.75 and 12.56%, respectively, as compared to deoiled ground nut cake containing control diet. It appears that NSKC could be used as a wholesome vegetable protein supplement upto 10% in the diet of rabbits without any adverse effect on commercial carcass traits. (*Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 8 : 1246-1250*)

Key Words : Broiler Rabbits, Neem Seed Kernel Cake, Carcass Traits, Nutrient Intake

INTRODUCTION

Rabbit husbandry is being recognized as crucial in meeting the critical meat shortage in developing countries (Owen, 1981) owing to its high potential in producing quality meat. Like other livestock species, economic rabbit production is, however, constrained by chronic shortage of feeds and fodder. Under these circumstances, most of the animal production systems in the tropics are gradually relying more on unconventional feed resources. Neem (*Azadirachta indica*) seed kernel cake (NSKC), a by-product of neem oil industry, is one such product showing great potential for livestock feeding (Nath et al., 1974). Recent reports indicate that it can be fed to rabbits in limited amount without any adverse effect (Fuzinimi et al., 1990; Salawu et al., 1994; Bhosale, 1994). However, vital information is lacking on various carcass traits of broiler rabbits as affected due to feeding of raw NSKC. Studies were, therefore, conducted to see the effect on the carcass characteristics of broiler rabbits by graded dietary levels of NSKC as a substitute for conventional protein supplement.

MATERIALS AND METHODS

Animals and management

Fourty eight, 6 weeks old mixed group of Soviet chinchilla (SC, 24) and White giant (WG, 24) rabbits were randomly allotted to four dietary treatments in a randomized block design. All the rabbits were reared under hygienic and uniform managerial conditions by housing them individually in clean metallic cages, fitted with feeders and waterers, located in well ventilated cement floored shed. Clean drinking water was provided *ad libitum*. The rabbits were dewormed with Mebex (Mebendazole-IP-40 mg/g; M/S Cipla Ltd. Bangalore, India) at fortnightly intervals.

Feeds and feeding

The rabbits were fed *ad libitum* iso-nitrogenous and iso-caloric composite [25 parts ground maize (*Zea mays*) hay, 75 parts concentrate] diets as per NRC (1977) requirements for growing rabbits. The respective experimental diets containing graded levels (0, D_1; 5, D_2; 10, D_3; 20, D_4% in the diet) of NSKC (g/kg DM : organic matter, 843; crude protein, 337; ether extract, 86; crude fibre, 136; nitrogen free extract, 284; Ash, 157) in place of 0,25, 50 and 100% of de-oiled ground nut cake (DGNC) nitrogen (table 1) were fed from 6 to 12 weeks of age.

Carcass studies

At the end of 6 weeks experimental feeding all the rabbits were slaughtered after starving them for 12 hr by Halal method (Ramayyan et al., 1980). Bleeding, skinning and evisceration were done as per the routine conventional procedures. Empty hot carcass weight included the cod fat but not any other fat or offal. The carcas was split into four primal cuts-fore legs,

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Table 1. Ingredient and chemical composition of diets

Ingredient/Constituent	Diet[1]			
	D_1	D_2	D_3	D_4
Ingredients, % air dry feed				
Maize hay (ground)	25	25	25	25
Yellow maize	35	35	35	35
Deoiled ground nut cake	18	13.5	9	0
Neem seed kernel cake	0	5	10	20
Meat meal	8	8.5	8.5	9.5
Wheat bran	5.5	4	3	0
Molasses	5	5	5	5
Tallow	1.0	1.5	2.0	3.0
Mineral mixture[2]	2.0	2.0	2.0	2.0
Sea salt	0.5	0.5	0.5	0.5
Chemical composition, % Dry matter				
Organic matter	89.3	89.2	88.8	87.5
Crude protein	16.5	16.2	16.5	16.4
Ether extract	5.3	5.7	6.7	8.7
Crude fibre	10.7	10.3	10.7	12.0
Nitrogen free extract	56.8	57.1	54.9	50.5
Ash	10.7	10.8	11.2	12.5
Neutral detergent fibre	43.7	43.6	44.1	43.2
Acid detergent fibre	16.6	15.6	16.1	17.1
Digestible crude protein[3]	11.2	11.2	11.5	10.9
Total digestible nutrients[3]	63.3	63.5	64.0	62.2
Gross energy (kcal/g DM)	4.5	4.4	4.3	4.5
Digestible energy (kcal/g DM)[3]	2.7	2.6	2.5	2.6

[1] Added 30 g vitablend (M/s Glaxo, Bombay) containing 50,00 IU and 5,000 IU of vitamin A and D_3 per g respectively, 50 g Terracycline HCl (50 μg/g) (M/s Hoechst India Ltd., Bombay) and 50 g Duocoxin (Sulpha-Quinoxaline, 16.67%; Amprolium HCl, 16.67%) as coccidiostat (M/s Dynamic Pharmaceutical Pvt. Ltd., Bombay).

[2] The mineral mixture contained (g/kg) : calcium, 284; phosphorus, 149; potassium iodide, 2.5; copper, 1.2; manganese, 1; cobalt, 1; sulphur, 1.5 and iron, 5.

[3] Adapted from Vasanthakumar (1995).

chest, loin and hind legs. The hind legs were separated by sharply cutting across the carcass immediately in front of hip joint. The lion was separated from the chest at the last rib. Fore legs were removed from the chest by separating muscles between scapula and ribs (Hiner, 1962). The primal cuts were further separated into lean and bones to arrive at bone : meat ratio in each cut and total carcass. The weight of primal cuts were expressed as percentage of empty hot carcass weight.

The weight of inedible offals (blood, pelt, trouts, tail, gut, lungs with trachea) and edible organs (heart, liver, kidney and dressed head) were recorded soon after slaughter and expressed as percentage of liveweight. The ratio between edibles and the sum of inedibles was used to calculate the yield of edibles per unit of inedibles.

The dressing percentage of empty carcass, carcass with pluck and carcass with pluck and dressed head were expressed on fasted pre-slaughter weight (Lukefar et al., 1982). The eye muscle (Longismus dorsii) area was measured in sq. cm with the help of graph paper.

Organoleptic evaluation

Meat samples pooled from each dietary treatment were pressure cooked (10 psi) with salt (1.5%, w/w) and without salt and were subjected to organoleptic evaluation on 7 point Hedonic scale by a panel of 7 semi-trained judges to assess the appearance (based on reflection of colour, marbling, distribution of muscles and connective tissues, firmness and wetness of surface), odour, taste, texture, tenderness, juciness and its overall acceptability (Keeton, 1983). The loss on cooking was expressed as percentage of raw muscle weight reduced by cooking the meat at about 115℃ for 10 minutes after attaining the come up time in a domestic pressure cooker.

Chemical and statistical analysis

The representative meat samples collected from all the primal cuts of sacrificed rabbits were mixed and minced thoroughly after removing the visible fat for chemical analysis in terms of moisture, crude protein, ether extract and ash (AOAC, 1980).

The experimental data were subjected to analysis

of variance as per the methods of Snedecor and Cochran (1967) by programming and proccessing on a computer.

RESULTS AND DISCUSSION

Carcass traits

Differences among dietary groups were non-significant ($p>0.05$) for the pre-slaughter weight and any of the carcass traits including percent yield of edibles and inedibles and meat : bone ratio in the rabbits sacrificed after 6 weeks of experimental feeding (table 2). Similarly, the dressing percentage did not differ due to incorporation of NSKC in the diet. The effect of breed and diet × breed interaction on dressing percentage was also non-significant. The dressing percentage (carcass with pluck and head) varied between 54.6-57.7, irrespective of dietary treatment. Centoducanti et al. (1990) observed a better carcass yield on 16% dietary CP than 18 or 21%. However, Abdella et al. (1988) reported no significant difference in dressing percentage among rabbits fed 16, 18 or 20% CP. In the present study, though rabbits consumed lesser DE than the stipulated requirements of NRC (1977), it did not influence the dressing percentage. Better dressing percentage was obtained with 15% CP and 2.5 kcal DE/g DM in Californian and Newzealand rabbits (Hemid et al., 1988) which compared well with CP (16%) and DE (2.6 kcal/g) values of various NSKC incorporated diets in this experiment.

Except for higher ($p<0.05$) percentage yield of leg and loin on the diets D_2 and D_3, the yield of other primal cuts did not differ significantly among the dietary treatments. The incorporation of NSKC in the diets had no significant effect on meat-bone ratio of various primal cuts as well as overall carcass and yield of edibles per unit of inedibles (table 2). The average bone-meat and inedible-edible ratio ranged from 1.88-2.08 and 1.64-1.75, respectively. Non-significant difference was observed in eye muscle area representing the leanness of carcass in broiler rabbits. Similar observations were recorded by Gowda (1994) and Khan (1994) in New Zealand White rabbits fed ammonia treated NSKC supplemented diet.

Chemical composition

None of the chemical constituents, like moisture,

Table 2. Carcass characteristics of rabbits

Attribute	Diets				SEM
	D_1	D_2	D_3	D_4	
Pre-slaughter weight, g	1388.0	1391.3	1413.7	1277.8	88.8
Carcass weight, g	632.6	630.6	646.7	543.6	52.3
Carcass weight with pluck, g	686.4	686.6	702.7	597.4	55.0
Carcass weight with pluck and head, g	779.3	779.5	796.5	686.0	58.9
Dressing percentage					
Carcass	44.5	46.0	46.7	43.1	0.1
Carcass with pluck	50.5	50.2	50.8	47.4	1.3
Carcass with pluck and head	57.4	57.1	57.7	54.6	1.2
Primal cuts					
Fore legs weight, g	103.7	107.9	113.3	97.4	8.7
Forelegs, %	16.6	17.1	17.6	18.0	0.6
Bone:Meat ratio (B:M) in forelegs	2.4	2.2	2.5	2.0	0.2
Chest weight, g	118.6	118.5	124.4	106.3	11.2
Chest weight, %	18.8	18.8	19.2	19.4	0.6
B:M in chest	0.98	0.84	0.86	0.99	0.2
Loin weight, g	146.9	169.0	168.0	135.8	4.6
Loin, %**	23.3^{a}	24.5^{ab}	25.8^{c}	25.2^{bc}	0.6
B:M in loin	2.4	2.2	2.0	2.0	0.2
Hind legs weight, g	226.0	246.0	236.9	201.4	20.3
Hind legs, %*	36.5^{a}	38.3^{b}	36.7^{a}	37.0^{a}	0.5
B:M in hind legs	2.8	2.5	2.6	2.6	0.2
Overall B:M ratio	2.7	1.9	1.9	1.9	0.1
Overall inedible:edible ratio	1.6	1.7	1.7	1.6	0.1
Eye muscle area, sq cm	1.8	1.9	2.1	1.5	0.2

^{a,b,c} Means with different superscripts in a row differ significantly : *$p<0.05$, **$p<0.01$.

crude protein, ether extract and ash in the fresh meat of rabbits, differed significantly due to dietary variations (table 3) similar to the observations of Gowda (1994) and Bhosale (1994) in rabbits fed processed NSKC incorporated diets.

Table 3. Chemical composition (% on fresh basis) of rabbit meat

Attribute	Diets				SEM
	D_1	D_2	D_3	D_4	
Moisture	75.7	75.6	75.5	75.5	0.15
Ether extract	1.9	1.9	1.9	1.9	0.02
Crude protein	20.4	20.3	20.3	20.3	0.06
Ash	1.7	1.6	1.6	1.6	0.04

Organoleptic evaluation

Sensory attributes of pressure cooked meat with and without salt, were found similar as judged by 7 member semi-trained taste panel on 7 point Hedonic scale, including appearance (as reflection of colour, marbaling, muscles/connective tissue distribution, firmness and wetness of surface), taste, odour, texture, juciness, tenderness and overall acceptability (table 4). The percent cooking loss of meat ranged from 26.3 to 28.0 (without salt) and 28.2 to 29.8 (with salt). It appears that neem bitters present in NSKC did not impart any bitter taste or odour. Similarly, no difference was evident in the percent loss of raw muscle weight between NSKC incorporated composite diets and control (D_1). Comparable scores and no-untoward taste were reported by earlier workers in pork and meat of rabbits fed processed NSKC (Sushil kumar et al., 1989; Khan, 1994; Gowda, 1994; Bhosale, 1994).

Nutrient intake

Consumption of various nutrients per kg meat production is presented in table 5. The rabbits fed diet with 20% NSKC-(D_4) consumed significantly ($p<0.05$) more DM and DE as compared to those on other diets which had similar levels of intake. However, the intake of other nutrients per kg meat production during this period was comparable among the rabbits, irrespective of diet.

Though the feed cost (Rs./kg production) did not vary significantly due to dietary variations, it was numerically lower on D_2 and D_3 by 7.8 and 12.6%, respectively as compared to that on GNC containing diet (D_1). The lower cost of composite diets having NSKC was not reflected in terms of feed cost per unit meat production because of compensatory higher intake of these low energy density diets corroborating the findings of Huang et al. (1989).

The findings of the experiment suggest that NSKC may be used as a wholesome vegetable protein supplement up to 10% for shorter period during fryer stage without any adverse effect on commercial carcass characteristics.

Table 4. Organoleptic evaluation of broiler rabbit meat

Attribute	Diets				SEM
	D_1	D_2	D_3	D_4	
Without salt					
Appearance	6.1	6.0	6.1	6.1	0.55
Odour	5.9	5.9	5.9	5.9	0.05
Taste	5.9	5.8	5.9	5.8	0.05
Texture	6.1	6.1	6.0	6.1	0.04
Tenderness	5.9	5.9	6.0	6.0	0.04
Juiciness	6.0	6.1	6.1	6.1	0.44
Overall acceptability	6.1	6.2	6.2	6.2	0.03
With salt (1.5% w/w)					
Appearance	6.1	6.2	6.2	6.2	0.04
Odour	5.9	6.0	6.0	6.1	0.06
Taste	6.1	6.1	6.0	6.0	0.06
Texture	5.9	6.0	5.9	5.9	0.06
Tenderness	5.9	6.0	6.1	6.0	0.04
Juiciness	5.9	6.0	6.0	6.0	0.05
Overall acceptability	6.2	6.2	6.2	6.2	0.05

Table 5. Nutrient intake (kg or Mcal) per kg meat production

Attribute	Diets				SEM
	D_1	D_2	D_3	D_4	
Edible meat, g	241.6	271.1	281.1	186.9	35.7
Intake per kg meat					
Dry matter*	10.7^a	10.1^a	9.9^a	13.7^b	2.5
Crude protein	1.8	1.6	1.6	2.2	1.3
DCP	1.2	1.1	1.1	1.5	0.1
TDN	6.7	6.4	6.3	6.5	2.4
DE*	28.7^{ab}	26.3^a	25.1^a	36.2^b	3.5
Feed cost/ kg gain (Rs.)[1]	28.7	26.1	24.9	29.6	2.42

Means with different superscripts in a row differ significantly, *$p<0.05$.

[1] US$ 1 = Rs. 42.0

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