

The potential of various types of bacteria as probiotics in poultry

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Abstract

Biotechnology, which utilizes bacteria as probiotics in livestock, especially poultry, has been widely researched. Probiotics are known to be used as an alternative to antibiotics in poultry farming. The type of microorganism used as a probiotic is strongly related to the chemical and physical properties of the digestive environment. Therefore, the microbes used must also be specific microbes that can have a good influence on livestock. The mechanism of action of probiotics is also quite diverse. Probiotics have a role in neutralizing toxins produced by pathogenic bacteria and inhibiting the growth of these pathogenic bacteria by preventing colonization of the small intestine wall. The ability of probiotic microorganisms to secrete toxins that reduce or hinder the development of pathogenic microorganisms in the digestive tract also increases immunity in their hosts. Research mentions *Lactobacillus sp*, *Bacillus sp*, *Aerococcus viridans*, *Bifidobacterium dentium*, *Enterococcus faecium*, *Lactobacillus casei*, and *Streptococcus uberis* as potential probiotics for poultry. The research method used is meta-analysis. This research method is carried out by summarizing, reviewing, and analyzing data from several pre-existing research results. The results of this article were obtained from animal feed biotechnology, the potential of bacteria as probiotics for poultry, and a comparison of the types of bacteria used as probiotics in poultry.

Keywords: Bacteria; Biotechnology; Probiotics; Feed; Poultry

1. Introduction

The development and advancement of technology in the field of livestock is currently growing rapidly. The use of appropriate technology is increasingly being carried out to increase livestock productivity. The high market demand and increasing human need for livestock are the reasons for developing various methods in the livestock field. One of the fields of technology that is now widely used in the livestock world is biotechnology.

Biotechnology, which utilizes bacteria as probiotics in livestock, especially poultry, has been widely researched. Probiotics are known to be used as an alternative to antibiotics in poultry farming. When administered adequately, WHO defines probiotics as living microorganisms that can provide scientifically measurable positive effects on eukaryotic organisms [1]. The type of microorganism used as a probiotic is strongly related to the chemical and physical properties of the digestive environment. Some of the digestive organs of poultry (crop, proventriculus, and gizzards) have high acidity. Therefore, the microbes used must be resistant to acid. The study of the types of bacteria that can be used as probiotics in poultry is very interesting to discuss. Therefore, this paper aims to discover the biotechnology of animal feed, the potential of bacteria as probiotics for poultry, and the comparison of the bacteria used as probiotics in poultry.

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2. Research methods

The research method used is meta-analysis, which is carried out by summarizing research data and reviewing and analyzing data from several pre-existing research results [2]. The data taken to get a conclusion includes relevant journals published in the last 10 years in the Google Scholar database. The observations were obtained using biotechnology, bacteria, probiotics, feed, and poultry.

3. Results and discussion

3.1. Animal feed biotechnology

Biotechnology is a branch of science that studies the use of living things (bacteria, fungi, viruses, and others) and products from living things (enzymes, alcohol) in the production process to produce goods and services [3]. The application of biotechnology to animal feed often uses microorganisms. The main objectives of adding microorganisms to feed are: 1) preserving feed, better known as the silage process, 2) improving the quality of feed with low nutritional value, and 3) improving rumen conditions. Microorganisms that are used can be probiotics (bacteria, fungi, yeasts, or mixtures) or can be fermentation products or extract products from a fermentation process (usually enzymes) [4].

Probiotics are live microbes that can live or thrive in the intestine and can benefit their hosts directly or indirectly from the results of their metabolites [5]. The administration of these live microorganisms in sufficient quantities can affect the composition and ecosystem of their digestive microflora. The European Food Safety Authority (EFSA) 2012 stated that the criteria for microorganisms that must be possessed are not producing toxins, not having antibiotic resistance, and not pathogenic bacteria. Probiotic microorganisms must be non-pathogenic, gram-positive, strain-specific, and anti-*E. coli*, resistant to bile fluid, live, attached to the intestinal mucosa, and contain at least 30×10^9 cfu/g [4].

3.2. Potential of bacteria as probiotics for poultry

Probiotics can be bacterial, fungal, or yeast. However, the most probiotic microbes are bacteria. Probiotics generally come from the group of Lactic Acid Bacteria, but not all Lactic Acid Bacteria are probiotics [6]. Familiar and safe probiotics used for livestock are: *A. niger*, *A. oryzae*, *B. coagulans*, *B. lentus*, *B. pumilus*, *B. amylophilus*, *B. ruminicola*, *L. acidophilus*, *L. brevis*, *L. mesenteroides*, *P. acidolacticii*, *P. shemanii*, *S. cerevisiae*, *S. cremoris*, *S. faecium*, *S. lactis*, and *S. thermophilus*.

The mechanism of action of probiotics is quite diverse. Pathogenic microbes are very active in remodeling substances found in the colon to produce toxic, carcinogenic, or methanogenic metabolites derived from poisonous materials, drugs, steroids, or metabolites from feed ingredients. In some animals, these metabolites often cause damage to the intestinal mucosa. They can even lead to the formation of tumors or other diseases, so that these toxic metabolites must be discarded. Probiotics have a role in neutralizing toxins produced by pathogenic bacteria and inhibiting the growth of these pathogenic bacteria by preventing colonization of the small intestine wall [7].

Lactic acid-producing probiotic microorganisms from the *Lactobacillus* species can also produce cellulase enzymes that help the digestive process. This enzyme can break down coarse fiber, a component that is difficult to digest in the digestive tract of poultry. The ability of probiotic microorganisms to secrete toxins that reduce or inhibit the development of pathogenic microorganisms in the digestive tract is a condition that can increase the immunity of the host animal. The toxins produced are antibiotics for pathogenic microorganisms, so the diseases caused by them are reduced or can disappear or heal on their own [4]. This can provide benefits to the health of the host animal so that it is resistant to disease; thus, the administration of probiotics to poultry is expected to provide benefits, significantly increasing production appearance, namely quantity (high livestock and meat production) and quality (sound and hygienic quality of eggs and meat).

3.3. Comparison of types of bacteria that have the potential to be probiotics in poultry

Research conducted [7] stated that lactic acid bacteria had been successfully isolated from the intestines of broiler chickens, and all of the lactic acid bacteria were suspected to belong to the *Lactobacillus sp.* These lactic acid bacteria can create clear zones on the medium grown with *E. coli* bacteria, which shows that these bacteria can produce antibacterial compounds that effectively inhibit the growth of *E. coli* pathogenic bacteria. The existence of this ability can be an indication that these successful lactic acid bacteria can be used as probiotics for poultry.

This is also in line with research conducted by [6], which stated that the bacteria *Bacillus sp*—producing phytase enzymes, which are enzymes that can break down phytate acid, which is characterized by the formation of clear zones around bacterial colonies that are grown on selective media containing sodium phytate. It can be said that *Bacillus sp*. bacteria has the potential as a probiotic for poultry.

The study by [8] isolated several probiotic candidate bacteria types: *A. viridans*, *B. dentium*, *E. faecium*, *L. casei*, and *S. uberis*. Declaring that the probiotic bacterial candidate is non-pathogenic, has antimicrobial (in vitro) activity against *Salmonella enterica*, and is resistant to colonization in broiler intestines for 40 days with a $>10^{10}$ cfu/gram concentration. This is in line with the requirements of microorganisms used as probiotics.

Table 1 Comparison of types of probiotic bacteria

Types of bacteria	Criteria for probiotic microorganisms			
	Able to survive in acid reflux conditions	Able to attach to mucus or intestinal epithelial cells	Produces antimicrobial activity	Not pathogenic bacteria
<i>Lactobacillus sp.</i> *	+	+	+	+
<i>Bacillus sp.</i> **	+	+	+	+
<i>Aerococcus viridans</i> ***	+	+	+	+
<i>Bifidobacterium dentium</i> ***	+	+	+	+
<i>Enterococcus faecium</i> ***	+	+	+	+
<i>Lactobacillus casei</i> ***	+	+	+	+
<i>Streptococcus uberis</i> ***	+	+	+	+

Information: * [7], ** [6], *** [8]

4. Conclusion

The application of biotechnology to animal feed often uses microorganisms. The microorganisms used can be probiotics (bacteria, fungi, yeast, or mixtures), fermented products, or fermented extract products. Probiotic microorganisms must be non-pathogenic, gram-positive, strain-specific, and anti-*E. coli*, resistant to bile fluid, live, attached to the intestinal mucosa, and contain at least 30×10^9 cfu/g. Probiotics can be bacterial, fungal, or yeast. However, the most probiotic microbes are bacteria. Bacteria can be probiotics for poultry because their mechanism of action is able to neutralize toxins and inhibit the growth of pathogenic bacteria, produce cellulase enzymes, and act as antibiotics. It is said that the strains of bacteria *Lactobacillus sp*, *Bacillus sp*, *Aerococcus viridans*, *Bifidobacterium Dentium*, *Enterococcus faecium*, *Lactobacillus casei*, and *Streptococcus uberis* have indications as probiotics for poultry.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

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