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EFFECT OF DIETARY SUPPLEMENTATION OF PROBIOTICS AND ENZYMES ON NUTRIENT DIGESTIBILITIES IN BROILER RABBITS REARED UNDER TWO SYSTEMS OF HOUSING

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Abstract

An experiment was conducted to study the influence of dietary supplementation of probiotics and enzymes on nutrient digestibilities in broiler rabbits reared under two systems of housing . A total of 144 weaned rabbits were divided into 2 groups of 72 each and housed under conventional cage system and backyard system. The rabbits in each housing system were divided into 4 groups of 18 each. Diet T1 served as control T2 was supplemented with Kemzyme HF @ 500 Ton of feed, Diet T3 was supplemented with Probiotic (*S.boulardi*50% and *P. acidilacticii*50%), @10^9 CFU of feed and Diet T4 contained both probiotics and enzymes at the same concentration. At the end of 16 weeks growth trial, a digestibility trial was conducted for 5 days, to assess the effect of inclusion of probiotics and enzymes on nutrient digestibility. The dry matter intake in rabbits fed rations supplemented with probiotics and enzymes was significantly higher in both the systems of housing. The mean digestibility coefficients of dry matter, organic matter, crude protein, crude fiber, ether extract and nitrogen free extract were 72.64 ± 1.26, 73.10 ± 1.23, 78.61 ± 1.03, 71.59 ± 1.32, 81.12 ± 1.34 and 70.80 ± 1.46 respectively. In both the housing systems, rabbits fed experimental diets recorded significantly higher digestibility coefficients than control group. It was concluded that rabbits can be reared profitably under backyard system and supplementation of probiotics and enzymes had a positive influence on the digestibility of nutrients.

Key words: Backyard, Enzymes, Meat composition, Probiotics, Rabbit, Slaughter.

The Food and Agriculture Organization's (FAO) recipe to fight world hunger has rabbit as its key component. In developing countries such as India, where enormous meat shortages exist, the potential for rabbit production is greatest. As an alternative to broiler chicken rearing, rabbit for meat is gaining momentum nowadays. In fact backyard rabbitries are best suited for our country to increase the per capita income and per capita animal protein availability. In view of the higher initial capital investment in providing cage system of housing, the proposed study is aimed to evaluate the effect of raising rabbits under back yard system.

Since long, antibiotics and many other chemicals have been used as growth stimulators in animals. But the use of antibiotics in feeding of animals is being discouraged and the use of certain live microorganisms either alone or in combination as probiotics is gaining importance. The use of micro-organism as feed additives (probiotics) is currently widely promoted as an "alternative" to antibiotic growth promoters. Similarly the use of Fibrolytic, proteolytic and lipolytic enzymes to improve the digestibility of nutrients is being explored. The aim of the proposed experiment was to study the effect

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of inclusion of probiotics and enzymes on nutrient digestibility in broiler rabbits reared in two different housing systems.

MATERIALS AND METHODS

A total of 144 weaned rabbits (28 days) of 3 breeds viz. New Zealand White, Grey Giant and Flemish Giant, maintained at the "Rabbit Production for Meat" scheme of the Department of Animal Genetics and Breeding, College of Veterinary Science, Hyderabad were divided into two groups and were reared in conventional cage system and backyard rearing system, until 16 weeks of age. Each group was subdivided into 4 groups each consisting of 18 rabbits. The three breeds were equally represented in all the groups. Rations supplemented with probiotics and enzymes or both were fed to three groups of rabbits while one group was fed control ration.

Housing and management

Bunnies under cage system of rearing were housed in galvanized iron wire net cages arranged in rows on an iron frame at a height of about 2.5 feet from the floor. Each bunny was provided a cage floor area of 1 square foot. Cages were equipped with automatic waterers and earthen pots were used as feeders. The asbestos roof of the rabbitry was covered with a thin layer of paddy straw, which was wetted with overhead water sprinklers during hot periods of the day. Gunny cloth curtains were hung around the sheds to protect the animals from extreme temperatures. For backyard system, a thatched roof shed with gravel floor and chain link wire mesh walls was erected and rabbits were provided floor space of about 2 square feet per bunny. Concentrate feed and fresh and clean drinking water were made available *ad- libitum* by using earthen bowls.

Experimental rations and feeding

The four experimental rations were prepared and fed to different groups as follows: T_1: control ration without any supplement; T_2: T_1 + Kemzyme HF @ 500 gms/Ton of feed; T_3: T_1 + Probiotic (*Saccharomycesboulardi* 50% and *Pediococcus acidilacticii 50%,* 10^9 CFU/gm of feed and T_4: T_1 + Probiotic + Enzyme at above levels. Kemzyme HF contained Cellulase (>1,00,00,000), Xylanase (>26,00,000), Pectinase (>2,50,000), ß-glucanase (>10,00,000), ά-Amylase (>7,00,000), Protease (>6,00,000) and Lipase added kemin Units per kg product.

The concentrate feed mixture contained maize (50%), groundnut cake (24%), wheat bran (25%) and mineral mixture (1%). Coccidiostat and Vitamins A, D, E and C were added to the feed mixture at recommended levels (ICAR, 1998). Feed and water were made available *ad-libitum* to all the experimental animals. About 200 gms of lucerne green fodder was offered to each rabbit daily.

At the end of 16 weeks growth trial, a digestibility trial was conducted for 5 days, to assess the effect of inclusion of probiotics and enzymes on nutrient digestibility, in animals reared under two systems of housing.

Sampling of Feeds and Feed residues

Representative samples of concentrate mixture and lucerne green grass were collected daily during collection period before offering to the animals and were kept for dry matter estimation. The dried samples were pooled for 5 days and ground in a laboratory willey mill and ground material was preserved in air tight polythene bags for subsequent analysis. Similarly representative samples of feed and fodder refusals were collected every day for dry matter estimation.

Sampling of faeces

Faeces as and when voided by each animal were collected carefully into separate containers kept for each animal which were covered with lids to prevent evaporation losses. The total quantity of faeces voided during the preceding 24 hours was weighed at 9.00 AM daily. The faeces collected was thoroughly mixed and a representative sample was taken for each animal to carry out laboratory analysis for proximate principles.

For dry matter estimation, an aliquot of 1/100 part of faeces voided during 24 hours was taken into petri dishes, from the individual rabbits and dried in hot air oven at 100 ± 5°C overnight. The

dried samples of 5 days were pooled and ground in laboratory willey mill and stored in polythene bags for further analysis.

For nitrogen estimation, 1/1000 part of total faeces voided per day by each animal was weighed, mixed with sufficient quantity of 20 per cent sulphuric acid and preserved in previously weighed airtight screw capped sample bottles.

Proximate Analysis

The proximate analysis of feeds, faeces and residues were performed as per the methods described by AOAC (1997).

RESULTS AND DISCUSSION

Dry matter intake (DMI)

The results of the digestibility studies are presented in Tables 1 and 2. The mean dry matter in take was significantly higher in diets supplemented with enzymes (T_2), probiotics (T_3) and probiotics and enzymes (T_4) as compared to control in both systems of housing, Similar results were reported in NZW broiler rabbits fed rice bran rich diets supplemented with exogenous enzymes and probiotics[14].Non significant effect of enzymes (Protease/ Protease + Xylnase addition) in NZW X Californian Rabbits on feed intake was reported [6]. *Pediococcus acidilactici* exerts positive effects on the balance and function of the intestinal flora[7] which explains improvement in DM intake.

Dry matter (DM) digestibility

DM digestibility coefficients were significantly higher in diets T_3 (probiotics) and T_4 (probiotics+enzymes) compared to other diets. However, the later was statistically similar with enzymes supplemented diet (T_2). The increased DM digestibility in probiotics supplemented diets could be due to selective stimulatory effect of probiotics on microbes responsible for nutrient degradation in caecum. The increased DM digestibility in diets supplied with enzymes might be due to the general assumption that hydrolytic activity and digestive volume correlate positively with digestion efficiency. The present results were in line with the observations of [12] who reported increased digestibility in six week old weaner rabbits whose diets were supplemented with enzymes and probiotics. Similar results were also reported by [1, 3, 14].

Organic matter (OM) digestibility

Organic matter digestibility coefficient increased significantly ($P \leq 0.05$) in both the systems of housing with supplementation of probiotics and enzymes which may be due to higher feed intake and stable intestinal microbial health leading to effective utilization of available nutrients. Similar findings were reported by [9] when diets were supplemented with probiotics in NZW rabbits.

Crude protein digestibility

The Crude protein digestibility coefficient was significantly higher in diets supplemented with probiotics (T_3) and probiotics and enzymes (T_4) in both the systems of housing which might be due to increased activity of favourable microbes under the influence of yeast and better assimilation of proteins in the intestines. The presence of proteases probably increased the utilization of vegetable proteins and legumes which might have resulted in increased CP digestibility in T_2 as compared to control.Increased CP digestibility in probiotics supplemented diets was reported by [8,5,13]. Increased CP digestibility in enzymes supplemented diets in broiler rabbits was observed by [14,12].

Crude fibre digestibility

The probiotics supplemented diet (T_3) recorded significantly higher CF digestibility co efficient as compared to control and enzymes supplemented diets. The higher CF digestibility in probiotics supplemented diet could be due to lowered pH in the upper small intestine by stimulation of lactic acid producing bacteria leading to better utilization of fibre fraction of the diet[16]. The presence of cellulase enzymes in the diets (T_2 and T_4) which breaks down the cellulose polymers and improves the cellulose and hemicelluloses fraction in the fibre explains the increased crude fibre digestibility in T_2. The increased CF digestibility due to the effect of probiotics and enzymes similar to the present results were reported by many workers [5,1,14, 3,12].

Table 1. Mean digestibility of nutrients in broiler rabbits reared under cage system as affected by experimental rations

Effect	Dry Matter intake (g)		Digestibility (%)											
		Dry Matter		Organic Matter		Crude Protein		Crude Fibre		Ether Extract		Nitrogen Free Extract		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Overall	119.87	7.00	74.36	1.43	74.72	1.41	76.76	1.50	71.82	1.58	84.70	1.16	73.78	1.57
T1	75.98^{c}	4.14	65.89^{c}	0.53	66.36^{c}	0.60	66.68^{c}	0.92	61.84^{b}	2.42	78.75^{c}	1.97	65.12^{c}	1.51
T2	104.93^{b}	6.45	72.92^{b}	2.34	73.50^{b}	2.27	76.50^{b}	2.00	73.90^{a}	1.88	83.10^{bc}	1.91	72.30^{b}	2.90
T 3	148.94^{a}	2.07	81.00^{a}	1.35	81.32^{a}	1.41	83.23^{a}	1.12	78.06^{a}	1.67	90.05^{a}	0.67	80.84^{a}	1.53
T4	149.63^{a}	7.92	77.64^{ab}	2.08	77.70^{ab}	2.05	80.63^{ab}	1.91	73.46^{a}	2.11	86.88^{ab}	1.59	76.87^{ab}	2.25

Means with similar superscript in each column do not differ significantly (P≤0.05)

Table 2. Mean digestibility of nutrients in broiler rabbits reared under backyard system as affected by experimental rations

Effect	Dry matter intake (g)		Digestibility (%)											
		Dry Matter		Organic matter		Crude Protein		Crude Fibre		Ether Extract		NFE		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Overall	110.26	5.61	70.92	2.05	71.48	1.99	80.46	1.35	71.37	2.14	77.55	2.21	67.81	2.33
T1	78.50^{b}	8.36	58.66^{c}	1.24	59.56^{c}	1.27	73.35^{c}	0.83	56.97^{c}	3.18	62.57^{b}	3.00	54.78^{c}	1.86
T 2	119.21^{a}	6.92	69.92^{b}	2.08	70.51^{b}	2.03	78.31^{b}	1.82	71.68^{b}	1.81	79.65^{a}	2.93	66.64^{b}	2.21
T 3	124.61^{a}	8.78	73.19^{b}	3.31	73.64^{b}	3.14	82.24^{b}	2.20	75.99^{ab}	2.12	82.60^{a}	2.60	69.32^{b}	3.98
T 4	118.74^{a}	10.50	81.91^{a}	2.25	82.20^{a}	2.17	87.93^{a}	1.30	80.84^{a}	1.70	85.36^{a}	1.55	80.52^{a}	2.92

Means with similar superscript in each column do not differ significantly (P≤0.05)

Ether extract digestibility

Rabbits fed rations T_2, T_3 and T_4, which were supplemented with enzymes, probiotics and probiotics + enzymes recorded significantly higher ether extract digestibility, as compared to control in backyard system of rearing whereas, in cage system of rearing rationsT_3 and T_4 had significantly higher EE digestibility coefficients with a non-significant increase in rabbits fed diet 2. The increased ether extract digestibility could be due to increased DM intake and also reflecting the increased DM digestibility. Similar findings were also reported by [9,1,3]. The observations of the present study were also in line with the findings of [11]who reported higher EE digestibility in 6 week old crossbred rabbits fed diets supplemented with enzymes and probiotics.

Nitrogen free extract (NFE) digestibility

The NFE digestibility was significantly (P≤0.01) influenced by the experimental rations (Table 22 and 24) in both the housing systems. The NFE digestibility coefficients in rabbits fed rations T_2, T_3 and T_4 were significantly higher when compared to the rabbits fed control ration, in both the housing systems. The increased NFE digestibility coefficients in the present investigation can be attributed to the increased digestibility of dry matter and other nutrients which might have been facilitated by the supplementation of rations with enzymes and probiotics or both.

Feed intake and feed conversion ratio

The total feed intake in T_1, T_2, T_3 and T_4 is presented in Tables 1 and 2 respectively. The weight gain (g), FCR (kg DMI/kg gain) and cost of feed per kg gain (Rs) was 1000.33, 5.45, 58.11 in T_1, 1076.39, 5.25, 56.88 in T_2, 1176.78, 5.04, 54.48 in T_3 and 1167.84, 5.06 and 55.22 in T_4 respectively. The overall feed intake and FCR were reported to be ranging from 37.13 to 49.03 g/d and from 3.45 to 6.23 [11,1,4] who reported that the DM intake was significantly higher in rabbits kept in cages than those reared in hutch.

The feed conversion ratio slightly decreased in rabbits fed diets supplemented with probiotics and enzymes resulting in decreased feed cost per kg gain in body weight. The results of the present study are in accordance with the results reported by [10] who reported that the daily feed intake and FCR ranged from 39.83 to 49.03g and 4.36 to 6.23 in meat type rabbits

Under backyard system of the weight gain (g), FCR (kg DMI/kg gain) and cost of feed per kg gain (Rs) was 984.42, 5.33, 58.22 in T_1, 1029.56, 5.45, 57.42 in T_2, 1198.44, 5.09, 52.91 in T_3 and 1197.88, 5.23 and 54.12 in T_4 respectively.

In general, the dry matter intake has increased while the FCR declined slightly in the rabbits fed diets supplemented with either probiotics or enzymes or both indicating higher feed efficiency. This has also resulted in decreased feed cost per kg gain making addition of supplements economical. The results of the present study are in agreement with the results of [14] who reported that the daily feed intake was significantly higher in rations supplemented with enzymes and probiotics, while[12] observed no significant differences in the daily feed intake when rabbit diets were supplemented with enzymes and probiotics.

CONCLUSION

The present study conclusively revealed that rabbits can be reared profitably under backyard system of housing with less capital inputs and supplementation of probiotics and enzymes had the beneficial effect in increasing the digestibility of nutrients.

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