Effect of dietary supplementation of *Pulvis Curcuma Longa* on the voluntary feed intake, nutrient digestibility and Growth performance of Broiler rabbits under summer stress

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Abstract

Eighteen four weeks' old weaned Broiler rabbits of comparable body weights were allotted to three dietary treatment groups of six rabbits in each group namely T0 (basal control diet, T1 (basal diet added with Turmeric (*Curcuma longa*) Rhizoid Powder, TRP, at the ratio of 150mg) and T2 (basal diet added with TRP at the ratio of 300mg/100g diet). Feeding cum growth trial and digestion trial were during summer months of April, May and June to study voluntary feed intake, growth rate and nutrient utilization by the experimental animals. TRP included in the diets of experimental groups consisting 6.72 % CP, 5.04% ether extract, 3.96% crude fibre, 7.85% total ash. Depression in voluntary feed intake due to summer stress did not alter due to the inclusion of turmeric powder. The weekly mean body weight gain, feed conversion efficiency and digestibility of nutrients did not show significant difference by the supplementation of turmeric rhizome powder in the diets of rabbit in present study.

Keywords: Summer stress, Turmeric, Curcumin, Antioxidant, Rabbit, Nutrient, Digestibility, Growth performance.

Introduction

Commercial rabbit production has been gaining much attention in recent years due to their high prolificacy, rapid growth rate, small body size and high meat yields. Rabbits can convert 20% of the protein they eat into edible meat (Kulkarni, 1994) which is higher than pigs (16-18%), beef (8-12%). in tropical climates where temperature hovers around 40°C during summer hinders the commercial rabbit production. Bidar district of northern Karnataka, where average daily maximum temperature during study period was around 35-40°C.

Rabbits are highly susceptible to heat stress due to few functional sweat glands and evince difficulty in heat evaporation with increasing environmental temperature (Cheeke et al., 1987). They find difficulty in dissipating heat at high environmental temperatures. Heat load imposed upon rabbit can be alleviated through genetic, managerial or nutritional means. Supplementing heat stressed rabbits with cool water, (Habeeb et al., 1994) Vitamin C (Al-Shanty, 2003) mineral water (Marai et al., 1994) or enzyme mixture preparations (Tawfeek.1996) were found to help rabbit withstand heat stress.

Herbal compounds like epigallocatechin (green tea catechin), curcumin, indole-3-carbinol, resveratol etc are currently undergoing clinical trials due to their chemopreventive and antioxidant properties (Greenwald, 2004). Turmeric (*Curcuma longa*) an extensively used spice, food preservative, and coloring material has biological actions and medicinal applications.

Curcumin has shown to have anti-inflammatory, antioxidant, anticarcinogenic, antimutagenic, anticoagulant, antidiabetic, antibacterial, antifungal, antiprotozoal, antiviral, antifibrotic, antivenom, antiulcer, hypotensive, and hypocholesterolemic activities. The antioxidant activity of curcumin is attributed to two methylated phenols and an enol form of di-ketone. Curcumin reduces the activity of reactive oxygen species and elevates the antioxidant enzymes superoxide dismutase, catalase, and glutathione peroxidase levels in the blood (Joe and Lokesh, 1994). Keeping these points in view, the present study was carried out with the objective to study the effect of turmeric rhizome powder on growth, feed intake and feed efficiency in heat stressed broiler rabbits and on nutrient digestibility.

Table 1: Mean dry matter intake (DMI g/day) by experimental rabbits

Weeks	T0	T1	T2
1	34.34 ± 1.13	36.38 ± 1.11	31.46 ± 1.87
2	43.50 ± 2.70	40.47 ± 0.64	39.47 ± 0.83
3	48.65 ± 0.82	39.22 ± 2.74	37.67 ± 2.08
4	46.99 ± 1.39	49.66 ± 1.83	46.40 ± 2.01
5	53.20 ± 1.17	50.54 ± 1.02	51.29 ± 1.18
6	61.45 ± 1.47	58.47 ± 2.36	59.68 ± 4.08
7	69.48 ± 4.33	67.29 ± 2.38	67.55 ± 3.78
8	68.30 ± 2.03	71.12 ± 1.05	67.87 ± 1.09
Mean ± SE	53.24 ± 4.37	51.64 ± 4.61	50.17 ± 4.89

Material and methods

Experimental animals and dietary treatments: Eighteen four weeks' old weaned Broiler rabbits of comparable body weights were selected for the study. They were randomly allotted to three dietary treatment groups of six rabbits in each group namely T0, T1 and T2. Experimental diets were prepared in the form of total mixed ration (TMR) using locally available ingredients such as spinach hay, 30 parts; maize, 28 parts; deoiled rice bran, 25 parts; soybean meal, 15 parts; mineral mixture, 1.5 parts; vitamin mixture, 0.2 parts; and salt, 05 parts, and the ration thus prepared was isonitrogenous and isocaloric. The TMR served as the basal control diet (T0) and the basal diet added with TRP at the ratio of 150mg and 300mg/100g diet were designated as T1 and T2 respectively. The rabbits were kept in individual cages (15 X 18 X11 inches) and were housed in a well ventilated laboratory animal house. Temperature and humidity of laboratory animal house was recorded daily at 8.00AM and 4.00PM for minimum and maximum values by using wet bulb and dry bulb thermometer.

Feeding and digestion trial: The feed samples were analyzed for proximate principles (A.O.A.C., 1990). Calcium and phosphorous (Talapatra et al., 1940) and forage fiber fractions (Goering and VanSoest, 1970). Feeding cum growth trial was conducted for a period of 8 weeks during summer months of April, May and June. Voluntary feed intake, weekly body weight gain and average daily gain were determined. Weekly feed efficiency was calculated from the weekly body weight changes and average daily gain data. A digestion trial was conducted for a period of four days after the completion of 5 weeks of feeding trial to study the nutrient utilization by the experimental animals. Data of the feeding, growth, digestion trial were subjected to statistical analysis by using sigma stat and results were compared (Snedecor and Cochran 1985).

Results and discussions

Chemical Composition of TRP and experimental diets: The experimental ration was consisting 15.56 (T2) to 16.84% (T0) crude protein. The proximate composition of turmeric rhizome powder included in the diets of experimental groups consisting 6.72 % CP, 5.04% ether extract, 3.96% crude fibre, 7.85% total ash and is in agreement with the earlier reports. Ishita Chattopadhyaya et al. (2004) reported that curcumin content of turmeric powder is 2-5% and the antioxidant property of turmeric is attributed to curcumin. The chemical composition of experimental diet of all the three treatment groups was comparable and as per the standard recommendation (NRC, 1977). Addition of turmeric powder at 0.15 and 0.30 % in T1 and T2 did not alter the chemical composition of experimental diets.

Effect of Turmeric on voluntary feed intake: Effect of Turmeric on voluntary feed intake is depicted in table 1. The lower feed intake may be due to depression in feed intake in summer temperatures in semi arid tropics as

Table 2: Mean weekly body weights (g) of experimental rabbits

Weeks	T0	T1	T2
0	481.66 ± 52.49	461.66 ± 34.19	481.66 ± 42.38
1	631.66 ± 59.18	581.66 ± 39.02	605.00 ± 45.73
2	700.00 ± 55.55	648.33 ± 46.07	680.00 ± 38.55
3	818.33 ± 55.10	748.33 ± 47.07	803.33 ± 34.12
4	880.00 ± 45.68	826.66 ± 47.09	861.66 ± 35.15
5	923.33 ± 40.79	905.00 ± 49.91	903.33 ± 33.13
6	1048.33 ± 36.82	999.16 ± 40.54	1003.33 ± 40.30
7	1068.33 ± 33.20	1046.66 ± 47.51	1078.33 ± 45.49
8	1125.00 ± 30.95	1101.66 ± 42.84	1115.00 ± 33.64
Mean ± SE	852.96 ± 72.23	813.24 ± 73.55	836.85 ± 72.08

Table 3: Weekly mean feed conversion ratio of experimental rabbits

Weeks	T0	T1	T2
1	1.63 ± 0.84	2.24 ± 0.30	2.02 ± 0.22
2	7.82 ± 2.80	4.25 ± 0.99	8.48 ± 3.88
3	3.16 ± 0.41	2.47 ± 0.69	2.35 ± 0.47
4	12.49 ± 8.00	4.86 ± 0.75	6.59 ± 1.18
5	11.41 ± 2.91	5.99 ± 1.76	12.38 ± 5.09
6	3.79 ± 0.66	4.86 ± 0.75	4.48 ± 0.50
7	15.90 ± 3.53	9.39 ± 2.01	8.45 ± 1.98
8	11.58 ± 3.83	8.26 ± 2.03	8.63 ± 2.00
Mean ± SE	8.47 ± 1.83	5.29 ± 0.89	6.67 ± 1.25

reported by Prasad and Karim (1996), Habeeb et al. (1994), Marai et al. (2006). It appears that increase in turmeric level depresses voluntary intake as observed in the present study, but it did not differ significantly between the groups. Similar observations were made by Emadi and Kermanshahi (2006) and Durrani et al. (2006) in chicks who reported that at 0.50% level turmeric significantly decreased feed consumption of chicks where as feed intake of birds supplemented with 0.25, and 1.00% levels turmeric was similar to that of control group birds. Similarly Remirez-Tortosa et al. (1999) reported that turmeric feeding did not influence feed intake in rabbits. Antioxidant ascorbic acid supplementation to the heat stressed birds helped them to adapt to high environmental temperature but had no effect on feed intake (Aengwanich and Chinarasri, 2004).

Weekly body weight changes and average daily gain: From Table 2, it is evident that average daily body weight gains (g/day) though lower due to harsher summer in this part of the country than Egypt but are comparable with results of Marai et al. (2006) which may be due to lower feed conversion ratio in summer than winter. The weekly mean body weight of treatment groups did not show significant difference though there was inconsistency in average daily body weight gain but was within normal range and did not differ between groups. The results are in concurrence with Ramirez-Tortosa et al. (1999) in rabbits; Emadi and Kermanshashi (2006) in chicks who reported that at 0.25, 0.50 and 0.75% levels turmeric had no effect on weight gain. Similarly Durrani et al. (2006) reported that at 0.25 and 1.00% levels turmeric had no effect on body weight but at 0.50% levels birds gained significantly higher body weight. They observed optimum antioxidant activity of turmeric at the level of 0.50% on account of increased protein synthesis in birds. The results of the present study showing no significant effect on average daily gain may be due to lower inclusion levels of turmeric rhizome powder in diet.

Feed conversion efficiency: From the table-3, the feed conversion efficiency values of the present study were comparable to Marai et al. (2006) which may be indication of summer stress. The feed conversion efficiency among all dietary treatment groups was similar. The results are in concurrence with Emadi and Kermanshashi (2006) in chicks; Durrani et al. (2006) in chicks who noted that 0.50% level elicited better feed conversion ratios than 0.25 and 1.00% levels of turmeric in the diets of chicks.

Digestibility of nutrients: The digestibility of nutrients (Table 4) in broiler rabbits during summer months in the present study were lower than the results of Kiran (2005) who obtained the values of digestibility of proximate composition during late winter months. Similar results were reported by Sahin and Kucuk (2001) in broiler Quails kept at high ambient temperature who attributed the effects to decreased activity of digestive enzyme namely trypsin, chymotrypsin and amylase at temperatures 320C and above. However Prasad and Karim (1996) reported that digestibility of DM, CP energy and ADF was

Table 4: Percent digestibility of nutrients (Mean ± SE) in experimental animals

Parameters	T0	T1	T2
Dry matter	69.44 ± 0.76	66.70 ± 0.78	67.43 ± 1.03
Organic matter	70.29 ± 1.02	67.97 ± 0.91	67.96 ± 0.82
Crude protein	77.92a ± 0.73	73.86b ± 0.36	75.05ab ± 1.17
Ether extract	80.74 ± 1.55	78.84 ± 0.67	81.22 ± 0.70
Crude fibre	36.92a ± 0.77	32.21b ± 0.97	39.17a ± 1.36
Nitrogen free extractives	74.27 ± 1.06	72.78 ± 0.98	71.23 ± 0.86
Neutral detergent fibre	59.02 ± 1.66	58.37 ± 2.25	58.58 ± 1.33
Acid detergent fibre	51.21 ± 0.67	48.97 ± 1.94	48.88 ± 1.72

significantly higher in summer than winter and rainy season in tropical conditions.

The digestibility of nutrients namely dry matter, organic matter, nitrogen free extractives, neutral detergent fibre and acid detergent fibre was not altered by the supplementation of turmeric rhizome powder in the diets of rabbit in present study (Table 4). But the digestibility of CP and CF decreased significantly in T1 than T0 and T2. Patel and Srinivasan, (2000) reported that curcumin increased digestibility of nutrients as it elevates the activity of pancreatic Lipase, Amylase, Trypsin, Chymotrypsin. Further Kazim Sahin et al. (2001) reported improved digestibility due to antioxidants Vitamin C and Vitamin E supplementation in the diets of heat stressed Quails. Similarly Sahin and Kucuk (2001) reported restoration of negative effects on digestibility of nutrients in birds kept at high ambient temperature by vitamin C supplementation. In present study the levels of turmeric supplemented in experimental diet were lower to the levels tried in the above reports.

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