



Briefing to Probiotics, Prebiotics and Synbiotics

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Abstract

To exploit the elite genetic worth of present day animal and poultry breeds, intensified rearing practices are adopted in order to fulfill the demand of globally increasing human population. Arise of antimicrobial resistance raises the concern of food safety for humans. To pace the increasing current demand of animal products, nutrient utilization and production performance can be maintained by use of alternate feed additives including probiotics and prebiotics or their combination as synbiotic. Since, the gut ecology is extremely important and is influenced by a variety of factors, including commensal bacteria and dietary components, manipulation of gut microbiome can be done by use of such substances. Several benefits like improved growth, better nutrient utilization and optimum production performance can be attributed to the use of pro-, pre- and synbiotic substances. Commonly used pro- and prebiotics are listed in this paper. Use of such potential feed additives to ensure animal health can address the questions raised for human food safety.

Key words: food safety, probiotics, gut microbiome, nutrient utilization

Introduction

Globally there is increase in human population which proportionately gives rise to the need for food derived from plants and animals. Consequently much exploitation of genetic worth of animals is being used in intensified rearing practices to meet the demand of animal origin food. Feed additives are used as growth supporting substances in animal diet. In past years, antibiotics were used at sub-therapeutic doses on large scale in animal feed as feed additives to control growth of pathogens and as preventive measure against several infectious diseases. But the worldwide increase in anti-microbial resistance among various bacteria due to injudicious use of antibiotics leads to threatening of food safety and human health. As a result, the European Commission issued a ban on use of antibiotics as growth promoters in animal production. For such reason, alternate methods were come into practice to boost growth of livestock and poultry industry with safer production of animal products. In developing alternative methods for enhancing growth of animals and poultry, probiotics and prebiotics plays significant role with securing food safety concerns also.

Probiotics

The term probiotics means 'for life', in opposite to the term antibiotics, which means 'against life'. According to the WHO, probiotics refers to all those live strains of microorganisms which are cultured under controlled conditions and have fruitful effects on health when provided to the host. In certain amount they beneficially affect to alimentary tract of host and provide health related advantages. They should be non-toxic to host and should survive the

various processing methods followed during feed preparation and storage conditions. Commonly direct fed microbial include strains of lactic acid bacteria, *Enterococcus*, *Bifidobacterium*, *Bacillus*, *Aspergillus oryzae* and *Saccharomyces cerevisiae* yeast. Their common mode of action is attributed to the competitive exclusion process. When probiotic microorganism reaches GI tract of animal, they effectively occupy niche and make environment hostile for pathogens. They multiply and colonize so pathogenic organisms can be eliminated. Immune system modulation, attachment to intestinal mucosa, aiding in maintaining integrity of intestinal barriers and release of natural anti-microbial substances are known to be other modes of action of probiotics inside gut of host animal. When the integrity of intestinal epithelium is maintained, chances of entry of pathogens to blood decreases and consequently inflammatory reactions are minimized. Probiotics orchestrates the balance between pro and anti-inflammatory substances released in body and thus modulate immune system effectively. Enterocytes proliferates at augmented rates due to production of short chain fatty acids by probiotic cultures. Healthy enterocytes aids in keeping gut barrier tight and thus prevents passage for pathogen entry to systemic circulation. Elevated villus height, villus width, expanded cell area, continue cell mitosis and shallow crypt depth are the morphological features in probiotic supplemented host animal. Moreover, intestinal absorption increases, nutrient utilization optimizes and overall performance of animal enhances. Combination of different strains in probiotic culture seems to be more promising in comparison to mono-cultures.

The role of probiotics as potent feed additive is extensively explored in monogastric animals like poultry and swine. In broilers, incidences of fatal disease like salmonellosis, coccidiosis and necrotic enteritis significantly reduced by supplementation of probiotics in diet. Layers tend to give eggs with low cholesterol in yolk, increased egg counts, better egg quality, more egg mass and enhanced feed efficiency when fed lactic acid bacteria as additive. Additionally, probiotics are crucial for preserving the intestinal microbiota's balance, which in turn promotes optimal nutrient utilization and keeps harmful microorganisms out, reducing the need for antibiotics in the raising of chickens.

Prebiotics

GIT of animal is profoundly occupied with numerous microbial species with various functions in relation to the host animal. Micro-environment of gut varies with different sections and also the profile of microbes inhabiting in them. Gut microbiome usually associated with variety of works like fermentation of feed, nutrient utilization, vitamin synthesis, controlling gut pathogens and balancing host immune system. There is continuous interaction between gut microbiota and host gut mucosa through various metabolites of digestion process. Modulating gut microbiota has emerged as a popular strategy to enhance host health, guard against various ailments and infections and also provide vital vitamins and energy, the latter of which may be essential for physiological regulatory networks.

According to Gibson and Roberfroid, the word 'prebiotic' refers to those non-digestible feed substances that may have favorable effects on host attributed to their selectively growth provoking property towards beneficial microorganisms in gut. Fermentation of prebiotics in later sections of gut results in release of certain metabolic products which changes gut microbiome composition, which in turn improves host health. Micro environment (anaerobic condition, feed transit time, pH, etc.) of distal part of gut found to be suitable for fermentation process by certain bacterial species. They act on prebiotic substances and release various products including short chain fatty acids mainly the butyrate, known to promote the growth of enterocytes. Thus epithelial integrity is maintained and nutrient utilization is optimized. Fructooligosaccharides (FOS), glucomannan oligosaccharides (GOS), inulin, arabinoxylo oligosaccharides (AXOS), xylan

oligosaccharides (XOS), chito-oligosaccharides (COS), isomalto-oligosaccharides (IMO), pectin oligosaccharide (POS), mannan-oligosaccharide (MOS), lactulose and other dietary carbohydrates are commonly studied prebiotic substances in monogastric animals.

Since GI tract is the major organ for nurturing immune cells, its crucial role regarding immune system modulation attaining much attention now-a-days. Grossly the gastrointestinal tract serves as a vital barrier against infectious agents and antigens which could harm the normal physiology of body. The GIT immune system is unique in its ability to discriminate between substances that are possibly safe and those that pose a risk to the body system. Prebiotics are effective substances as they work in a variety of ways, such as modulating of mucus secretion at intestine mucosa, reducing the binding between bacteria and the epithelial barrier, strengthening epithelial tight connections, boosting cell viability and stimulating the manufacture of IgA antibody. Numerous research studies have demonstrated that prebiotics modify the expression of pro-inflammatory cytokines and hence improving immune system function in host animal.

Synbiotics

Simultaneous administration of probiotics and prebiotics is referred as synbiotics. The prebiotic substance favors the growth and colonization of probiotic organisms inside gut environment and thus the synergistic action is produced. Synbiotics were developed to address potential issues with probiotic survival in the gastrointestinal system and hence they possess both probiotic and prebiotic qualities. Probiotics operate as a barrier to protect the alimentary tract from pathogens and positively influence intestinal balance. Conversely, probiotic bacteria receive their energy and nourishment from fermentation of prebiotics in distal gut portions. Consequently, when both ingredients are combined properly in a single product, the effect found to be greater than when either probiotic or prebiotic provided alone in diet of animals.

Conclusion

The world population is expected to expand and as present patterns continue to rise exponentially, forecasts indicate that by 2050, there will be more than 9 billion people on the planet. Proportionately the demand of animal derived products also rises. Shifting of conventional animal raising practices to modernization and intensification challenges animal health and use of feed additives becomes inevitable. Global concern about anti-microbial resistance, abstains the feeding of antimicrobial drugs in animal diet. As alternative approach, probiotics and prebiotics seems to be beneficial to improve animal performance. They positively affects gut microbiome composition, enhances gut integrity, promotes colonization of favorable microbes, increases intestine function, orchestrates with immune system, elevates nutrient utilization and escalates overall production performance of the host animal. Combination of probiotics and prebiotics as synbiotics also seems to be promising way to enhance animal productivity and health. The use of such substances minimizes the use of antibiotics in animal feed, lowers production cost and ensures food safety to promote better human health. Although, as avenues for future research to support host health, optimal dosage, safety considerations, identification and characterization of novel potential prebiotics and microorganism strains to be used as probiotics and understanding the mechanism of interaction of synbiotics with host system should be prioritized and to be evaluated with further studies.

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