Advances in
Biotechnology & Microbiology
ISSN 2474-7637

Juniper PUBLISHERS key to the Researchers

Review Article
Volume 15 Issue 3 - February 2020
DOI: 10.19080/AIBM.2020.15.555913

Adv Biotechnol Microbiol

Review on Effects of Probiotic in Chicken Feed

Wondimu Adugna* and Yonas Belete

Department of Animal Science, Raya University, Ethiopia

Submission: January 30, 2020; **Published:** February 13, 2020

***Corresponding author:** Wondimu Adugna, Department of Animal Science, College of Agriculture and Natural Resource, Raya University; P.O. Box 92, Maychew, Ethiopia

Abstract

Probiotics is live cultures of microorganisms that have a beneficial effect on the health of animals and that stimulates the growth of beneficial microorganisms and reduces the amount of pathogens. Thus, improving the intestinal microbial balance of the host and lowering the risk of gastro-intestinal diseases. Probiotics can be harmful to debilitated and immune-compromised populations. *Lactobacillus bulgaricus*, *Lactobacillus* plantarum, *Streptococcus thermophillus*, *Enterococcus faecium*, *Bifidobacterium species* and *E.coli*. With the exception of *Lactobacillus bulgaricus* and *Streptococcus thermophillus*, all the other organisms are all intestinal strains [1-10]. *Lactobacillus*, *Streptococcus* and *Bifidobacterium* are the commonly used groups in the production of probiotics which administered orally, acted beneficially on host health through inhibiting pathogens, enhancing intestinal immunity, and having a protective effect on the gut micro flora. When supplemented to chicken probiotics improve feed-intake, growth performance, meat quality, egg production, egg quality and have cholesterol lowering potential in poultry products. The increase of productivity in the poultry industry has been accompanied by various impacts, including emergence of a large variety of pathogens and bacterial resistance. These impacts are in part due to the indiscriminate use of chemotherapeutic agents as a result of management practices in rearing cycles [11-25].

Keywords: Chickens; Egg production; Growth performance; Probiotic

Abbrevations: AA: Amino Acid; BW: Body Weight; CFU: Colony Forming Unit; DFM: Direct Feed Microbial; FCR: Feed Conversion Ratio; FI: Feed Intake; LMPU: Liquid Probiotic Mixture Culture; PUFA: Poly Unsaturated Fatty Acid; TLC: Total *Lactobacillus* Count; TVC: Total Viable Count

Introduction

Feed is one of the largest costs associated with commercial poultry production [24]). According to [20], further assessment of feed supplements has transpired due to increases in diet costs. In a study by [23], a significant interaction was found between the hen's dietary intake and line for several parameters, such as percentage yolk, yolk/albumen ratio, and the cholesterol content of the egg yolk. Nutritionally well-balanced feeding and better feed efficiency are components that can ensure economically successful poultry production [19,26-30].

Probiotics is live cultures of microorganisms that have a beneficial effect on the health of animals and that stimulates the growth of beneficial microorganisms and reduces the amount of pathogens. They have been approved to provide many benefits to the host animal and animal products production. They are used as animal feed to improve the animal health and to improve food safety with examples of the application in poultry, ruminant, pig and aquaculture [31-35]. The micro flora in the gastrointestinal tracts of poultry plays a key role in normal digestive Processes and in maintaining the animal's health. Probiotics stimulates the growth of beneficial microorganisms and reduces the amount of pathogens thus improving the intestinal microbial balance of the host. Intake of Probiotic lowers the risk of gastro-intestinal diseases by stimulating the growth of beneficial microorganisms. Supplementation of probiotics alleviates the problem of lactose intolerance, the enhancement of nutrients bioavailability, and prevention or reduction of allergies in susceptible individuals [10].

Moreover, it has been shown that probiotics could protect birds against pathogens by colonization in the gastrointestinal tract. Probiotic and competitive exclusion approaches have been used as one method to control endemic and zoonotic agents in chicken. In traditional terms, competitive exclusion in poultry has implied the use of naturally occurring intestinal microorganisms in chicks and poultry that were ready to be placed in brooder house. Supplementation of probiotics may avert the use of cholesterol-lowering drugs in people with high cholesterol level profile [36,37]. There are researches conducted on the effects of supplementation of probiotics, prebiotic and symbiotic on the quality of poultry products in different parts of the world on different breed of hens. Probiotic and competitive exclusion approaches have been used as one method to control endemic and zoonotic agents in poultry. In traditional terms, competitive exclusion in poultry has implied the use of naturally occurring intestinal microorganisms in chickens that were ready to be placed in brooder house. Therefore, the objective of this paper is to review the effects of probiotic supplementation on broilers and layers performance [38-40].

Review on Effects of Probiotic Supplementation in Chicken Feed

Mode of inclusion

Although the hypocholesterolemic potential of probiotics and probiotics has been widely studied, an accurate dosage of administration has yet to be established [20]. Culture mix indicated a minimum presence of 1.04×108 colony forming unit/gram (*Lactobacillus acidophilus*, *Lactobacillus* casei, *Bifidobacterium thermophilus* and *Enterococcus faecium*) was used by [15]. According to [26], reported the dosage of basal diet with drinking water containing 0.5- 1% of daily feed. On the other hand, [25] included four probiotic concentration (0, 400, 1000- and 2000-gram ton-1 feed providing 0, 1.28×106, 3.2×106 and 4.6×106 colony forming unit/gram feed concentration). Many of past studies has revealed that the effective administration dosages of probiotics vary greatly and is dependent on the strains used and the clinical characteristics of subjects, such as lipid profiles.

Effects on growth performance

In the study of [23] to determine if a *Bacillus amyloliquefaciens*-based direct-fed microbial supplement had an effect on broiler chickens. It was concluded that the supplementation of 30 mg/kg and 60 mg/kg of *Bacillus amyloliquefaciens*-based direct-fed microbial in the plant protein-based diet improved the growth performance of broilers, and was associated with positive effects on nutrient utilization, intestinal morphology, and cecal micro flora. On the other hand [35] reported that a significant increase in body weight gain in broilers fed with probiotics *Lactobacillus*, *Bifidobacterium*, coliforms, and Clostridium species. Results from [18] indicated that the live weight gains were significantly higher in birds supplemented with probiotics as compared to the control group at all levels during the period of 2nd, 4th, 5th and 6th weeks of age, both in vaccinated and non-vaccinated birds. Other studies [6] demonstrated increased live weight gain in probiotic fed birds. On the other hand, [24] found higher weight gains in broilers subjected to two probiotic species. Also [32] reported that probiotic (*Saccharomyces cervisiae*) supplementation of broilers, at level of 1, 1.5 and 2%, had significantly increased the body weight gain, feed consumption and feed conversion efficiency. Reports [9] have suggested that probiotic supplementation improved performance of broilers. [27] reported that Thepax and Saccharomyces cerevisiae had positive effects on performance of Japanese quails. As [40] reported an overall increase in body weight gain in chicken fed with multistrain probiotics compared with that in control group fed basal diet. As [33] reported that significantly higher body weight is recorded on broiler flocks that received probiotics. As indicated by [17] demonstrated that inactivated probiotics, disrupted by a high-pressure homogenizer, have positive effects on the production performance of broiler chickens when used at certain concentrations. As [14] reported that probiotics improved digestion, absorption and availability of nutrition accompanying with positive effects on intestine activity and increasing digestive enzymes.

In a study by [22], a multiple enzyme-producing *Bacillus*-based direct-fed microbial was tested on broiler chickens fed a rye-based diet in order to determine if growth performance and other factors would be effected. In the study of [26] a significant increase in body weight of broilers fed with *Lactobacillus acidophilus* and *Lactobacillus* casei. As [3] showed that the supplementation of probiotic (*Lactobacillus acidophilus*, *Bacillus subtilis*, *Saccharomyces cerevisiae* and *Aspergillus oryzae*) indicated significant increase body weight gain after 6 weeks of experiment. However, some studies show that probiotic supplementation doesn't improve chickens' feed intake [26], while [36] found inconsistent results, maybe because of type of diet ingredients which can affect probiotic's growth or their metabolites. As [39] found that body weight changes were not significantly different among treatment groups and feed conversion ratio was not affected by the dietary probiotic supplementation.

Effects on feed intake

The study of [22] found that the *Bacillus*-based direct-fed microbial enhanced the feed conversion ratio, as well as bird body weights and bone quality measurements and [32] reported that probiotic (*Saccharomyces cervisiae*) supplementation of broilers had significantly increased feed consumption. Results from a study by [8] indicated that probiotics did not have any significant positive effect on broilers FI, Body Weight (BW) and Feed Conversion Ratio (FCR). As [27] reported that Addition of Thepax and Saccharomyces cerevisiae significantly increased FI in Japanese quails. Rise in feed and water consumption is recorded in laying hens fed with Liquid Probiotics Mixed Culture (LPMC) containing two type microorganisms, *Lactobacillus* and *Bacillus species* 30]. Inclusion of probiotic caused no significant increase in feed consumption, egg production and egg weight [25]. As indicated by [12] reported that supplementation of probiotic *Lactobacillus* cultures did not influence the Feed Intake (FI), egg production or egg mass of hens throughout the 48-week

How to cite this article: Wondimu Adugna, Yonas Belete. Review on Effects of Probiotic in Chicken Feed. Adv Biotech & Micro. 2020; 15(3): 555913. DOI: 10.19080/AIBM.2020.15.555913

period. As [40] reported an increase body in FI in chicken fed with multistrain probiotics compared with that in control group fed basal diet. As [31] reported FI values of different treated groups were approximately similar and lacked significance with layer flock that fed with Saccharomyces cerevisiae. However, feeding viable *Lactobacillus* at 1100 mg kg^{-1} (4.4 ×107 colony forming units (cfu) kg1) increased daily feed consumption, egg size, nitrogen and calcium retentions [30]. As reported by [39], feed consumption was not affected by the dietary probiotic supplementation. As indicated by [5], there was improvement in feed efficiency, beneficial effects of on digestion and utilization of nutrients due to probiotic supplementation.

Effect on cholesterol-depressing potential

As indicated by [6], the dietary supplementation with probiotic decrease cholesterol concentration when compared with birds fed basal diet, prebiotic and antibiotic diets. The cholesterol content of eggs produced by probiotic (*Lactobacillus* culture) fed hens was significantly lower by 15.3% and 10.4% when compared to those of the control hens at 24 and 28 weeks of age, respectively [12]. Similarly [25] reported that probiotic *Bacillus subtilis* and *Bacillus* licheniformis supplementation reduced the plasma cholesterol and triglyceride significantly. A study by [3] showed that the supplementation of probiotic (*Lactobacillus acidophilus*, *Bacillus subtilis*, *Saccharomyces cerevisiae* and *Aspergillus oryzae*) indicated significant decrease in serum cholesterol concentration after 6 weeks of experiment with probiotic treatment.

In the study of [26] reported that the cholesterol level of serum significantly decreased in groups supplemented with probiotics in assimilation of cholesterol by *Lactobacillus* compared to control group fed with basal diet. The same study also reported that there is a significant decrease in the serum level of triglycerides between control group and groups treated with *Lactobacillus acidophilus* and *Lactobacillus* casei supplemented in broiler diet in combination with water or alone. As [21] reported that supplementation probiotic *Bacillus licheniformis* and *Bacillus subtilis* decreased egg yolk cholesterol and serum cholesterol levels in Brown-Nick layer hybrids. The fat digestion rate is linked to the rate of gallbladder acids in digestion latex and subsequently the lipid concentration. *Lactobacillus acidophilus* and *Lactobacillus casei* in diet or water cause a decrease in gallbladder acids in digestion latex and this resulted in a reduction in the ability of fat digestion and therefore decreasing lipid level of blood [11].

Effects on the intestinal micro organism

As the study by [18] attempted to evaluate the effect of probiotics with regard to clearing bacterial infections and regulating intestinal flora by determining the Total Viable Count (TVC) and Total *Lactobacillus* Count (TLC) of the crop and cecum samples of probiotics and conventional fed groups at the 2^{nd}, 4^{th} and 6^{th} week of age. Their result revealed competitive antagonism. The result of their study also evidenced that probiotic organisms inhibited some no beneficial pathogens by occupying intestinal wall space. They also demonstrated that broilers fed with probiotics had a tendency to display pronounced intestinal histological changes such as active impetus in cell mitosis and increased nuclear size of cells, than the controls. This result of histological changes support the findings of Samanya and Yamauchi and they indicated that birds who were fed dietary *B. subtilis* var. natto for 28 days had a tendency to display greater growth performance and pronounced intestinal histologies, such as prominent villus height, extended cell area and consistent cell mitosis, than the controls. On the other hand, [2] compared the effects of providing a Direct-Fed Microbial (DFM) with the feeding of salinomycin on intestinal histomorphometrics, and microarchitecture and they found less mucous thickness in DFM-treated chickens and the density of bacteria embedded in the mucous blanket appeared to be lower in DFM-treated chickens than in the control in all intestinal segments. As demonstrated by many researcher t probiotic species belonging to *Bacillus*, *Bifidobacterium*, *Enterococcus*, *Aspergillus*, *Lactobacillus*, *Streptococcus Candida*, and *Saccharomyces* have a potential effect on modulation of intestinal micro flora and pathogen inhibition.

Effects on egg production

Hen day production and egg weight in layers supplemented with Liquid Probiotics Mixed Culture (LPMC) containing two type microorganisms, *Lactobacillus* and *Bacillus* species is the highest as reported by [30]. As indicated by [21] the supplementation probiotic *Bacillus licheniformis* and *Bacillus subtilis* increased egg production and decreased percentages of damaged egg in Brown-Nick layer hybrids. On the other hand [12] reported that the addition of probiotics did not have significant effect on egg production and egg mass but significant effect was recorded on egg weight and [13] also found no significant improvement in egg production of hens supplemented with Prima Lac, a commercial product containing *Lactobacillus* species.

On the other hand, significant improvement in egg production was observed in hens fed with a mixed culture of *Lactobacillus acidophilus*, *Lactobacillus casei* and *Lactobacillus acidophilus* [38] reported that egg production in Hisex Brown layers fed with probiotics contained *Lactobacillus plantarum*, *Lactobacillus delbrueckii subspps*, *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, *Bifidobacterium* bifidum, *Streptococcus salivarius subspps* and *Enterococcus faecium*, *Aspergillus oryza* and *Candida pintolopesii* showed greater egg production than the group fed with basal diet. Moreover, there were linear increases in egg production with increased supplemental probiotic. As reported in many study egg quality had improved by the addition of a liquid culture of probiotic bacteria to the basal diet. However, the egg weight was significantly greater in *Lactobacillus* Culture fed hens (58.77 gram) from 20 to 68 weeks of age. On the other hand, [31] indicated that significant higher egg production was recorded in layers hen supplemented with probiotic *Saccharomyces cerevisiae*.

How to cite this article: Wondimu Adugna, Yonas Belete. Review on Effects of Probiotic in Chicken Feed. Adv Biotech & Micro. 2020; 15(3): 555913. DOI: 10.19080/AIBM.2020.15.555913

Effects on Egg quality

The egg's interior consists of 65% albumen or white and 35% yolk; the egg albumen is mainly water, and the egg yolk is 32% lipid and 16% protein For consumers, the internal egg quality (albumen and yolk) is very important, and egg quality is key for consumer appeal [4]. Internal egg qualities like albumen weight, Albumen- length, albumen index and also yolk weight, yolk- height, width, yolk index, yolk color are differently increased in treated groups then comparable to control group [34]. As [5] reported Shell breaking strength, shell weight and shell thickness increased significantly as a result of probiotic supplementation. This beneficial effect on eggshell quality due to probiotic feeding may be attributed to a favorable environment in the intestinal tract by feeding of probiotics, which was evident for increased concentration of Ca in serum with probiotic supplementation; a similar trend was also observed in the studies Shell breaking strength was significantly higher in the probiotic-fed groups. This could be attributed to the higher shell thickness, which might have created greater resistance resulting in higher breaking strength.

Effects on the lipid composition and oxidation of the meat

Fatty acid composition is an important component of meat quality, associated with its dietetic value. Research on the influence of various probiotics on the fatty acid profile of meat is relatively scarce, but the overall results show positive effect of the probiotics, mainly related to reduction in saturated and increase of polyunsaturated fatty acids. Feeding broilers with *Aspergillus awamori* and *Saccharomyces cerevisiae* or combination of them led to significant decrease in the saturated C16:0 and C18:0 and increase in C18:1 as well as in the polyunsaturated C18:2, C18:3, C20:4 [2]. The same was observed when the diet of the birds contained *Aspergillus awamori* and *Aspergillus Niger* in different amounts (0.01%, 0.05%, and 0.1%) [1]. As well as *Aspergillus awamori* in combination with selenium nano particles [1] also [16] observed increase in the C18:3 in breast and C18:2 and C18:3 in the thighs after probiotic administration; however, in another experiment, [16] observed reduction in the n-6 PUFA in both breast and thigh. Further [16] found slight increase of mono and polyunsaturated, while decrease in the saturated fatty acids in broilers fed probiotics alone or in combination with pollen.

Conclusion

Probiotics have a number of beneficial effects in chicken production. According to different studies, provision of probiotics improves feed intake, feed conversation ratio, stimulates growth rate, increases egg production or enhanced egg production, improved eggshell quality and humoral immune response, and decreased the cholesterol content in eggs. Despite the wide use of probiotics in chicken production, an accurate dosage of administration has yet to be established. It can be mixed into water and feed with different dosages. The present review reveals that probiotics could be successfully used as nutritional tools in chicken's feed for promotion of growth, modulation of intestinal micro flora and pathogen inhibition, immunomodulation and promoting meat quality of birds. Generally, probiotics provide the following function for chickens.

References

1. Saleh AA (2014) Effect of feeding mixture of *Aspergillus* probiotic and selenium nanoparticles on growth, nutrient digestibility's, selected blood parameters and muscle fatty acid profile in broiler chickens Anim Sci Pap 32: 65-67.
2. Saleh AA, Eid YZ, Ebeid YZ, Kamizono T, Ohtsuka A, Hayashi K (2011) Effects of feeding *Aspergillus awamori* and *Aspergillus niger* on growth performance and meat quality in broiler chickens. Poult Sci 48: 201-206.
3. Amer MY, Khan SH (2012) A comparison between the effects of a probiotic and an antibiotic on the performance of Desi chickens Veterinary World. 5(3): 160-165.
4. Anyaegbu BC, Onunkwo DN, Irebuisi D (2016) Evaluation of Hen Age, Body Weight and Egg Weight on Percent Egg Component and the Internal Composition of Harco Hen Eggs Sci-Afric. Journal of Scientific 4(5): 943-945.
5. Arun K Panda, Savaram S, Rama Rao, Manteta VLN Raju (2007) Effect of probiotic (*Lactobacillus sporogees*) feeding on egg production and quality, yolk cholesterol and humoral immune response of white Leghorn layer breeders 20-25.
6. Ashayerizadeh A, Dabiri N, Mirzadeh KH, Ghorbani MR (2011) Effect of dietary supplementation of probiotic and prebiotic on growth indices and serum biochemical parameters of broiler chickens. Journal of Cell and Animal Biology 5(8): 152-156.
7. Ashayerizadeh O, Dastar B, Shargh MS, Ashayerizadeh A, Mamooee M (2009) Influence of antibiotic, prebiotic and probiotic supplementation to diets on carcass characteristics, hematological indices and internal organ size of young broiler chickens. Journal of Animal and Veterinary Advances 8(9): 1772-1776.
8. Babazadeh D, Vahdatpour T, Nikpiran H, Jafargholipour MA, Vahdatpour S (2011) Effects of probiotic, prebiotic and synbiotic intake on blood enzymes and performance of Japanese quails (*Coturnix japonica*). Indian Journal of Animal Sciences 81(8): 870-874.
9. Banday MT, Risam KS (2002) Growth performance and carcass/ characteristics of broiler chicken fed with probiotics Poultry Abstracts 28: 388.
10. Chiang SS, Pan TM (2012) Beneficial effects of *Lactobacillus paracasei* subsp paracasei NTU 101 and its fermented products Applied Microbiology and Biotechnology 93(3): 903- 916.
11. Corcoran BM, Stanton C, Fitzgerald GF, Ross RP (2005) Survival of probiotic *lactobacilli* in acidic environments is enhanced in the presence of metabolizable sugars Applied and Environmental Microbiology 71(6): 3060-3067.
12. Daneshyar M, Kermanshahi H, Golian A (2009) Changes of biochemical parameters and enzyme activities in broiler chickens with cold-induced ascites Poultry Science 88(1): 106-110.
13. Davis GS, Anderson KE (2002) The effects of feeding the direct-fed microbial, PrimaLac, on growth parameters and egg production in single white leghorn hens Poultry Sciences 81(6): 755-759.

How to cite this article: Wondimu Adugna, Yonas Belete. Review on Effects of Probiotic in Chicken Feed. Adv Biotech & Micro. 2020; 15(3): 555913. DOI: 10.19080/AIBM.2020.15.555913

14. Edens F (2003) An alternative for antibiotic se in poultry: probiotics Revista Brasileira de CiênciaAvícola 5(2): 75-97.

15. Ghavidel SZ, Kambiz NA, Naser MS, Saeed A, Afshar M, Masoud M Seyed AS (2012) Effects of lactobacillus-based probiotic on growth performance, mortality rate and carcass yield in broiler chickens. Annals of Biological Research 2(2): 325- 331.

16. Hossain ME, SY Ko, Kim GM, Firman JD, Yang CJ (2012) Evaluation of probiotic strains for development of fermented *Alisma canaliculatum* and their effects on broiler chickes Poultry Science 91: 3121-3131.

17. Huang MK, Choi YJ, Houde R, Lee JW, Lee B, et al. (2004) Effects of *Lactobacilli* and Acidophilic fungus on the production performance and\immune responses in broiler chickens Poultry Science 83: 788-795.

18. Kabir Rahman MM, Rahman MB, Rahman MM, Ahmed SU, Sani ML (2004) The dynamics of probiotics on growth performance and immune response in broilers International Journal of Poultry Science 3(5): 361-364.

19. Katoch S, Sharma KA, Chahota R, Sharma KS, Radmila Marković, Sefer D (2013) Performance of Broiler Chicken Fed Varied Nutrient Density Diets Supplemented with Direct Fed Microbial Acta Veterinaria (Boegrad) 63(5-6): 643-653.

20. Kidd MT, Araujo L, Araujo C, McDaniel CD, McIntyre D (2013) A Study Assessing Hen and Progeny Performance Through Dam Diet Fortification with a *Saccharomyces cerevisiae* Fermentation Product Journal of Applied Poultry Research 22: 872-877.

21. Kurtoglu V, Kurtoglu F, Seker E, Coskun B, Balevi T, et al. (2004) Effect of probiotic supplementation on laying hen diets on yield performance and serum and egg yolk cholesterol. Food Additives and Contaminants 21(9): 817-823.

22. Latorre JD, Hernandez-Velasco X, Bielke LR , Vicente JL , Wolfenden R , et al. (2015) Evaluation of a Bacillus Direct-Fed Microbial Candidate on Digesta Viscosity, Bacterial Translocation, Microbiota Composition and Bone Mineralisation in Broiler Chickens Fed on a Rye-Based Diet. British Poultry Science 56(6): 723-732.

23. Lei XJ, Ru YJ, Zhang HF (2015) Effect of Bacillus *amyloliquefaciens*-Based Direct-Fed Microbials and Antibiotic on Performance, Nutrient Digestibility, Cecal Microflora, and Intestinal Morphology in Broiler Chickens Journal of Applied Poultry Research 23: 486-493.

24. Lowman ZS, Ashwell CM (2016) Parental Diet Effects on Egg Component Weights and Shell Quality. Journal of Applied Poultry Research 25: 437-442.

25. Mahdavi AH, Rahman HR, Pourreza J (2005) Effect of probiotic supplements on egg quality and laying hen's performance International. Journal of Poultry Science 4(4): 488-492.

26. Mansoub NH (2010) Effect of Probiotic Bacteria Utilization on Serum Cholesterol and Triglycrides Contents and Performance of Broiler Chickens Global Veterinaria 5(3): 184-186.

27. Nikpiran H, Vahdatpour T, Babazadeh D, Vahdatpour S (2013) Effects of *Saccharomyces Cerevisiae*, Thepax and Their Combination on Blood Enzymes and Performance of Japanese Quails (*Coturnix Japonica*). Journal of animal and plant sciences 23(2): 369-375.

28. Ooi LG, Liong MT (2010) Cholesterol-lowering effects of probiotics and prebiotics: A review of *in Vivo* and *in Vitro* Findings. Int J Mol Sci 11(6): 2499- 522.

29. Haščík P, I Elimam, J Garlík, M Bobko, J Tkáčová (2014) Fatty acid content in broileŕs Ross 308 meat muscles after using bee pollen and probiotic as supplementary diet into their mixture microbial Biotech Food Sci 4: 67-69.

30. Raka Pambuka S, Sjofjan O, Eka Radiati L (2014) Effect of Liquid Probiotics Mixed Culture Supplements through Drinking Water on Laying Hens Performance and Yolk Cholesterol. Journal of World's Poultry Research 4(1): 5-9.

31. Saadia MH, Nagla KS (2010) Effect of Probiotic (*Saccharomyces cerevisiae*) Adding to Diets on Intestinal Microflora and Performance of Hy-Line Layers Hens Journal of American Science 6(11): 159-169.

32. Shareef AM (2009) Effect of probiotic (*Saccharomyces cerevisiae*) on performance of broiler chicks. Iraqi Journal of Veterinary Sciences 23: 23-29.

33. Sherief MA, Sherief MSA (2011) The Effect of Single or Combined Dietary Supplementation of Mannan Oligosacharide and Probiotics on Performance and Slaughter Characteristics of Broilers. International Journal of Poultry Science 10(11): 854-862.

34. Sathya C, Murugaian P (2015) Effect of dietary supplementation of probiotic and *Curculigo orchioides* rhizome powder on egg quality parameters and biochemical composition of Japanese quail. Biomedicine and computational biology 166-167.

35. Song J, Xiao K, Ke YL, Jiao LF, Hu CH, et al. (2014) Effect of a probiotic mixture on intestinal microflora, morphology and barrier integrity of broilers subjected to heat stress. Poult Sci 93(3): 581-588.

36. Timmerman HM, Veldman A, van den, Elsen E, Rombouts FM, et al. (2006) Mortality and Growth Performance of Broilers Given Drinking Water Supplemented with Chicken- Specific Probiotics Poultry Science 85(8): 1383-1388.

37. World Health Organization (WHO) (2008) Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases the six objectives of the 2008- 2013 Action Plan are Blood.

38. Yoruk MA, Gul M, Hayirli A, Macit M 2004) The effects of supplementation of humate and probiotic on egg production and quality parameters during the late laying period in hens Poultry Science 83(1): 84-88.

39. Yousefi M, Karkoodi K (2007) Effect of Probiotic Thepax and *Saccharomyces cerevisiae* Supplementation on Performance and Egg Quality of Laying Hens International Journal of Poultry Science 6(1): 52-54.

40. Zhang ZF, Kim IH (2014) Effects of multistrain probiotics on growth performance, apparent ileal nutrient digestibility, blood characteristics, cecal microbial shedding, and excreta odor contents in broilers Poultry science 93(2): 364-370.

How to cite this article: Wondimu Adugna, Yonas Belete. Review on Effects of Probiotic in Chicken Feed. Adv Biotech & Micro. 2020; 15(3): 555913. DOI: 10.19080/AIBM.2020.15.555913