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Animal nutrition and Role of Probiotics

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ABSTRACT

The productivity, health, and well-being of companion animals and cattle are greatly influenced by animal nutrition. Veterinarians are leading the way in converting research results into workable strategies for maximizing animal health and performance as scientific and technological developments continue to transform the field of animal nutrition. In addition to the rapid advancement of livestock breeding techniques, breeders' expectations for feed additives that can ensure faster growth rates, protect against pathogenic infections, and enhance other production parameters like feed absorption and meat, milk, and egg quality are also rising. The usage of probiotics is seen with high hopes. Employed primarily to preserve the balance of the livestock's intestinal microbiota, they seem to be a successful strategy in the battle against infections that endanger both animals and humans.

Keywords: Animal nutrition, Probiotics, Animal health, feed additives

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Introduction

The world's population is predicted to reach nine billion by the year 2050 [1]. The need for food originating from plants and animals is expanding along with the human population, which is a constant growth factor [2]. Scientists are therefore searching for ways to allow food production to intensify while simultaneously lowering production costs and adhering to strict quality and safety (environmental and human) criteria [3]. Feed additive types have an impact on animal health and the yield of quality meat, eggs, milk, and fish [4]. Animal intestinal diseases like Campylobacter, Salmonella, Listeria, and Yersinia are a direct source of food contamination and a cause of zoonoses. Animal production is inextricably linked to human nutrition and health. To improve the quality and safety of meat while also taking animal welfare and the environment's preservation into consideration, innovative techniques for breeding animals have been created. A major factor in increasing animal productivity is animal nutrition and feeding, in addition to other sciences (genetics, management, hygienic practices, etc.). In a similar spirit, it is widely acknowledged that proper nutrition and feeding enable animals to realize their full potential for productivity rather than producing high-potential animals [5]. The profitability of livestock is mostly determined by the care and attention to nutrition that animal producers provide to feeding and nutrition. The quality of products derived from animals is greatly impacted by their feeding practices. This includes the immediate composition of various body components (proteins, lipids, water), as well as the sensory (color, taste, smell), biochemical-functional (such as the ratio of various fatty acids), and even technological aspects (in milk, meat, eggs, etc.) of these products [6]. Animals are biological converters of nutrition and energy into high-quality raw materials (such as wool and leather) for human apparel and accessories as well as into raw matters (meat, eggs, milk, honey) for human consumption. Animal nutrition is therefore essential to both the health and welfare of companion animals as well as to all farm animal productions. Antibiotics and other pharmaceuticals were once widely utilized, mostly to alter the gut flora and increase animal growth and production [7]. Extended usage of those medications has resulted in the emergence of drug-resistant bacteria, endangering the well-being of consumers and having an adverse impact on the environment [8]. In this case, other natural compounds with comparable effects have been looked for. Probiotics are among the main impacts of these supplements; they also allow resistance to pathogenic bacteria colonization and enhance host mucosa immunity, which reduces pathogen load, improves animal health, and lowers the risk of food-borne pathogens in food [9].

Role of Probiotics in animal nutrition

The term "probiotic," which means "for life," is a relatively recent addition to the vocabulary of microorganisms known for their beneficial effects on both humans and animals. These microbes support gut microbial equilibrium and are involved in health maintenance [10]. Later, tissue extracts that promoted microbial growth and animal feed supplements that helped animals by balancing their intestinal flora were also described by this term, which was first used to describe substances produced by one microorganism that stimulated the growth of others. The most often utilized bacterial genera in probiotic products are Lactobacillus, Bifidobacterium, Escherichia, Enterococcus, Bacillus, and Streptococcus. A few Saccharomyces fungal strains have also been employed. The first probiotic and the one that has attracted the greatest clinical attention to far is Lactobacillus rhamnosus GG (LGG). Animal health administration has entered a new era thanks to probiotics. This study intends to assess the impact of probiotics on animal health and identify opportunities for long-term probiotic use in this industry [11].

Mechanism of action of probiotics

Though their exact mode of action is still unknown, probiotics are generally described using general phrases like competitive exclusion or colonization resistance. The processes by which they have biological effects are still poorly understood. To sustain the microbial ecology of the gut, the gut microenvironment influences the host's nutrition, feed conversion, and disease. The gut flora frequently shifts in favour of pathogenic bacteria that can induce diarrhea and appetite loss during times of stress, illness, or antibiotic therapy [12]. According to Oelschlaeger, probiotic effects can be divided into three categories based on how they work: (i) Probiotics may have the ability to alter both the innate and acquired immune systems of the host. This mechanism of action is probably significant not only for the treatment of (chronic) inflammation of the digestive system or portions thereof, but also for the prevention and therapy of infectious illnesses. Furthermore, the elimination of malignant host cells may benefit from this probiotic activity; (ii) Probiotics may also directly impact commensal or pathogenic microbes. The prevention, treatment, and restoration of the microbial balance in the gut are all impacted by this principle in numerous situations; iii) Lastly, acts impacting host products, such as dietary components and bile salts, and microbial products, such as toxins, may be the basis for probiotic actions. By doing this, the host and food components may be detoxified in the gut and toxins may be rendered inactive. According to the same author, a probiotic's ability to perform a particular function is determined by its metabolic characteristics, the molecules on its surface, and the substances it secretes [13].

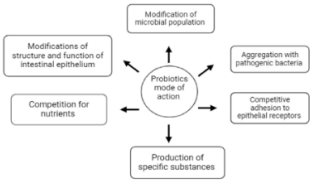

Fig. 1: Mode of action of probiotics

Benefits of probiotics in animal production

Numerous advantages of probiotic administration have been demonstrated in humans as well as animals.

1. Improved growth rate

Probiotic microorganisms have been shown to have a shown beneficial effect on the gut microbiota in animal nutrition. In chicken, pig, sheep, goat, cattle, and equines, the administration of probiotic strains singly or in combination dramatically increased feed intake, feed conversion rate, daily weight growth, and total body weight. Probiotics improved the absorption of some nutrients, stabilized the ruminal pH and lactate, and promoted development in a manner like that of avilamycin treatment [14].

2. Milk production

Probiotic supplements to animal feed have a positive impact on milk production, fat content, and protein content in the future. greater serum cholesterol and total lipid concentrations, as well as greater milk fat and protein content at the mid-sucklin period in sows, provide evidence that probiotic therapy dramatically improved blood and milk parameters. In dairy cows, Aspergillus oryzae and Saccharomyces cerevisiae have been shown to enhance milk production and milk protein percentages [15].

3. Meat production

Nowadays, there is a noticeable increase in the market demand for meat that is both safe and of high quality. Producers are keen to employ safe, natural fodder supplements that don't include chemicals because they enhance animal health, boost output, and enhance the quality of the product. Probiotics improved carcass yield and water-holding capacity while lowering meat hardness and cooking loss. Probiotic microorganisms that produce lactic acid, such as those from the genera Lactobacillus, Pediococcus, and Streptococcu have been used in fermented sausages [16].

4. Egg production

Probiotics reduced egg contamination and raised egg yield and quality. Egg shell thickness, weight, and serum calcium were all raised by probiotics. Probiotics also dramatically lowered plasma cholesterol and triglycerides, supporting the critical roles that gut microbes (GIT) play in the recycling of lipids. In broilers generated by the breeder flock, probiotics had no influence on chick quality or production efficiency [17].

Future perspective of probiotics in animal nutrition

Studies have shown that probiotics are a major source of antimicrobials that are good for your health and give nutrients for animal husbandry [18]. Probiotics can supplement growth-stimulating antibiotics, strengthening the animals' immune systems in the process. Probiotics' effects on organisms are currently understood, although research is still being done to elucidate some of their additional mechanisms of action [19]. The mode of action of probiotics will be crucial in the future to combat a certain component of animal performance or growth. Probiotics have several benefits, both in diagnosis and treatment. More investigation into gene expression pathways or metabolic processes linked to the impact of probiotics may unveil these uses. Several issues pertaining to diseases in both humans and animals can also be resolved by focusing on probiotic uses. cutting-edge molecular methods include metabolomics and transcriptome analysis. give thorough details on the probiotics' methods of action, highlighting their positive effects and how they enhance bird performance [20]. Probiotics have several uses, including specialized therapeutic and diagnostic applications. These can be further explored by doing research on certain gene expression pathways, including those identified by metabolomics assays linked to the impact of probiotics. Several disease-related issues in both humans and animals can be evaluated by focusing on probiotic applications [21].

Conclusion

Every day, there are more and more people on the planet. Effective yet safe solutions were essential to solving the food production crisis and displacing the dangerous use of antibiotics in farming industries to meet the expanding population's need for meat and fish production. However, none of the special strains of probiotics can ensure safety when combined with regular ones. Transferable antimicrobial resistance, virulence factors, hemolytic potential, and an undesired yield of toxic biochemical compounds are only a few of the potentially harmful characteristics of certain probiotics. Unique probiotic strains for each species in each environment need to be identified to prevent any causalities. Every probiotic has different effectiveness and responses. For a probiotic to flourish, colonize, spread, and benefit its hosts in each setting, the ideal conditions must be found. Before probiotics are introduced to the nutritional feed of farm animals, it is crucial to understand the immunomodulatory effects of various probiotics and their viability. Additionally, in-depth research on dosage dependence must be conducted by verifying the identity of the organism through molecular testing at a reference laboratory. Before any kind of confidence can be placed on probiotic guidelines, further research must be done.

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