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Review Article

PROBIOTIC SUPPLEMENTATION IN RABBIT: A REVIEW

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Abstract- The rabbit farming is an important emerging enterprise in many countries of the world. Advantages such as small body size, short generation interval, rapid growth, genetic diversity and high productive potential make rabbit convenient as meat producing small animal in developing countries of the world like India. Raising rabbits in an intensive system can cause many physiological and environmental stress results in spreading of enteric diseases such as coccidiosis and epizootic rabbit enteropathy. The lower level of antibiotics over the years has been used in rabbit production as growth promoters and prophylactic agent of diseases. The European Union Commission banned the use of antibiotics as a growth promoter in animal diets, because of issues with antibiotic resistance and antibiotic chemical residue in animal products, which may cause problems for human health. To replace the antibiotics, new ways are used for prevention and control of infections, which can modulate the gut microflora. These non-antibiotic compounds with bacteriostatic or bactericidal activity are probiotics, prebiotics, bacteriocins and organic acids. Definition of the probiotic is a live microbial feed additive, which has a beneficial effect on the host animal by means of improving its intestinal microbial balance. The bacteria which are generally used as probiotics include the lactic acid bacteria–lactobacilli, enterococci, bifidobacteria and yeasts.

Keywords- Rabbit farming, Emerging enterprise, Coccidiosis, Antibiotics, Growth promoter, Probiotics, Prebiotics, Organic acids

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Introduction

The rabbit farming is an important emerging enterprise in many countries of the world. Rabbit farming has great potential in the economy of high hilly areas [1]. Small body size, short generation interval, rapid growth rate, high productive capacity and genetic diversity are characteristics, which make rabbit suitable as meat producing small livestock in developing countries of the world [2]. Rabbits can convert 20% of the protein they eat into edible meat, which is higher than beef (8-12%) [3]. Raising rabbits in an intensive system can cause many environmental and physiological stresses, mainly during the weaning period. These stresses result in spreading of enteric diseases such as coccidiosis and epizootic rabbit enteropathy, which have a negative effect on growth performance, feed efficiency and animal health status. Weaning posed dietary, environmental, social and psychological stresses, which interfere deeply with feed consumption, gastrointestinal tract development and adaptation to the weaning diet [4]. Incorporation of antibiotics in foodstuffs can reduce digestive disorders and improve growth performance of farm animal [5]. The lower level of antibiotics over the years has been used in rabbit production as growth promoters and prophylactic agent of diseases [6]. Due to controversy with antibiotic resistance and antibiotic chemical residue in animal products, which may create problems for human wellbeing [7], the European Union Commission banned the use of antibiotics as a growth enhancer in animal diet [8]. This ban poses a serious challenge for rabbit meat producers. Because of the very complex and unique digestion of rabbit, this species is susceptible to enteric diseases, particularly after weaning. To replace the antibiotics, new ways are used for prevention and control of infections which can modulate the gut microflora. These non-antibiotic compounds with bacteriostatic or bactericidal activity are probiotics, prebiotics, bacteriocins and organic acids [9].

Probiotics

Definition of the probiotic is live microbial feed additive which has a beneficial effect on the host animal by means of improving its intestinal microbial balance [10]. The bacteria which are generally used as probiotics include the lactic acid bacteria–lactobacilli, enterococci, bifidobacteria and yeasts [11]. Probiotics create beneficial conditions for nutrient utilization. Effect of probiotics on better intestinal digestion and the higher efficient energy utilization in rabbits has been documented by researchers [12,13]. Enteric diseases of rabbits can be prevented by probiotics that contain yeast, live bacteria or bacterial spores. Probiotics boost gut colonization and stabilize eubiosis. These functions strengthen the animal's non-specific immune system [14].

Although the mechanism of action of probiotic has not been elucidated, it might include reduction of toxin production, stimulation of enzyme production by the host, production of some vitamins or antimicrobial substances, competition for adhesion to epithelial cells, increase resistance to colonization, stimulation of the immune system of the host and reduction of stress in rabbits [15]. The mode of action of probiotics may be by decreasing population of harmful bacteria by decreasing intestinal pH [16]. Dietary administered probiotic bacteria reduced the frequency of *E. coli* translocation [17] and were effective in preventing the growth of *E. coli* O157:H7 in the intestinal tract of neonatal rabbits [18]. There is a dose reliable good effect of a probiotic on *E.coli* occurrence in the caecum and small intestine in rabbit [19]. Beneficial effects of probiotics are such as change in enteric flora and reduction of *Escherichia coli,* a decrease in intestinal pH, a production of antimicrobial substances, and reduction of toxic amines and ammonia levels in the GIT and blood [20].

The objective of the present paper is to review the effect of supplementation of probiotic on growth performance, mortality and morbidity, carcass characteristics and haemato- biochemical parameters.

In this paper, efforts have been made to review information on

- Growth performance
- Feed intake and feed conversion ratio
- Mortality and morbidity
- Haemato-Biochemical parameters (Cholesterol, glucose and triglycerides)
- Carcass characteristics

Growth performance

Shanmuganathan *et al.* (2003) [21] reported that 24 New Zealand White rabbits when supplemented diet with a yeast culture (at 200 ppm) and effective micro-organisms (1 %) had a significant difference (P<0.05) on body weight among treatment groups.

Amber *et al.* (2004) [22] revealed that final body weight was significantly (p<0.05) increased in the rabbits received a pelleted diet with probiotics (Lact-A-Bac) than without probiotic.

Matusevicius *et al.* (2006) [23] reported that New Zealand White rabbits, fed with composed feed containing BioPlus 2B® probiotic, were by 310 g or 18 %, significantly (p<0.05) heavier than rabbits in the tested group fed with composed feed without a probiotic.

Simonova *et al*. (2009) [13] reported that application of probiotic strain *E. faecium* CCM7420 strain (1.0 × 10^9 CFU/ml, 500 µl/animal/day)had significantly (P< 0.01) increase body weight compared to other treatment group.

Chrastinova *et* al. (2010) [24] observed that application of probiotic strain *E. Faecium* AL41 strain (10^9cfu /ml/animal/day) had highest body weight gains than that of either sage (*Salvia officinalis*at 10 ml/animal/day) or *Eleutherococcus senticosus* (Ginseng dry extract at 30g/100 kg feed) or a control diet without any supplements in drinking water.

Omer *et al*. (2010) [25] noted that body weight was significantly (p<0.05) increased in yeast (0.50%) supplemented group compared to control group.

Ewuola *et al*. (2011) [26] observed that the final body weight of growing New Zealand White rabbits were significantly (P<0.05) higher due to treatment with(probiotics: Biovet®-YC at 500 g/ton in compared with control ones.

Shrivastava *et al.* (2012) [27] reported that the effect of probiotic on body weight in the rabbit was found to be non-significant however the rabbits of probiotic supplemented (60g) group had higher body weight than the rabbits of the control group.

Abd-El-Hady (2013) [28] reported that rabbits when fed with 300 g and 400 g probiotic digestarom/ ton feed showed significant (P<0.05) increased in average body weight during the last experimental week (9 weeks) compared with the control and averages of weekly body gain of Alexandria rabbit increased by enhancing the dietary digestarom® level.

Amber *et al*. (2014) [12] observed that the rabbits (at the age of 3 weeks) when fed basal ration supplemented with MIX1 (mixture of prebiotic i.e. Bio-MOS Reg; mannan oligosaccharide at 1g/kg diet and a probiotic i.e. Bio-Plus Reg.2B, *Bacillus subtilis* and *Bacillus licheniformis* at 0.4 g/kg diet) attained significantly (P<0.05) higher body weight than those rabbits supplemented with either prebiotic (Bio-MOS,MOS1), probiotic (Bio-Plus, PLUS1) or control group. They further noted that body weight of rabbits was significantly (P<0.05) higher for MIX1 than MIX2 (mixture of MOS and PLUS and supplemented to rabbits at 5 weeks of age); however, there was a non-significant difference between the body weight values of MIX1 and MOS1.

Shehu *et al.* (2014) [29] observed that rabbits fed diet supplemented with baker's yeast (*Saccharomyces cerevisiae*) @ 20, 40, 60 and 80 g per kg of basal diet, corresponding to 2 x 10^9, 4 x 10^9, 6 x 10^9 and 8 x 10^9 CFU/kg of basal diet, respectively in five treatment groups had highest body weight and supplement had significant (P < 0.05) effect on body weight among groups.

El-Sagheer and Hassanein (2014) [30] reported that rabbits diet when supplemented with enzymes and probiotic mixture supplementation Veta-zyme/kg @ 1 gVeta-zyme/kg commercial diet had Increase in body weight and Veta-zyme significantly (P≤0.05) improved body weight than those of un-supplemented diet.

Seyidoglu and Galip (2014) [31] noted that final body weight and total weight gain did not differ significantly (P>0.05) when male New Zealand White rabbits (aged 5-6 weeks) were reared on basal diet (control) or supplemented with live yeast culture, i.e. *Saccharomyces cerevisiae* (3.0 g/kg diet), *Spirulina plantesis* (3.0g/kg diet) or combination (3.0 g/kg diet *Saccharomyces cerevisiae*; at 5% diet *Spirulina plantesis*) for a period of 90 days.

Oso *et al.* (2013) [32] concluded that growing rabbits when fed with diet containing Prebiotic (MOS at 1.0 g/kg feed) showed highest (P<0.05) final live weight and weight gain as compared to either those rabbits fed on arabinoxylans oligosaccharides (Axe 1.0 g/kg feed) or Probiotic (*Prediococcus acidilactis* as 1×10^{10}CFU/g; 0.5g/kg feed or *Bacillus Cereus* as 1×10^9CFU/g @ 0.5 g/kg feed) or even other dietary combinations.

El deek *et al.* (2013) [33] noted that dietary supplementation of 0.2 % super action probiotic showed significantly (P<0.01) highest final body weight and daily weight gain in 14 weeks New Zealand White rabbit as compared to those groups fed on a diet supplemented with either zero or 0.1 % super action probiotic.

Brzozowski and Strzemecki (2013) [34] observed that there was a positive impact of probiotic (*Bacillus cereus var toyoi*) at 400 mg/kg of a probiotic preparation on body weight and weight gain in young rabbits than the control group without probiotic.

Shehata *et al.* (2012) [35] noted that addition of amino-yeast at 0.25, 0.50 and 0.75%, significantly (P<0.05) increased the daily body weight gain of the male New Zealand White rabbits as compared to control.

Lam Phuoc Thanh and Jamikom (2012) [36] postulated that average daily gain was increased significantly (P<0.05) in New Zealand White rabbits from 24.0 g/day in the control group to 28.1 and 27.9 g/day in 1×10^7CFU/g *Lactobacillus acidophilus* group and 0.5×10^7CFU/G L. *acidophilus* plus 0.5×10^6 cfu/g *Bacillus subtilis* group.

Khalil (2012) [37] noted that rabbit fed with a low protein diet and supplemented with 0.10 or 0.15 g multi-strain probiotics (protexien) /kg diet recorded 7.02 and 7.86 percent growth rate, respectively than a group without protexin supplementation.

Eczema and Eze (2012) [38] opined that inclusion of Bio-active yeast (probiotic *Saccharomyces cerevisiae*) at a level of 0.12 g yeast/kg of diet had a significantly (P<0.05) higher weight gain than that of those rabbits supplemented with either 0.08 or 0.16 or Zero g yeast/kg diet.

Feed intake

Eiben *et al.* (2008) [39] evaluated the effect of feed additives on fattening performance of 150 New Zealand White rabbits. The control group (T_1) was fed a diet without additives. The basal diet was supplemented with 1000 mg/kg of probiotic bacteria of *Bacillus subtilis and Bacillus licheniformis* (T_2 group); 0.3% prebiotic inulin (T_3 group); 0.3% organic acids (T_4 group) and 0.3% tannin (T_5 group). They observed that feed intake was not affected by the feed additives.

Chrastinova *et al.* (2010) [24] observed no differences among the experimental groups on feed intake in rabbits when fed with sage (*Salvia officinalis*) plant extract (10 µl/animal/day) in drinking water, *Eleutherococcus senticosus* (Ginseng dry extract 30g /100 kg feed) culture of *Enterococcus faecium* AL 41 strain 10^9 CFU / ml; 500 µl /animal/day).

Ewuola *et al.* (2011) [26] investigated the effect of prebiotics, probiotics and symbiotics on the performance of 32 weaned rabbits for the period of 12 weeks. They found that the daily feed consumption was not significantly different among the dietary treatments when fed with prebiotics: Biotronic® at 4 kg/ton, probiotics: Biovet®-YC at 500g/ton and symbiotics: the combination of both Biotronic® and Biovet®-YC.

Amber *et al.* (2014) [12] postulated that the rabbits (at the age of 3 weeks) when fed basal diet supplemented with a mixture of prebiotic i.e. Bio-MOS; mannan oligosaccharide at 1 g/kg diet and a probiotic i.e. Bio-Plus 2B, *Bacillus subtilis* and *Bacillus licheniformis* at 0.4 g/kg diet, significantly (P<0.05) increased feed intake.

Shehu *et al.* (2014) [29] demonstrated an experiment to evaluate the effect of baker's yeast (*Saccharomyces cerevisiae*) supplementation on nutrient digestibility and growth performance of 60 weaned rabbits for the experimental period of 12 weeks. They observed that diets supplemented with *Saccharomyces cerevisiae* at 60 g per kg significantly (P< 0.05) consumed more feed as compare to groups, which were supplemented @ 20, 40, 60 and 80 g per kg of basal diet, respectively.

Iwu *et al.* (2015) [40] observed that the inclusion of probiotics-phytase mixture @ 1000 g/ton of feed significantly (P<0.05) increased daily feed intake of 72 Californian rabbits.

Feed conversion ratio

Chrastinova *et al.* (2010) [24] conducted an experiment to study the effect of Phyto-additives and probiotics on the performance of 96 New Zealand white rabbits for the period of 6 weeks and observed better FCR in *Enterococcus faecium* (AL 41 strain 10^9 CFU / ml; 500 µl /animal/day) supplemented group and there was a significant difference (P<0.01) compared to control group.

Onu and Oboke (2010) [41] showed that rabbits fed 50 % maize processing waste based diet (MPW) supplemented with 200 mg of enzyme (grindazym) or 200 mg probiotic (yeast) per kg feed had significantly (P<0.05) superior feed conversion ratio as compared to MPW or non-MPW diet without supplementation.

Karima *et al.* (2011) [42] evaluated the effect of the dietary supplementation of different probiotic on growth performance, immune response, some blood parameters and carcass traits of 60 NZW rabbits. The experimental period lasted for 10 weeks. Rabbits were fed on a basal diet supplemented by 0.1 g/kg and 0.15g/kg of *Entrococcus faecum,* 3 g/kg, 0.35 g/kg of *Lactobacillus acidophilus* and other *Lactobacillus* strain with enzymes (AM Phi-Bact). They reported that dietary supplementation of *E. faecum* significantly improved (P<0.05) FCR by about 13.0% and 13.1% and *Lactobacillus* strains containing probiotic (AM Phi-Bact) dietary supplementation had no significant effect on FCR.

El-Kholy *et al.* (2012) [43] studied the effect of *Enterococcus faecalis* isolated from mother's soft faeces as probiotic dietary supplementation on productive, physiological and immunological capabilities of 320 NZW rabbits for the period of 40 days. They observed significantly (P<0.05) higher FCR in *E. Faecalis* (150 ml of culture per 1000 g of diet) group as compared to control group.

Ezema and Eze (2012)[38] conducted an experiment to study the effect of probiotic (*Saccharomyces cerevisiae*) on growth performance and some haematological parameters of 40 rabbit.They observed that there was no significant difference (P>0.05) in FCR among the treatment groups when fed with bioactive yeast (probiotic) at supplementation levels of 0.08, 0.12, and 0.16 g yeast/kg diet.

Thanh and Jamikorn (2012) [44] evaluated the effects of probiotic supplementation on feed efficiency of 64 weaning New Zealand White rabbits for the period of 6 weeks. They noted that the feed conversion rate was reduced significantly (P<0.05) to 2.55 and 2.56 in the *L. acidophilus* ($1x10^7$ CFU/g) and *B.subtilis* ($0.5x10^7$ CFU/g)diets as compared to 2.89 in the control diet.

Adeniji and Zubairu (2013) [45] reported better FCR in a diet supplemented with Probiotic A@0.005 kg/100 kg palm kernel cake and there was a significant effect (P<0.05) of supplementation on feed to gain ratio.

Adeniji *et al.* (2014) [46] studied the effect of replacing rice husk for groundnut cake with or without probiotics and enzyme supplementation in the diets of 72 grower rabbits. The experimental period lasted for 8 weeks. The 12 experimental diets fed with or without supplementation were such that, rice husk was fed to replace 0, 30 and 60% of dietary groundnut cake while there are 4 supplements (no supplements, probiotics A, Probiotics B and Enzyme). Each treatment had 3 replicate containing 2 rabbits each. They observed that the dietary supplementation with probiotic A had significant influence (P<0.05) on the feed to gain ratio of the rabbits.

Amber *et al*. (2014) [12] observed that the rabbits (at the age of 3 weeks) when fed basal diet supplemented with MIX1 (mixture of probiotics i. e. Bio-MOS Reg; mannan oligosaccharide at 1 g/kg diet and a probiotic i.e. Bio-Plus Reg.2B, *Bacillus subtilis* and *Bacillus licheniformis* at 0.4 g/kg diet) had significant effects (P<0.001) among the group

El-Sagheer and Hassanein (2014) [30] demonstrated an experiment to evaluate the effect of enzymes and probiotic mixture supplementation Veta-zyme on growth performance of 81 growing rabbits which fed on 1 g Veta-zyme/kg commercial diet and 2 g Veta-zyme/kg commercial diet. They noted that using 1 or 2 g Veta-zyme/kg diet improved FCR significantly (P<0.05) than those of un-supplemented diet.

Abd-El-hady and El-Abasy (2015) [47] studied the effect of supplementation of prebiotic (Bio-Mos®), probiotic (Bio-Plus® 2B) and their combination on growth performance. The content of Bio-Mos® is mann oligosaccharide and of prebiotic is *Bacillus subtilis* and *Bacillus licheniformis.* Experiment contains 64 New Zealand White rabbits. The experimental period lasted for 8 weeks. Experimental rabbits were divided into 2 equal groups. The 1st group was uninfected and subdivided into 4 subgroups. The 1st subgroup fed a basal diet (Control), the 2nd, 3rd and 4th sub groups fed on a basal diet supplemented with 1 g Bio-MOS, 0.4 g Bio-Plus and 1g Bio-MOS + 0.4 g Bio-Plus / kg, respectively. The 2nd group was similar to the 1st group but experimentally infected with *Pasteurella multocida*. They noted that 1st group showed lower feed conversion ratio when compared with control group.

Adeniji and Adewole (2015) [48] evaluated the effects of replacing brewers dried grains for groundnut cake with or without probiotics supplementation. The experiment was performed on 54 rabbits. The experimental period lasted for 8 weeks. The rabbits were allocated to nine dietary treatments. The nine experimental diets had brewers dried grains replacing groundnut cake at 0, 30, 60% dietary levels, with groundnut cake in the control diet being at 18.7%. There were 3 replacement levels (0, 30 and 60%) of brewers dried grains for groundnut cake by three supplement levels (no supplement, probiotic A and probiotic B). They reported that there was a significant effect (P<0.05) of the supplementation on a diet with 60 % brewers dried grains and probiotic B on FCR.

Ezema and Eze (2015) [49] studied the effect of probiotic on growth and economic benefit in 20 cross-bred rabbits for the period of 13 weeks. Rabbits were randomly divided into 4 groups of 5 rabbits each. Rabbits were fed on pelleted grower mash with probiotic supplementation at levels of 0.08, 0.12, and 0.16 g/kg of diet, respectively. They observed that there was no significant difference in FCR among the groups.

Mortality

El-Dimerdash *et al.* (2011) [50] demonstrated an experiment to evaluate the effect of the probiotic supplementation in drinking water on the performance of 65 NZW rabbits for the experimental period of 3 weeks. 60 rabbits were divided into 4 equal groups, control G_0, infected G_1, probiotic G_2, and probiotic infected G_3. In Probiotic groups (G_2, G_3) rabbits were supplied with probiotic powder contain *E. Faecium* in Drinking water (1g/ lit water). They noted a non-significant difference in mortalities between both infected groups (G_1) and probiotic infected group (G_3). Morbidity in Infected group (G_1) was about 17% during 1stweek, 49% in a 2nd week and 32% at 3rd week. While the probiotic infected group (G_3) was milder, reached 17% during the 1st week, 14% in 2nd week.

Thanh and Jamikorn (2012) [44] investigated the effects of probiotics supplementation on feed efficiency, growth performance of 64 weaning New Zealand White rabbits. The experimental period lasted for 6 weeks. At 28-days, the rabbits were randomly distributed into 4 groups. Rabbits were fed four diets. The treatments composed of basal diets with no probiotic supplement (control), $1x10^6$ CFU/g *B. subtilis* (BS), $1x10^7$ CFU/g *L. acidophilus* (LA), and $0.5x10^6$ CFU/g *B. subtilis* plus $0.5x10^7$ CFU/g *L. acidophilus* (BL). They noted that morbidity rate was significantly reduced to 0 % in the LA group, while this value was 31.3 % in the control group. None of the animal in any groups died during the study.

Wallace *et al.* (2012) [51] evaluated the effect of probiotic on 36 California White, New Zealand White and Chinchilla rabbit for 4 months. The study was contained two controls i.e. T_o- (treatment group without any additive in the basal diet) and T_o+ (treatment group treated with a coccidiostat prior to starting of feeding trial and fed the basal diet). The test treatment groups consisted of T_1 (supplemented with 1.0 ml probiotic /kg feed) and T_2 (supplemented with 1.5 ml probiotic /kg feed). They reported that there was a non-significant difference in the rate of mortality among the rabbits among the treatment groups.

Amber *et al.* (2014) [12] observed that the rabbits (at the age of 3 weeks) when fed basal diet supplemented with MIX1 (mixture of probiotic i.e. Bio-MOS Reg; mannan oligosaccharide at 1 g/kg diet and a probiotic i.e. Bio-Plus Reg. 2B, *Bacillus subtilis* and *Bacillus licheniformis* at 0.4 g/kg diet) reduced mortality.

El-Sagheer and Hassanein (2014) [30] investigated the effect of enzymes and probiotic mixture supplementation on growth performance of 81 growing rabbits. The experimental period lasted for 6 weeks. Rabbits were distributed into 9 groups, each of three equal replicates. Group 1 to Group 3 were served as controls. Group 4 to Group 6 were supplemented with 1 g Veta-zyme/kg commercial diet, while the group 7 to group 9 was supplemented with 2 g Veta-zyme/kg commercial diet. They noted a non-significant difference in mortality among groups.

Shehu *et al.* (2014) [29] evaluated the effect of baker's yeast (*Saccharomyces cerevisiae*) supplementation on nutrient digestibility and growth performance of 60 weaned rabbits. The experimental period lasted for 12 weeks. The animals were randomly divided into 5 treatment groups. T_1 was controlled without supplementation of *Saccharomyces*, T_2, T_3, T_4 and T_5 supplemented at the rate of 20, 40, 60 and 80 g per kg of basal diet, corresponding to 2×10^9, 4×10^9, 6×10^9 and 8×10^9 CFU/kg of basal diet, respectively. They observed a non-significant difference in mortality of all groups.

Blood parameter

Simonova *et al*. (2013) [52] noted that dietary supplementation with *Enterococcus faecium* CCM7420 (EF) and *E. senticosus* extract (ES) or their combination (EF+ES) had a significant difference ($P<0.05$) for glucose among groups.

Galip and Seyidoolu (2012) [53] observed that serum cholesterol value tended to be lower ($p<0.05$) in rabbit fed 2 g yeast, while the serum glucose level was slightly higher but statistically non significant in rabbits fed 4 g yeast.

Seyidoglu and galip (2014) [31] reported that there were non-significant effects on blood glucose, triglyceride and cholesterol values of rabbits when fed with the *S. cerevisiae* supplement (3 g/kg diet).

Abd-El-hady and El-Abasy (2015) [47] observed that rabbits when fed with prebiotic (Bio-Mos®,mann oligosaccharide), probiotic (Bio-Plus® 2B, *Bacillus subtilis* and *Bacillus licheniformis*) and their mixture reduced glucose ($P<0.05$), cholesterol & triglycerides ($P<0.001$) significantly compared with control group.

Sarat Chandra *et al.* (2015) [54] observed that there were non-significant differences in the blood glucose and slight but no significant differences were observed between the cholesterol content of rabbits when fed with probiotics (*Saccharomyces boulardi* 50% and *Pediococcus acidilacticii 50%,* 10^9 CFU/g of feed) and enzymes (Kemzyme HF at 500 g/Ton of feed)

Carcass characteristics

Shanmuganathan *et al.* (2003) [21] investigated the effect of supplemental enzymes, yeast culture and effective micro-organisms on performance of 24 New Zealand White rabbits for 10 weeks. The rabbits were supplemented either with enzymes (a mixture of cellulases and proteases at 400 ppm), yeast culture (at 200 ppm) and effective micro-organisms (1 %) in three groups. They noted that yeast increased carcass recovery by 24.7% while effective microorganisms increased it by 16.7%.

Onbasilar and Yalcin (2008) [55] studied the effects of dietary supplementation of probiotic and anticoccidial on performance of 48 NZW rabbits for 6 weeks. They noted that carcass yield and weight percentage of lung, heart, kidney and small intestine are not different among groups.

Matusevicius and Jeroch (2009) [56] studied the effect of Probiotic Toyocerin® @ 1×10^{10}CFU/g in 60 New Zealand white rabbits for 56 days. They noted that carcass weight as well as weight of valuable carcass parts increased.

Brzozowski and Strezemacki (2013) [34] opined that the addition of Bacillus Cereus Var. Toyoi, as a probiotic factor in the young rabbit's diet at a level of 400 mg/kg of a probiotic preparation showed positive results during fattening and dressing percentage.

El-Sagheer and Hassanein (2014) [30] conducted an experiment to study the effect of supplementation of enzymes and probiotic mixture (Veta-zyme) on 81 growing New Zealand white rabbits for 6 weeks. The probiotic was supplemented @1 g /kg commercial diet and 2 g /kg commercial diet. They observed no significant differences in carcass criteria such as carcass weight and dressing, pancreas, heart, liver, spleen and head weight percentages among all treatment groups.

Ewuola *et al*. (2011) [26] studied the effect of prebiotics (Biotronic® at 4 kg/ton), probiotics (Biovet®-YC at 500 g/ton) and symbiotics on the performance of 32 weaned rabbits for 12 weeks. They noted that Carcass characteristics is not significantly different ($p>0.05$) except right arm for different treatment groups.

Conclusions

More recently, a great deal of interest has developed concerning the many beneficial effects of probiotic. Different study reveals that the use of probiotic could enhance body weight, weight gain, feed intake and may have positive effect on haemato-biochemical parameter and carcass characteristics of rabbit.

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