REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

Influence of Probiotics on Poultry Production: An Organized Review

Taskeen Zaidi[1]*, Dr. Pravesh Belwal[2], Dr. Navghan Mahida[3]

*[1]Associate Professor, Department of Computer Sceince and Information Technology, Jain (Deemed to be University), Bangalore, India, Email Id- t.zaidi@jainuniversity.ac.in , Orcid Id- 0000-0002-1716-9262

[2]Assistant Professor, School of Engineering and Computer, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India, Email Id- ece.pravesh@dbuu.ac.in, Orcid Id- 0000-0003-2119-1494

[3]Assistant Professor, Department of Agricultural Economics, College of Agriculture, Parul University, Limda, Dist- Vadodara -391760, India, Email Id- navghan.mahida91080@paruluniversity.ac.in, Orcid Id- 0000-0001-6902-1588

Abstract

Probiotics are gaining acceptance recently as nutritional supplements and food components for the chicken business, serving as an alternative to antibiotics. Probiotics are a versatile feed supplement that is utilized with other supplements to promote enhanced efficiency and health. These substances are useful in digestion and indirectly in the immuno-modulation of the poultry immune method. To prevent infections from colonizing the poultry's digestive system, the probiotics are made up of a single bacterial strain or a blend of many strains. Specific instances of these microorganisms include Streptococcus, Lactobacillus, Enterococcus, Bifidobacterium, Aspergillus, Candida, Bacillus and Saccharomyces. A quality probiotic is defined by its capacity to benefit the host, withstand low pH and bile salts, stick to, as well as colonize the intestinal epithelium, not harmful to the host and generate antimicrobial compounds in response to pathogens. It strengthens the immune system, raises the quality of meat and eggs that enhances the productivity as well as growth of chickens. In this review, we analyze the influence of probiotics on poultry production. Increasing the efficacy and affordability of feeds is a major responsibility of the poultry feed business, which makes use of biotechnology. This shows that using probiotics might help growers to achieve better production results. Along with these benefits connected to production, improved defense against diseases and stress contribute to increased poultry resistance. As a result, probiotics are acknowledged as a useful response to problems in the poultry sector, including illnesses, pathogenic bacteria that are resistant to antibiotics and unfavorable environmental circumstances. The review's results are continuous efforts to improve the overall production outcomes and optimize nutrition for poultry.

Keywords: Probiotics, Poultry Production, feed additives, microorganisms, nutrition.

INTRODUCTION

Antibiotics are used in the poultry business globally to stop diseases and poultry infections to enhance the production of eggs and meat. Using antibiotics in food led to widespread issues such as the growth of drug-resistant bacteria, drug residues in the poultry bodies and imbalances in the natural micro-biota. Numerous dietary approaches use probiotic microorganisms to assist the host organism under physiological stress, lessen technology-induced stress and treat diarrheal illnesses (1). The pathogen suppression strategies advised by the probiotic bacteria include immune system activation, competing for nourishment, production of antimicrobial environment and chemicals as well as consensus for receptors on the intestinal epithelium (2). An effective probiotic needs to satisfy certain requirements for selection, such as a part of the normal gut micro-biota, possessing the capacity to withstand acid and bile, colonizing the intestinal tract, producing chemicals that are antimicrobial, or producing bacteriocin (3). It has to be reasonably priced for usage with farm animals, readily withstand large-scale growth and maintain its viability in field along with storage settings. Introduced probiotics species of Streptococcus, Bacillus, Enterococcus, Bifidobacterium, Aspergillus, Lactobacillus, Saccharomyces and Candida have been shown to improve broiler performance (4). Poultry meat production and consumption, especially of chicken meat, have been rising dramatically is shown in Figure (1).

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

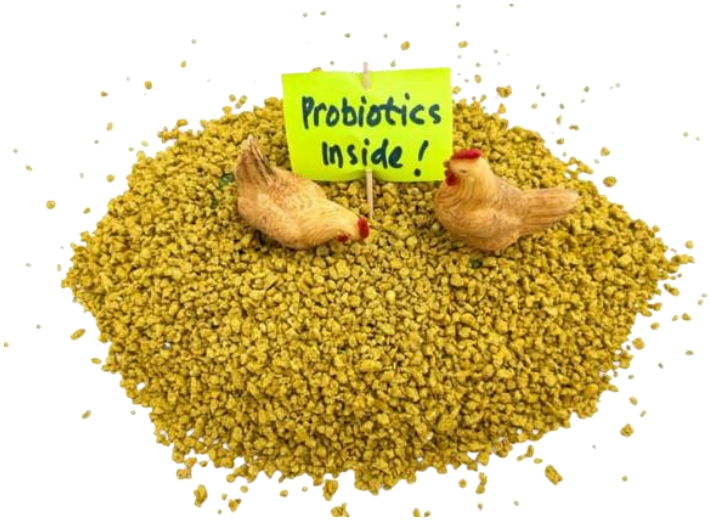

Figure (1). Probiotics for Poultry

(Source link:https://www.thehappychickencoop.com/wp-content/uploads/2023/08/Probiotics-for-chickens-featured-image.jpg)

The consumer desire for a better diet with meat as a necessary component is largely responsible for this industry's fast rise. A significant portion of the economies of many nations revolve around the production of poultry (5). The production of chicken on a big scale is prone to many stressful situations and illnesses, which leads to significant financial losses. The use of antibiotics as preventative measures has been called into doubt since harmful bacteria have evolved to become resistant to these drugs (6). Probiotics are seen to be the greatest way to close the gap and some farmers have started using them instead of antibiotics. A probiotic is called a direct-fed microbial, which is a bacterial culture that is administered to an animal to enhance its health. It contains a particular variety of microbes or many different strains (7). Probiotics in poultry have been studied using a wide range of various kinds of bacteria, as well as in some circumstances, especially unrecognized cultures. In many nations, the chicken business has grown to be a significant economic sector. Serious economic losses are caused by disease-related issues and environmental degradation in large-scale poultry production operations, while the birds are subjected to stressful situations (8). The usage of veterinary pharmaceuticals has increased in recent decades due to the prevention and control of illnesses. The effectiveness of antimicrobial agents as a preventative strategy has been raised into doubt due to the vast evidence of pathogenic bacteria evolving resistance to antimicrobials (9). Because of the potential for antibiotics to become less utilized as stimulants of growth for poultry and the uncertainty around their potential negative effects, manufacturers and consumers are searching for alternatives (10). Probiotics are investigated as a potential solution for this gap and some farmers have started using them instead of antibiotics. Probiotics in chickens work by competitively excluding and antagonistically interacting with the bacteria in the intestines to maintain normal micro-biota. This results in a change in metabolism through growing the function of stomach enzymes and decreasing the activities about bacteria's enzymes and the production of ammonia (11). The chicken feed business is dependent on biotechnology, which is essential to nutritionists' current efforts to create feeds that are more economical and effective. It is not enough to have a high-quality feed, that needs to make sure that it is used to its full potential (12). Digestion results from diet modifications or a diet deficient in nutrients that upsets the equilibrium of intestinal micro-biota. A diet high in vital nutrients and energy that is well-balanced is necessary to keep the gut healthy. There has been a lot of attention paid by nutritionists and veterinary professionals to the right use of nutrients and the addition of probiotics to promote chicken development (13). The body reacts to probiotics in ways that include infections, the production of harmful substances by bacteria and the transfer of genes associated with antibiotic resistance to other microorganisms inside the digestive tract (14). Probiotics in poultry affect metabolism by increasing the activity of digestive enzymes and decreasing that of bacterial enzymes and nitrogen production, it support the immune system, enhance the consumption of feed and digestion, as well as maintain regular intestinal micro-flora with antagonistic interactions coupled with competitive exclusion (15). One strategy for managing endemic and zoonotic pathogens in poultry is the use of probiotics and competitive

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

exclusion techniques. The use of naturally existing intestinal microbes in chicks and poults that were prepared for placement in brooder houses has been associated with competitive exclusion in poultry (16). Probiotics' inconsistent efficacy is one of its challenges due to their effects vary depending on the strains used, the dose and the environment while the poultry are raised. In this study, we analyze the effects of probiotics on a range of poultry production factors.

Contributions of this study:

- To explain the probiotics improve growth performance and have a favorable effect on poultry production.
- To emphasize the role that probiotics contribute to assist poultry use feed efficiently.
- To address the effect of probiotics on poultry immune system strengthening.

Probiotic for Poultry Production

Despite the synthesis of hydrolytic enzymes like amylase, lipase and protease, probiotic bacteria are essential for aiding in digestion and nutritional absorption. Furthermore, by regulating the host's immunological response and affecting microbial activity in the gut, these advantageous bacteria support the improvement of the immune system. Live microorganisms have shown to be defensive throughout clinical trials, protecting the intestinal mucosa as a barrier and functioning as biological antagonists. Figure (2) depicts the many roles that probiotic microorganism's activity.

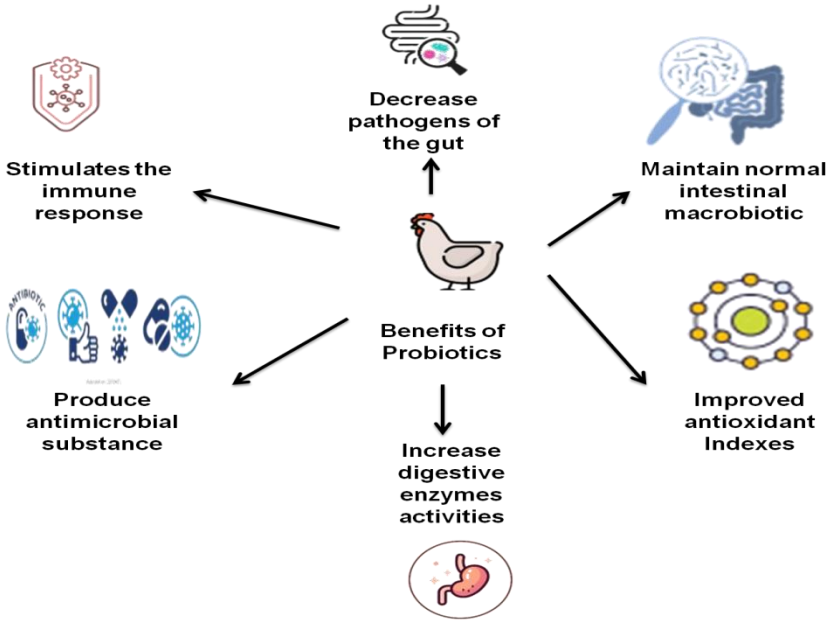

Figure (2). Probiotics provide a variety of purposes in poultry

(Source link: https://www.researchgate.net/figure/Probiotics-perform-many-functions-in-broiler-chickens_fig3_347442984)

Mechanism of antibiotic growth pro-motors

Synthetic growth promoters (SGPs) and Antibiotic growth promoters (AGPs) were recognized. Even while used at sub-therapeutic doses, it produced a favorable outcome. On productivity indices such as body weight, daily growth and feed conversion ratio (FCR). Their primary target for antibacterial activity was gram-positive bacteria. Although the exact processes behind the use of AGPs and SGPs to improve an animal's performance as well as growth remain to be explored, the results of the experiment were ideal in terms of output. According to recent discoveries, AGPs have the capacity to alter the variety of gut bacteria, especially healthy Lactic acid bacteria (LAB), which impact that the gut micro-biome is managed (17). Resolving contradictory information about AGPs requires further research, since discrepancies result from environmental influences on the outside

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

world, the makeup of each animal's micro-biota, or the animals' overall health. Certain residues in soil, water and animal products have prompted the withdrawal of AGPs, which had negative effects on allergies and antibiotic resistance. While it is apparent that AGPs have a positive impact on animal performance and have antibacterial properties, a more thorough comprehension of their mechanisms of action is needed. This information has to be weighed against the benefits and downsides of using substitute materials in agriculture (18).

Probiotics generated from Microorganisms

Probiotic efficacy is dependent on many factor, contains the strains' stability and the host strain's specificity, survival, the bird's age, the dosing rate, its nutritional including physiological state and its genetic composition. The small intestine has a significant population of facultative anaerobes, such as Lactobacillus and Streptococci, as well as anaerobic species, including Bacteroides and Bifidobacterium, proventriculus, gizzard, as well as cecal, Enterocyte and colonic epithelium are the three different areas of the gastrointestinal tract (GIT) that is probiotics grow colonies (19). The three main ways that a probiotic microbe in poultry contributes to the maintenance of a healthy gut micro-biota are shown in Figure (3). The production of metabolic enzymes that break down the complex carbohydrates in feed and the competitive exclusion of pathogens are two examples of these systems.

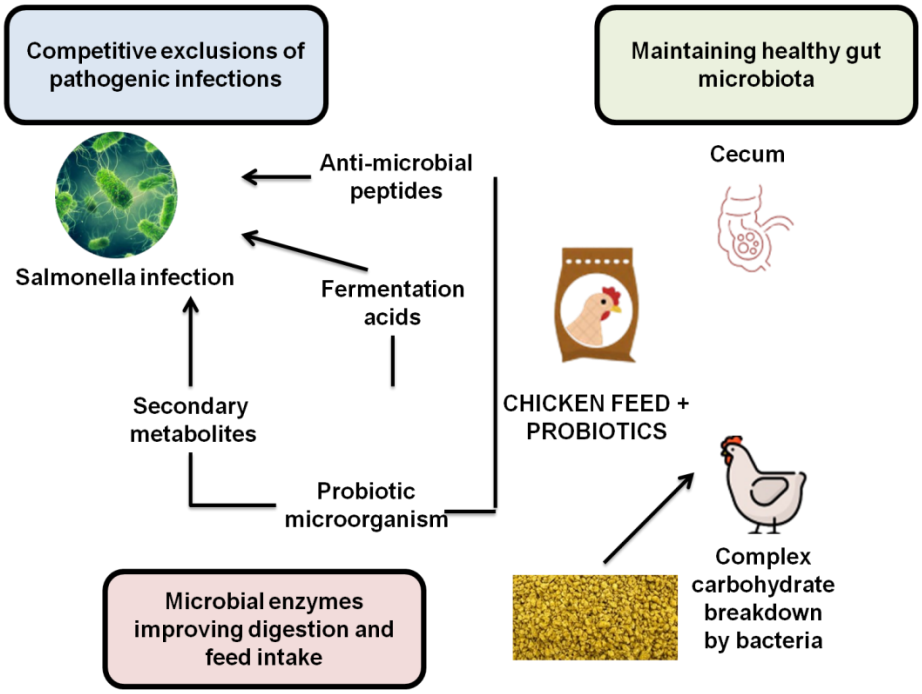

Figure (3). Probiotics function in poultry

(Source link: https://www.researchgate.net/figure/The-mode-of-probiotic-actions-in-poultry-Suresh-et-al-2020_fig1_353622309)

Probiotics as Aids to the Immunity

The antibacterial activity of probiotics and antibiotics is equivalent to that of organic acids, hydrogen peroxide, bacteriocin and short chain fatty acids (SCFA). The capacity of healthy microbes to raise anti-inflammatory chemicals such as TGF-β and IL-10 and neutralize cytokines that promotes inflammation. The concentrations of antibodies M and A are positively impacted by the addition of these feed additives (20). Additionally, a rise in the serum's total antioxidant capacity (TOAC) has been observed. The findings indicate that Lactobacillus rhamnosus activates the receptor in digestion that causes epidermal development, which lowers intestinal epithelial apoptosis and it is a crucial factor in the fight against gastrointestinal disorders. The micro-biota, or diversity of bacteria, is abundant in the digestive system of fowl (21). The micro-biota is

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

recognized as a biochemical organ that adapts to the host body's physiology and it is a crucial part of the gastrointestinal ecology. The intestine's shape and function are influenced by bacteria, which serve to expand intestinal crypts. In addition, the micro-biome in the gut has the ability to affect the way of intestine appears, especially while it comes to controlling immune responses (22). The micro-flora's gene reservoir, which codes for the enzymes required for metabolic transformations, is a crucial component. The breakdown of polysaccharides, which is aided by the presence of bacteria, depends on glycosidic hydrolysis and necessary of polysaccharide lyase genes, neither of which are present in poultry. Every bacterial micro-flora has a different metabolism, particularly while it comes to using probiotics. In addition, the micro-biome's composition is influenced by the quantity, caliber of calories as well as the diet's content and balance (23).

Biotechnology and the Feed Industry

An animal's digestive tracts micro-biota balance is enhanced by using a probiotic, which is a live microbial dietary supplement. The goal of probiotic-enriched foods is to encourage the development of good bacteria in the gut while inhibiting develops of destructive microorganisms. The gastro-intestinal area of poultry is empty upon hatching, but bacteria from their surroundings occupy it. Feral birds reared in commercial incubators have been shown to perform better, while probiotics are added to their meal (24). To competitively exclude harmful bacteria like E. coli, probiotics attach to certain oligosaccharide receptors on the gut wall. They neutralize endotoxins that are generated by harmful bacteria. Lowering the pH and producing an unfavorable environment for the survival of pathogenic bacteria is the conversion of lactose to lactic acid by lactobacilli. Therefore, a stronger and more efficient immune response is linked to the consumption of immune modulators in the diet (25). The weekly changes in broiler (BW) throughout the experiment are shown in Figure (4) and Table (1), which shows significant differences between treatments in weeks 4 and 6.

Table (1). Numerical outcomes of Mean broiler BW (Source: Author)

Period	Mean broiler BW(g)			
	Control	PFW	PF	AB
Start	1.5	1.6	1.57	1.8
WK 1	247.5	246.6	245.7	244.8
WK 2	500.11	500.8	500.6	500.4
WK 3	947.52	950.72	990.84	995.91
WK 4	1250.55	1251.62	1255.77	1260.92
WK 5	1754.61	1759.21	1721.11	1761.53
WK 6	2250.51	2260.71	2264.11	2274.12

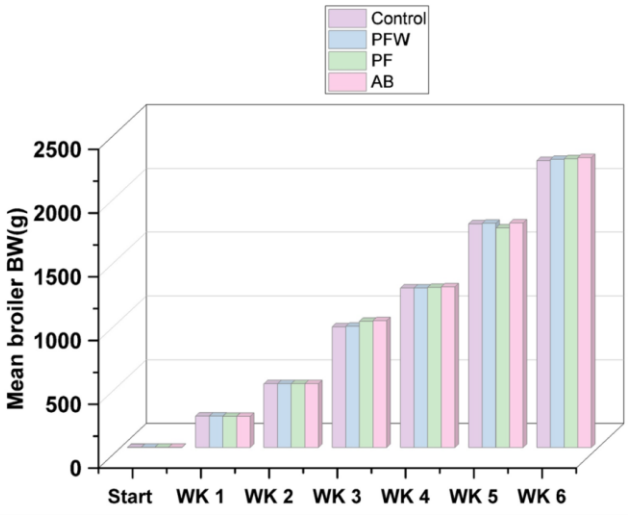

Figure (4). Mean broiler BW
(Source link: https://www.sciencedirect.com/science/article/pii/S0032579119403180)

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

In particular, during these weeks, broilers treated with antibiotic (AB) showed greater BW than the control group. Only in week six treatment PF provide a lower BW than AB. The broiler BW for the probiotic in feed and water ((PFW) did not change much from the AB treatment over the two weeks. The weekly feed intake (FI) for poultry throughout the experiment is shown in Figure (5). During the first two weeks of life, significant variations in FI were seen between the treatments. While compared to the control and AB treatments, treatments of PFW and probiotics in feed (PF) demonstrated that it reduced FI in week 1. This tendency was reversed in week two, as PFW and PF treatments showed increased FI in comparison to AB along with control treatments are shown in Table (2).

Table (2). Numerical outcomes of Mean broiler FI (Source: Author)

Period	Mean broiler FI (g)			
	Control	PFW	PF	AB
WK 1	248.67	249.89	252.43	260.12
WK 2	401.34	410.56	430.78	445.91
WK 3	621.12	644.34	649.52	650.72
WK 4	825.87	827.56	844.31	838.19
WK 5	1005.34	1010.51	1050.15	1060.1
WK 6	1100.01	1110.55	1125.85	1158.92

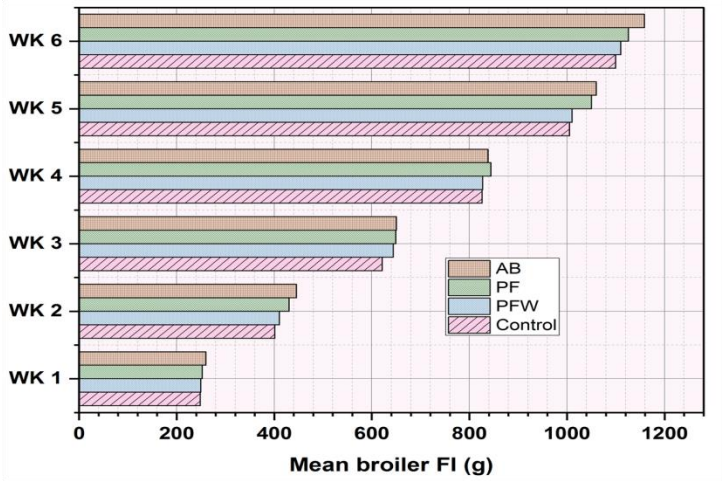

Figure (5). Mean broiler FI
(Source link: https://www.sciencedirect.com/science/article/pii/S0032579119403180)

Requirements for Probiotics Selection in the Poultry Industry

Selecting the probiotic strains requires a careful consideration of manufacturing safety protocols, technical features, application strategies, viability, host colonization and related health advantages.

Probiotics' Antimicrobial Action

The production of antimicrobial compounds by the selected probiotic strain is an essential need for the creation of probiotic products and probiotic-enriched meals. Probiotics are administered in adequate dosages to improve the health of the host. Through several procedures, contain the synthesis of antibacterial compounds, competing with pathogens for nutrients along with adhesion sites and immune system activation, probiotics demonstrate antimicrobial efficacy against infections. Numerous metabolic substances, including fatty acids, diacetyl, hydrogen peroxide and organic acids, that are produced by lactic acid bacteria have antibacterial qualities. Bacteriocins proteinaceous compounds that have particular inhibitory action against closely related species have been the subject of in-depth research (26).

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

Continuity with Intestinal Epithelial Cells

To identify probiotic bacteria is used to consider that it depends on the microbes' capacity of adhering to intestinal mucus and epithelial cells to colonize the intestinal epithelium. The intestinal mucosa's adherence promotes transient colonization, immunological modulation and the competitive exclusion of pathogens in addition to aiding in the prevention of probiotic cell washout. To ensure that a probiotic strain produces enzymes, vitamins, lactic acids and natural antibiotics, it has to attach the intestinal wall, colonize and reproduce. Pathogenic bacteria are expected to stick to mucosal surfaces during intestinal infections, disrupting the intestinal micro-biota. While probiotic bacteria adhere and colonize mucosal surfaces, it is efficiently rival infectious agents in favor of binding sites along with minerals, which stimulate the immune system, potentially serving defensive and protective functions (27).

Inability to Handle Low pH and Bile Salts

An essential need for choosing viable probiotic strains that ensure their viability and usefulness includes acid tolerance. Probiotics that are swallowed have varying degrees of tolerance for various parts of the digestive system, depending on the strain. Probiotics are proven to withstand the stomach transit, which exposes cells to an acidic environment. This proved shown by several in vivo and in vitro studies. Each strain and species of probiotic has a different level of tolerance to bile salts and acid, which makes them quite different from one another (28).

Probiotic Action Mechanism

Interference with Quorum Monitoring Signal Molecules

Bacteria use chemical signaling molecules referred as quorum sensing or auto-inducers for communication with their surroundings and to communicate with one other. Gene expression is regulated by this phenomenon of communication. Probiotic bacteria, such as Lactobacillus, Bifidobacterium and Bacillus cereus strains, function against pathogenic bacteria's auto-inducers by secreting enzymes or making auto-inducer antagonists (29).

Immune system control

Probiotics have the potential to strengthen the immune system by increasing macrophage phagocytic capacity, enhancing natural destroyer cell activity, encouraging the creation of immunoglobulin A (IgA) and regulating the production of cytokines (30).

Production of Antimicrobial Substances

Probiotics have shown promise in stopping the spread of diseases by secreting a variety of antimicrobial agents, such as bacteriocins, defensins, as well as short-chain fatty acids like lactic and acetic acids. These compounds function by lowering the lumen's pH. In particular, gram-negative bacteria' outer membranes are damaged by short-chain fatty acids, which inhibit the pathogen's ability to proliferate (31).

Displacement of Pathogenic Microbes through Rivalry

Probiotic bacteria inhabit beneficial adhesion sites, including intestinal villi and colonic crypts, to prevent or reduce the development of pathogens. Secreting mucins from goblet cells prevents enteropathogenic bacteria from adhering. Lactic acid bacteria produce acetic acid and lactic acid, among other metabolic products, which aid in this defensive mechanism. By reducing the pH of the gut, these materials create an adverse microenvironment that is inappropriate for dangerous germs to survive millimeters (32).

Adherence Competition

Pathogenic bacteria are unable to create colonies while probiotics compete with one another for attachment sites on the intestinal epithelium. These bacteria fight pathogens that invade for binding sites on cell surfaces and the

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

mucous layer that surrounds them in a manner specific to each strain. After probiotics attach themselves to the cells, a variety of biological processes take place, most notably the production of chemokines and cytokines (33).

Increasing the Integrity of the Epithelium Barrier

Probiotics affect many elements of the function of the epithelial barrier by lowering intestinal cell death. This substance, which is made up of mucins released by goblet cells is a crucial part of the intestines barrier's protection. Mucin polymerization creates the structural foundation of mucus and offers defense against abrasion, dehydration, toxins, enzymes and infections. Probiotics such as lactobacilli have been shown to affect the expression of many genes encoding adhesion junction proteins in T84 epithelial cells, including β-catenin and E-cadherin (34).

Application of Probiotics in the Poultry Industry

Probiotics are shown to increase laying poultry productivity and feed efficiency, which improves egg quality as shown in the Figure (6). Decreased yolk cholesterol levels, improved shell thickness and greater egg weight are indicators of this improvement. Like this, other probiotic strains have shown beneficial impacts on broiler species performance, including Streptococcus, Bacillus, Lactobacillus, Candida, Aspergillus, Bifidobacterium, Enterococcus and Saccharomyces. Supporting data suggests that poultry are more resilient to infections from Salmonella, Escherichia coli and Clostridium perfringens.

Figure (6). Probiotic benefits of poultry production
(Source link: https://pngtree.com/freebackground/poultry-hen-illustration_1789015.html)

The role of antibiotics against pathogenic infections

Probiotics are essential for inducing a defense mechanism and assisting in the suppression of possible intestinal infections in poultry. Probiotics operate through going up against pathogens for nutrients and adhesion sites on the gut wall, as well as by producing antibacterial chemicals. Probiotics such as lactic acid bacteria are recognized for their capacity to have antagonistic and inhibitory effects on harmful bacteria. Probiotics have been shown in several studies to have antimicrobial effects against pathogenic bacteria using metabolite synthesis. Numerous studies have shown that intestinal colonization with probiotic Lactobacillus strains protects hens from contracting Salmonella enterica serovar enteritidis (35).

Promoting Immune Responses: The Function of Probiotics

Experiments have shown that probiotics affect immunological responses for example feeding probiotics containing Lactobacillus to broilers resulted in higher levels of antibody production. Stressed-out broilers exhibit this modification of immunological responses. Probiotics based on Lactobacillus have been shown to reduce heat-stress-related problems in broilers, resulting in higher levels of antibody production compared to control groups. Supplementing broiler diets with probiotic Lactobacillus has been shown to enhance gut

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 24, No. 4 (2023)
http://www.veterinaria.org
Article Received: 19 October 2023; Revised: 07 November 2023; Accepted: 26 December 2023

immunity against coccidiosis. By influencing the gastrointestinal intraepithelial lymphocyte populations that express surface markers, the cluster of differentiation 4 (CD4) is achieved (36).

Effect on intestinal morphology

Several investigations looked at the impact of probiotic treatment on intestinal histomorphology. The findings indicate that the size of the villi and crypts in the small intestine, especially the jejunum of broilers, is affected by adding probiotic Lactobacillus species, namely Lactobacillus sakei Probio-65. Because probiotics stimulate cell mitosis and increase the proliferation of gut epithelial cells, probiotics are believed to increase the height of villi. Because it increases the surface area accessible for nutritional absorption, the increased villi length linked to probiotic intervention is beneficial to broiler chicks (37).

Improvement of production and growth

The function of probiotics as dietary supplements and their effect on growth performance has been studied in the context of chicken production. Probiotics are very effective in promoting animal development in the majority of trials. Discernible increase in the broiler productivity index is after the addition of Lactobacillus to the diet. Important elements like daily weight growth, feed efficiency and mortality rates are taken into account while calculating this score (38). To improve broiler growth rates the administration of Lactobacillus has decreased broiler mortality, especially those caused by pathogenic illnesses. Furthermore, adding probiotic supplements to the diet has been proven to improve broiler performance in several areas, such as greater carcass production, better feed efficiency and improved feed intake. Probiotics are crucial for improving the health and productivity of broilers in chicken farming, according to the data overall (39).

Quality Poultry Products

Egg production, quality and contamination in layers have been shown to be improved by probiotics. Eggshell weight, shell thickness and blood calcium levels in layers are enhanced by their supplementation. There has been a significant reduction in the proportion of broken eggs among layers in diets supplemented with commercial probiotics. Probiotics are acknowledged worldwide for their beneficial effects on meat quality in broiler diets (40). Probiotic supplementation in broilers influences aspects including nutrition, softness, taste, odor and flavor characteristics, all of which lead to higher-quality meat (41). The pectoral and thigh meats of broilers given probiotics are noteworthy for their propensity to have a greater ratio of unsaturated to saturated fatty acids. Based on the findings, it seems that probiotics assist meat fat change into healthy forms, which improves meat softness. For example, better softness has been associated with feeding broiler diets containing the probiotic Clostridium butyricum. In comparison, broilers given the probiotic Lactobacillus show improved overall organoleptic ratings in terms of general acceptability, juiciness, texture and look compared to those on typical basal diets (42).

CONCLUSION

Poultry production has endured serious problems with growth due to the rise of illnesses and antibiotic resistance in modern times. It follows that producers and owners of poultry are becoming more interested in natural goods. Particularly probiotics are recognized as beneficial dietary supplements. Intestinal infections brought through pathogenic microorganisms related to diseases and food-borne illnesses are analyzed as a possible treatment option. There's evidence that probiotics enhance animal and human health in a wealth of scientific studies. As the beneficial effects of these microbes become more widely acknowledged, probiotics are used in standard medical procedures, particularly in the treatment of gastrointestinal problems. This review to analyze probiotics strengthens growth performance and has a positive impact on the productivity of poultry. Probiotics exhibit qualities that are shown through study, some of which result in exclusion from their usage in the feed business. More harmful consequences result from a probiotic deficit than from an overabundance. Future studies on probiotics need to concentrate on examining the interactions between various bacterial strains since the compounds that result from these interactions are capable of being harmful.

REFERENCE

1. Popov, I. V., Algburi, A., Prazdnova, E. V., Mazanko, M. S., Elisashvili, V., Bren, A. B., ... & Chikindas, M. L. (2021). A review of the effects and production of spore-forming probiotics for poultry. Animals, 11(7), 1941.Doi:10.3390/ani11071941
2. Krysiak, K., Konkol, D., & Korczyński, M. (2021). Overview of the use of probiotics in poultry production. Animals, 11(6), 1620.Doi:10.3390/ani11061620
3. Jha, R., Das, R., Oak, S., & Mishra, P. (2020). Probiotics (direct-fed microbial) in poultry nutrition and their effects on nutrient utilization, growth and laying performance, and gut health: A systematic review. Animals, 10(10), 1863.Doi:10.3390/ani10101863
4. Abd El-Hack, M. E., El-Saadony, M. T., Shafi, M. E., Qattan, S. Y., Batiha, G. E., Khafaga, A. F., ... & Alagawany, M. (2020). Probiotics in poultry feed: A comprehensive review. Journal of animal physiology and animal nutrition, 104(6), 1835-1850.Doi:10.1111/jpn.13454
5. Ebeid, T. A., Al-Homidan, I. H., & Fathi, M. M. (2021). Physiological and immunological benefits of probiotics and their impacts on poultry productivity. World's Poultry Science Journal, 77(4), 883-899.Doi:10.1080/00439339.2021.1960239
6. Yousaf, S., Nouman, H. M., Ahmed, I., Husain, S., Waseem, M., Nadeem, S., ... & Chudhry, M. F. Z. (2022). A review of probiotic applications in poultry: improving immunity and having beneficial effects on production and health. Postępy Mikrobiologii-Advancements of Microbiology, 61(3), 115-123.Doi:10.2478/am-2022.010
7. Yaqoob, M. U., Wang, G., & Wang, M. (2022). An updated review on probiotics as an alternative of antibiotics in poultry—A review. Animal Bioscience, 35(8), 1109.Doi:10.5713%2Fab.21.0485
8. Bhogoju, S., & Nahashon, S. (2022). Recent advances in probiotic application in animal health and nutrition: A review. Agriculture, 12(2), 304.Doi:10.3390/agriculture12020304
9. Chen, P., Xu, T., Zhang, C., Tong, X., Shaukat, A., He, Y., ... & Huang, S. (2022). Effects of probiotics and gut microbiota on bone metabolism in chickens: a review. Metabolites, 12(10), 1000.Doi:10.3390/metabo12101000
10. Ahiwe, E. U., Dos Santos, T. T., Graham, H., & Iji, P. A. (2021). Can probiotic or prebiotic yeast (Saccharomyces cerevisiae) serve as alternatives to in-feed antibiotics for healthy or disease-challenged broiler chickens?: a review. Journal of Applied Poultry Research, 30(3), 100164.Doi:10.1016/j.japr.2021.100164
11. Darboe, A. K. (2022). Review on the use of probiotics in poultry production (Layers and broilers) as feed additives.Doi:10.22271/veterinary.2022.v7.i5a.442
12. Mak, P. H., Rehman, M. A., Kiarie, E. G., Topp, E., & Diarra, M. S. (2022). Production systems and important antimicrobial resistant-pathogenic bacteria in poultry: A review. Journal of Animal Science and Biotechnology, 13(1), 1-20.Doi:10.1186/s40104-022-00786-0
13. Seidavi, A., Tavakoli, M., Slozhenkina, M., Gorlov, I., Hashem, N. M., Asroosh, F., ... & Swelum, A. A. (2021). The use of some plant-derived products as effective alternatives to antibiotic growth promoters in organic poultry production: A review. Environmental Science and Pollution Research, 28, 47856-47868.Doi:10.1007/s11356-021-15460-7
14. Ramlucken, U., Lalloo, R., Roets, Y., Moonsamy, G., van Rensburg, C. J., & Thantsha, M. S. (2020). Advantages of Bacillus-based probiotics in poultry production. Livestock Science, 241, 104215.Doi:10.1016/j.livsci.2020.104215
15. Hussein, E. O., Ahmed, S. H., Abudabos, A. M., Aljumaah, M. R., Alkhlulaifi, M. M., Nassan, M. A., ... & Swelum, A. A. (2020). Effect of antibiotic, phytobiotic, and probiotic supplementation on growth, blood indices, and intestine health in broiler chicks challenged with Clostridium perfringens. Animals, 10(3), 507. Doi:10.3390/ani10030507
16. Merino, L., Procura, F., Trejo, F. M., Bueno, D. J., & Golowczyc, M. A. (2019). Biofilm formation by Salmonella sp. in the poultry industry: Detection, control and eradication strategies. Food Research International, 119, 530-540.Doi:10.1016/j.foodres.2017.11.024
17. Villagrán-de la Mora, Z., Nuño, K., Vázquez-Paulino, O., Avalos, H., Castro-Rosas, J., Gómez-Aldapa, C., ... & Villarruel-López, A. (2019). Effect of a synbiotic mix on intestinal structural changes, and Salmonella

Typhimurium and Clostridium perfringens colonization in broiler chickens. Animals, 9(10), 777.Doi:10.3390/ani9100777

18. Seidavi, A., Tavakoli, M., Slozhenkina, M., Gorlov, I., Hashem, N. M., Asroosh, F., ... & Swelum, A. A. (2021). The use of some plant-derived products as effective alternatives to antibiotic growth promoters in organic poultry production: A review. Environmental Science and Pollution Research, 28, 47856-47868.Doi:10.1007/s11356-021-15460-7
19. Temiraev, V. H., Baeva, A. A., Vityuk, L. A., Mamukaev, M. N., Yurina, N. A., Ktsoeva, I. I., ... & Vologirova, F. A. (2020). Effect of probiotics on digestive metabolism in growing and laying poultry birds. Journal of Livestock Science, (11).Doi:10.33259/JLivestSci.2020.33-39
20. Song, D., Li, A., Wang, Y., Song, G., Cheng, J., Wang, L., ... & Wang, W. (2022). Effects of synbiotics on growth, digestibility, immune and antioxidant performance in broilers. Animal, 16(4), 100497.Doi:10.1016/j.animal.2022.100497
21. Gyawali, I., Zeng, Y., Zhou, J., Li, J., Wu, T., Shu, G., ... & Zhu, C. (2022). Effect of novel Lactobacillus paracaesi microcapsule on growth performance, gut health and microbiome community of broiler chickens. Poultry Science, 101(8), 101912.Doi:10.1016/j.psj.2022.101912
22. Al-Khalaifa, H., Al-Nasser, A., Al-Surayee, T., Al-Kandari, S., Al-Enzi, N., Al-Sharrah, T., ... & Mohammed, A. (2019). Effect of dietary probiotics and prebiotics on the performance of broiler chickens. Poultry Science, 98(10), 4465-4479.Doi:10.3382/ps/pez282
23. El Jeni, R., Dittoe, D. K., Olson, E. G., Lourenco, J., Corcionivoschi, N., Ricke, S. C., & Callaway, T. R. (2021). Probiotics and potential applications for alternative poultry production systems. Poultry science, 100(7), 101156.Doi:10.1016/j.psj.2021.101156
24. Saadaoui, I., Rasheed, R., Aguilar, A., Cherif, M., Al Jabri, H., Sayadi, S., & Manning, S. R. (2021). Microalgal-based feed: promising alternative feedstocks for livestock and poultry production. Journal of Animal Science and Biotechnology, 12(1), 76.Doi:10.1186/s40104-021-00593-z
25. Stęczny, K., & Kokoszyński, D. (2021). Effect of probiotic preparations (EM) on productive characteristics, carcass composition, and microbial contamination in a commercial broiler chicken farm. Animal biotechnology, 32(6), 758-765.Doi:10.1080/10495398.2020.1754841
26. Martín, R., Chamignon, C., Mhedbi-Hajri, N., Chain, F., Derrien, M., Escribano-Vázquez, U., ... & Langella, P. (2019). The potential probiotic Lactobacillus rhamnosus CNCM I-3690 strain protects the intestinal barrier by stimulating both mucus production and cytoprotective response. Scientific reports, 9(1), 5398.Doi:10.1038/s41598-019-41738-5
27. Ding, X., Hu, X., Chen, Y., Xie, J., Ying, M., Wang, Y., & Yu, Q. (2021). Differentiated Caco-2 cell models in food-intestine interaction study: Current applications and future trends. Trends in Food Science & Technology, 107, 455-465.Doi:10.1016/j.tifs.2020.11.015
28. Ranjha, M. M. A. N., Shafique, B., Batool, M., Kowalczewski, P. Ł., Shehzad, Q., Usman, M., ... & Aadil, R. M. (2021). Nutritional and health potential of probiotics: a review. Applied Sciences, 11(23), 11204.Doi:10.3390/app112311204
29. Almanza, A., Carlesso, A., Chintha, C., Creedican, S., Doultsinos, D., Leuzzi, B., ... & Samali, A. (2019). Endoplasmic reticulum stress signaling–from basic mechanisms to clinical applications. The FEBS journal, 286(2), 241-278.Doi:10.1111/febs.14608
30. Yousefi, B., Eslami, M., Ghasemian, A., Kokhaei, P., Salek Farrokhi, A., & Darabi, N. (2019). Probiotics importance and their immunomodulatory properties. Journal of cellular physiology, 234(6), 8008-8018.Doi:10.1002/jcp.27559
31. Tenea, G. N. (2020). Peptide extracts from native lactic acid bacteria generate ghost cells and spheroplasts upon interaction with Salmonella enterica, as promising food antimicrobials. BioMed Research International, 2020.Doi:10.1155/2020/6152356
32. Lim, P. S., Wang, H. F., Lee, M. C., Chiu, L. S., Wu, M. Y., Chang, W. C., & Wu, T. K. (2021). The efficacy of Lactobacillus-containing probiotic supplementation in hemodialysis patients: a randomized, double-blind, placebo-controlled trial. Journal of Renal Nutrition, 31(2), 189-198.Doi:10.1053/j.jrn.2020.07.002
33. You, S., Ma, Y., Yan, B., Pei, W., Wu, Q., Ding, C., & Huang, C. (2022). The promotion mechanism of prebiotics for probiotics: A review. Frontiers in Nutrition, 9, 1000517.Doi:10.3389/fnut.2022.1000517

34. Kaur, H., & Ali, S. A. (2022). Probiotics and gut microbiota: Mechanistic insights into gut immune homeostasis through TLR pathway regulation. Food & Function, 13(14), 7423-7447.Doi:10.1039/D2FO00911K
35. Arif, M., Akteruzzaman, M., Islam, S. S., Das, B. C., Siddique, M. P., & Kabir, S. L. (2021). Dietary supplementation of Bacillus-based probiotics on the growth performance, gut morphology, intestinal microbiota, and immune response in low biosecurity broiler chickens. Veterinary and Animal Science, 14, 100216.Doi:10.1016/j.vas.2021.100216
36. Awais, M. M., Jamal, M. A., Akhtar, M., Hameed, M. R., Anwar, M. I., & Ullah, M. I. (2019). Immunomodulatory and ameliorative effects of Lactobacillus and Saccharomyces based probiotics on pathological effects of amebiasis in broilers. Microbial pathogenesis, 126, 101-108.Doi:10.1016/j.micpath.2018.10.038
37. Tukaram, N. M., Biswas, A., Deo, C., Laxman, A. J., Monika, M., & Tiwari, A. K. (2022). Effects of para probiotic as replacements for antibiotic on performance, immunity, gut health and carcass characteristics in broiler chickens. Scientific Reports, 12(1), 22619.Doi:10.1038/s41598-022-27181-z
38. Salah, A. S., Ahmed-Farid, O. A., & El-Tarabany, M. S. (2019). Carcass yields, muscle amino acid and fatty acid profiles, and antioxidant indices of broilers supplemented with synbiotic and/or organic acids. Journal of animal physiology and animal nutrition, 103(1), 41-52.Doi:10.1111/jpn.12994
39. Saleem, K., Saima, Rahman, A., Pasha, T. N., Mahmud, A., & Hayat, Z. (2020). Effects of dietary organic acids on performance, cecal microbiota, and gut morphology in broilers. Tropical Animal Health and Production, 52, 3589-3596.Doi:10.1007/s11250-020-02396-2
40. Rafiq, Kazi, Muhammad Tofazzal Hossain, Rokeya Ahmed, Md Mehedi Hasan, Rejaul Islam, Md Ismail Hossen, Sourendra Nath Shaha, and Mohammad Rafiqul Islam. "Role of different growth enhancers as an alternative to in-feed antibiotics in the poultry industry." Frontiers in Veterinary Science 8 (2022): 794588.Doi:10.3389/fvets.2021.794588
41. Mohanto, K., Aye, A. T., & Ahasan, S. A. (2022). Probiotics over antibiotics in the poultry industry. Bangladesh Journal of Veterinary Medicine (BJVM), 20(1), 11-16.Doi:10.33109/bjvmjj2022am2
42. Kabir, S. L., & Islam, S. S. (2021). Biotechnological applications in poultry farming. Sustainable Agriculture Reviews 54: Animal Biotechnology for Livestock Production 1, 233-271.Doi:10.1007/978-3-030-76529-3_8