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The Effects of Some Feed Additives in Nutrition of Ruminant Animals

Muslimo Abdullahi Sheikh Hassan[a], Mehmet Akif Karslı[b *]

Kırıkkale University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Kırıkkale, Türkiye

[a]ORCID: 0000-0003-3901-9844; [b]ORCID: 0000-0002-3081-9450

*Corresponding Author
E-mail: mehmetakifkarsli@kku.edu.tr

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Abstract

In this review, the use of some feed additives in the diets of ruminant animals is discussed. Brief information about the anatomy of the digestive system of ruminants and the metabolism of some nutrients in these animals are presented. In addition, summary information about some feed additives used in animal nutrition is given. Particularly detailed information about pre/probiotics among feed additives is presented, and the effects of S. cerevisiae, known as yeast, are discussed. In ruminant animals, unlike the monogastrics, feed additives, especially pre-and probiotics, are utilized to affect fermentation in the rumen. In addition, it is seen that it is used to increase immunity in pre-ruminants. However, it is obvious that more studies are needed on these issues.

Keywords: Review, feed additive, pre/probiotic, ruminant.

INTRODUCTION

Ruminants are hoofed animals that are include cattle, sheep, and goats, with a particular digestive system that helps them to utilize fibrous plant material for energy production more efficiently compared with other herbivore animals. Ruminant animals have a different digestive mechanism compared with monogastric animals such as pigs and poultry, in which feedstuffs are fermented to create energy precursors for the animal’s use. Livestock owners can be able to care for ruminant animals if they understand how the digestive system of the animal operates (Parish et al., 2017). Knowing the digestive system and understanding the metabolism of nutrients in ruminants are of vital importance in terms of proper feeding of the animals. In addition, the ability to manipulate the metabolism in favor of animals also depends on a good knowledge of the system (Chuch, 1993). Therefore, in order to feed these animals precisely and economically, it is necessary to know the structure of the digestive system and how it works.

Recently, feed additives are substances that have been widely used in animal diets. Knowing their mode of action and manipulating the rumen metabolism with them for the benefit of animals is extremely important in terms of profitability and healthy products in animal husbandry. As a matter of fact, many studies are carried out in this context. In this review, some examples of the benefits obtained in these studies are presented. It was also explained how each prebiotic improves the ecosystem through direct or indirect processes in this review.

RUMINANT DIGESTIVE ANATOMY AND PHYSIOLOGY

The ruminant digestive system consists of the four champers, namely the rumen, reticulum, omasum, and abomasum. Ruminant animals eat a high-roughage, low-concentrate diet. Roughages such as hay, straw, grazed forages, and silage are all examples of roughages, which are high in fiber, low in energy meals and only 50 to 65 percent digestible. Unlike monogastric animals, ruminants can consume very high amounts of feed quickly and without chewing. Then, they grind the feed by ruminating them.

Rumen is the stomach's first and largest region. Solid feed is combined and partially broken down in the rumen. The rumen is home to millions of bacteria and other microbes that aid in the breakdown of roughages through fermentation. Microbes found in the rumen also synthesize amino acids and B-complex vitamins, which are necessary for cell growth and maintenance in the body of ruminants (Ergün et al., 2001).

Reticulum is the stomach's second segment. The reticulum is a tiny pouch on the rumen's side that captures foreign items like wire, nails, and other sharp objects. Because ruminants do not digest their feed before swallowing it, they can swallow foreign items from time to time.

Omasum is the third chamber of the stomach. The omasum grinds the feed and extracts some of the water from it. Omasum works as a kind of mixer, in which hydrochloric acid and digesting enzymes are mixed with consumed feedstuff.

Abomasum is the stomach's fourth camper, because it functions like the stomach in monogastric animals, the abomasum is often accepted as the true stomach of ruminants (Chuch, 1993).

MICROORGANISMS IN THE RUMEN

Roughage digestion is dependent on microbes in ruminants. Bacteria, protozoa, and fungi are among the microorganisms found in the rumen. Bacteria are the most abundant microbes in the rumen, with around 1 billion bacteria per milliliter of rumen fluid. In the rumen, bacteria are responsible for the majority of meal digestion. They

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degrade cellulose and produce volatile fatty acids (VFAs). The ruminant gets 60 to 80 percent of its energy from the VFAs. Protozoa are responsible for around 25% of the fiber digestion in the rumen. Fungi account for up to 8% of total rumen microorganisms. In more resistant forages, such as corn, fungi are responsible for the breakdown of cellulose and lignin (Chuch, 1993).

The type and amount of microorganisms in a ruminant's rumen have a significant impact on feed conversion and gain rate. To optimal productivity, various types of microbes must be present in the right amount. Protozoa are inversely proportional to bacteria in the rumen. Protein utilization will be increased by eliminating or reducing the amount of protozoa in the rumen if a ruminant is fed in a manner that is friendliest to bacteria in the rumen. Feeding yeast culture to animals, for example, could assist maintain a healthy rumen bacterial community's in the rumen (Anonim, 2021[a]).

METABOLISM

Metabolism is the chemical process through which cells manufacture the molecules and energy required for life to exist. Catabolism and anabolism are two types of metabolism. Catabolism is the metabolic breakdown of complex (bigger) molecules into simpler (smaller) molecules, which frequently results in energy release. Anabolism is the phase of metabolism during which complex (big) molecules like proteins and lipids are generated from simpler (smaller) molecules (Anonim, 2021[b]).

CARBOHYDRATE METABOLISM

Carbohydrates are a vital source of energy for ruminant animals. Ruminants get carbohydrates by eating plants that synthesize carbohydrates by photosynthesis, using light energy from the sun. Carbohydrates can be found as starch or cell wall, which are long polysaccharide chains, whereas carbohydrates are stored as glycogen in animals, which is a molecule. Since these big polysaccharides observed in plants have a huge number of chemical linkages, they generate a lot of chemical energy when they are utilized. When these molecules are broken down during metabolism, the energy contained in their chemical bonds is released, which can be used to power cellular operations.

Carbohydrate metabolism in ruminants is different from monogastric animals, and unlike monogastric animals, they can also utilize carbohydrates in cellulotic structure. This type of carbohydrates can be fermented in the rumen with the help of enzymes secreted by the microorganisms in the rumen. In ruminants, carbohydrate metabolism begins in the rumen and continues to the cellular level in the animal's body. Ingested carbohydrates are fermented by microorganisms in the rumen. Acetic, butyric, and propionic acids, known as organic acids, are formed by the fermentation of carbohydrates in the rumen. Besides these products, small amounts of different organic acids, methane, carbon dioxide and ATP occur. The percentages of fermentation end products in the rumen vary depending on the carbohydrate source of the feed given to the animals. The main reason for this is the population of microorganisms in rumen microflora. Feeds rich in cellulose cause rumen pH to increase as it triggers rumination. In this case, since the cellulotic microorganism population is high in the rumen, more acetic acid is produced in this case, while the acetic acid ratio is relatively low in the case of consuming concentrated feeds. Some feed additives can affect the microflora and alter the fermentation products formed here in favor of the animals. Thus, feed additives can help ruminants to utilize the energy of the feed more effectively. These organic acids, which are absorbed from the rumen wall and taken into the body, are used in the synthesis of glucose and fatty acids of the animal's body.

The metabolism of a cell can turn any monosaccharide (simple sugar) into energy. Excess carbohydrates are stored as glycogen in animals, ready for metabolism if the organism demands energy. When an organism's energy demands rise, carbohydrates are broken down into monosaccharides, which are subsequently dispersed to all of the organism's live cells. Monosaccharides like glucose ($C_6H_{12}O_6$) are commonly used for energy production. Each sugar molecule is broken down inside the cell by a complex series of chemical processes. The chemical energy produced from the monosaccharide's bonds is used to make high-energy adenosine triphosphate (ATP) molecules. All cells use ATP as their principal source of energy. Cells use ATP molecules to do immediate tasks (Anonim, 2021[c]).

PROTEIN METABOLISM

Proteins are the most common organic components and account for a significant portion of the dry body weight. These are nitrogen-containing macromolecules with repeating units made up of L-alpha amino acids. Proteins are mainly consisted of 20 amino acids and in general, 9 of them are essential amino acid that needs to be taken by diets. There is an amino group, an acid group, a hydrogen atom, and a side group in each amino acid. The side group is what distinguishes each amino acid. Each protein's form and function are determined by its amino acid sequence. Amino acids are chemical molecules with two functional groups: amino and carboxyl. The amino group ($-NH_2$) is basic in nature, whereas the carboxyl group (-COOH) is acidic.

Protein metabolism in ruminant animals is quite different from monogastric animals. Ruminants have the ability to synthesize high quality proteins from non-protein nitrogenous compounds through microorganisms in the rumen. In ruminants, protein metabolism begins in the rumen, as does carbohydrate metabolism. In the rumen, microorganisms convert non-protein nitrogenous compounds and some of the true proteins to ammonia. Then, this ammonia is utilized by another group of microorganisms and is transformed into a protein, which is expressed as microbial protein, which meets a significant proportion of the protein requirement of the host animal. The true proteins taken with the feed that cannot be degraded in the rumen and the microbial protein synthesized in the rumen pass into the abomasum. Abomasal and post abomasal protein metabolism follows a similar pathway to monogastric animals.

Amino acids go through a series of processes to release ammonia, including transamination and deamination in the body of animals. The amino groups of amino acids are used to make urea, which is an excretory end product of protein metabolism. The carbon skeletons of amino acids are first transformed to keto acids (through transamination), which then go on to one of the following destinations:

- Used to generate energy.
- It's used to make glucose, but it's also used to make fat and ketone bodies.

• Plays a role in the synthesis of non-essential amino acids (Anonim, 2021[d]).

FEED ADDITIVES

Feed additives are compounds, microorganisms, or preparations that are added to feed or water for one or more of functions to do. They can be chemical substances or organisms. They improve the growth and health of animals by increasing digestion, absorption, and assimilation of nutrients. They may have a significant impact on physiological processes such as immunity, stress resistance, and reproduction. Feed attractants, immune-stimulants, prebiotics, probiotics, acidifiers, essential oils, and other inclusions can be classified as feed additives (Van Saun, 2014; Watts and Lawrence, 2020.)

Livestock producers widely use feed additives all over the world for different purposes such as providing important nutrients, increasing feed palatability, improving growth performance, and optimizing feed usage. Animals with strong growth performance require a high level of health, and the use of appropriate chemicals is a common argument. With rising industry standards and consumer awareness, as well as demand for healthy animal-derived foods, the industry is under pressure to find more natural and non-residual alternatives to the conventional feed additives that were previously used as animal feed products. Consumer and animal welfare are the key issues that drive the value of feed additives (Pandey et al., 2019).

Probiotics, prebiotics, enzymes, and herbs are some of the commonly used feed additives. Herbs and their extracts (botanicals) have been proven to have a wide range of activities, not only stimulating feed intake but also stimulating endogenous secretions or having antimicrobial properties. Herbal feed additives are becoming more important in sustainable livestock production due to the ban on antibiotics.

The usage of feed additives such as ascorbic acid, prebiotics, probiotics, and herbal extracts benefits the animal husbandry industry. The antibacterial, anti-inflammatory, antioxidant of medical herbs, must be investigated for digestibility, and immune-stimulant in animal feeding as well as safe human eating (Pandey et al., 2019).

CLASSIFICATION OF FEED ADDITIVE

Feed additives commonly used in animal diets can be classified as enzymes, probiotics, prebiotics, antioxidants, growth promoting antibiotics, and coloring compounds. The main goal of these various substances is to improve the growth, health of animal and products obtained from animals.

ENZYMES

Exogenous enzymes are frequently given to monogastric animals to improve digestibilties of diets and utilization of nutrients. They are also added into the feed of ruminant animals to improve digestion of feedstuffs such as silages. They are mainly used with cereal grains and plant-based byproducts because several nutrients in these feedstuffs have “bounds,” that are not broken down by enzymes released from developed animals.

PROBIOTICS/ PREBIOTICS

Probiotics and prebiotics are terms used to describe organisms or substances that help maintain a healthy microbial balance in the intestine and include both live and non-living species. It's critical to promote a healthy gut flora, especially as antibiotic growth promoters (AGPs) are taken out of animal feeds. Through a variety of processes, probiotics aid in the prevention and management of gastrointestinal infections, as well as the improvement of performance and productivity in production animals. Healthy bacteria populations in the gastrointestinal (GI) tract are frequently linked to higher animal performance, indicating improved digestion and immunity.

ANTIOXIDANT

The need for antioxidant protection has grown more evident as meals containing high levels of animal and vegetable fats have become more common. Oxidation happens in feeds and feedstuffs, causing lipid rancidity and the breakdown of vitamins A, D, and E, as well as amino acids, causing lower energy values for the diet. There are two types of antioxidants: natural and synthetic. These compounds have the ability to prevent or stop the generation of free radicals, hence protecting against reactive oxygen species. Antioxidants reduce rancidity in oils while also improving shelf life and feed quality.

ANTIBIOTIC GROWTH PROMOTERS

Antibiotics' growth-promoting effects were identified in the 1940s when poultry were fed feed containing tetracycline fermentation byproducts. Since then, growth promoters have been ban to include a wide range of antibiotics that are used on a variety of animals. Antibiotic growth promoters are chemicals used in feed to treat disease and enhance animal development and performance at a low sub therapeutic dose. With the increasing consumer demand and advancements in feed conversion to animal-derived foods, the use of AGPs has fully banned in animal diets from 1 January 2006 in EU countries (Cherian, 2021).

IN GENERAL PROBIOTIC AND PREBIOTIC

Probiotics are non-pathogenic live microorganisms that can provide health benefit to the host when they are given in sufficient doses. Probiotics' health benefits are immune-modulatory action in the gut, where they stimulate the release of immune modulators such cytokines and IgA in the intestinal mucosa.

Probiotics are generally given to ruminants to alter rumen fermentation in favor of the host animal. Probiotics, an influence rumen fermentation by increasing feed digestibility, changing rumen microbiota and composition of organic acid produced in the rumen so that animal can benefit more from feedstuffs consumed. Probiotics boost digestion of cellulolytic carbohydrate and microbial protein synthesis during digestion, while keeping rumen pH and lactate level at desirable levels. Thus, ruminal acidosis can be reduced by using a direct-fed probiotic. Probiotics can also help you absorb more nutrients (Adjei-Fremah et al., 2018).

Probiotics have been widely used to facilitate gut health, decrease diarrhea and bloating, and prevent infections in ruminant animals. Many researches have indicated that addition of probiotics into ruminant diets is beneficial for animals. Probiotics boost host disease resistance through regulating and balancing gut microorganisms, and also promoting animal growth and development. Recent studies have noted that using probiotics as a feed additive for ruminants increases growth performance, productivity, and the animals' overall health and well-being (Adjei-Fremah et al., 2018).

Prebiotics are substances that encourage the growth of beneficial bacteria, primarily in the intestine, and alter the microbiota of the colon. A prebiotic is a non-digestible feed element that enhances host health by selectively boosting the growth and activity of one or a small number of bacteria in the colon. A prebiotic is a fermented element that allows for specific changes in the composition and activity of the gastrointestinal microflora, leading positive effects on the host's well-being and health. A dietary prebiotic is a fermented food that causes specific changes in the gastrointestinal microbiota's composition and activity (Yirga, 2015).

They are feeds or dietary supplement that has been shown to improve the host's health through regulating the microbiota. Prebiotics are not medications, they don't work because of component absorption or the component acts directly on the host, rather they work because of changes in the resident bacteria- either modifying their proportions or their activity. A prebiotic can be a fiber, however not all fibers are prebiotics. Symbiotic are a type of nutritional supplement that combines probiotics and prebiotics in a synergistic way.

A prebiotic is a fiber such as fructose oligosaccharide and galactose that is consumed and is designed to promote the microflora in the large intestine. Three broad techniques are commonly used to produce prebiotic oligosaccharides. These techniques; plants' native oligosaccharides are extracted directly, natural polysaccharide hydrolysis under control and enzymatic synthesis employing hydrolases or glycosyltransferases.

GASTROINTESTINAL EFFECTS OF PROBIOTIC AND PREBIOTIC

The nutritional requirements of animals in intensive production systems can be satisfied by supplementing the limiting nutrients in concentrated form, allowing them to generate huge quantities of goods quickly. However, using feedstuffs that ferment quickly in the rumen can create rumen conditions that are unsuitable for fibro-lytic microbes, preventing fiber digestion. Furthermore, the nutritional quality of a feed is influenced not only by nutrient content, but also by a variety of other parameters such as hygiene, anti-nutritional factor content, digestibility, palatability, and the effect on intestinal health.

Probiotic is a live microbial feed supplement that positively affects the microbial balance in the gut of the host animal. The use of probiotics could be a viable alternative to the usual practice of using sub therapeutic antibiotics. Several studies have found that probiotics have positive effects on the enhancement of growth and prevention of disease (Yirga, 2015).

Prebiotics can modify the microbial habitat in the intestine, hence they may prevent the development of infectious bowel disease. A variety of prebiotics have been shown to be useful in influencing the microbiota. Inulin, germinated barley foodstuff (GBF), and oligosaccharides like oligo-fructose are examples of these. Bloody diarrhea and mucosal damage were reduced when a mixture of prebiotics was used. Carcinogenesis may be hampered by the gut microbiome. Increased lactic acid bacteria in the stomach may result in a decline in some bacterial enzymes involved in carcinogen production or activation (Sethy et al., 2017).

Prebiotics aid especially growth of certain type of bacteria such as lactobacillus. At the same time, they may also inhibit pathogens by competing for receptor sites on the gut wall and reducing persistence and thereby decrease the potential risk of infection. They may also compete effectively for nutrients with pathogens. It's also been suggested that by promoting apoptosis, it could help to lessen the risk of colon cancer. Prebiotics help to build tolerance to gastric acidity, mammalian digestive enzyme hydrolysis, and GI absorption (Sethy et al., 2017).

PROBIOTIC AND PREBIOTIC IN RUMINANT'S NUTRITION

Ruminant animals mainly depend on a symbiotic relationship between the host animal and the rumen microbes, at which the microorganisms provide protein, vitamins, and short-chain organic acids to the host animal. Microbial sources are primarily responsible for the energy ingested, glucose generated in the liver, and protein digested in the abomasum. In reality, the microbial cells synthesized in the reticulo-rumen contribute up to 90% of the protein that reaches the small intestine and up to 50% of the host energy needs in a fully functioning ruminant. The digestion and fermentation of plant polymers is aided by microbial communities, which is especially important in mature herbivorous species.

Probiotics can improve the health of intestine by facilitating a well-balanced microbial ecosystem, increasing digestive capacity and bioavailability, preventing enteric pathogens from colonizing the intestine, restoring gut microflora, lowering pH, and improving mucosal immunity and nutrient absorption. As a consequence, they are expected to boost ruminant productivity and overall health (Retta, 2016).

Calves are born as pre-ruminants and their digestive system works like monogastric animals until the rumen and other stomach compartments have fully developed. Prebiotics can be used to boost growth in veal calves fed low-roughage diets (i.e., diets low in fibrous material) during the first few weeks of life, or for longer in the case of veal calves fed low-roughage diets (i.e., diets low in fibrous material). Prebiotics can help with growth, diarrhea and respiratory disease prevention.

The propensity of ruminants to digest most prebiotics has limited their usage in animal. However, advancements in rumen-protective technologies may allow these feed ingredients to be employed in feedlot and dairy cattle in the future. Also, various kinds of non-digestible oligosaccharides can be found in the plant cell wall in nature, including plants that are commonly utilized for animal feed. Cello-oligosaccharides, galactosyl lactose and yeast cell wall extracts are the prebiotics utilized in pre-weaned calves (Anadón et al., 2019).

PROBIOTIC AND PREBIOTIC MODE OF ACTION

Probiotics generally reveal their effects as; enhancement of the epithelial barrier, increased adherence to intestinal mucosa, and associated inhibition of pathogen adhesion, competitive exclusion of pathogenic microorganisms, generation of anti-microorganism chemicals, and immune system regulation (Bermudez-Brito et al., 2012). Diverse prebiotics reveals action or processes, which are mostly unknown and reliant on the prebiotic additive's structure and contents. Many prebiotics, on the other hand, share a common method of action mutually exclusive stimulation of the development and metabolic activity of beneficial microorganisms like Bifid-bacterium and Lactobacillus spp.

The capacity of yeast probiotics to promote a balanced microbiome regardless of intestinal pH variations is one of the benefits or mechanisms of action that classify them as prospective alternatives to in-feed antibiotics. By offering competitive binding sites for pathogenic bacteria, yeast prebiotics have been shown to control the spread of undesirable intestinal infections in animal (Ahiwe et al., March 2021).

Prebiotics have been proposed as an alternative to antibiotics in recent years. Prebiotics influence the gut ecosystem through a variety of mechanisms, including altering the intestinal bacteria, improving the epithelium, and stimulating the immune system. Prebiotics are thought to alter not only these features but also the overall relationship between the host and the gut microbiota.

Prebiotics, such as oligosaccharides, glucans, and fructans, will be studied for their impact on the interaction of the intestinal microbiota, gut integrity, and animal immunity. We'll go over how prebiotics improve gut growth and general animal health by modulating the microbial community and regulating cytokine and antibody production. Understanding how prebiotics interact with the intestinal ecology could lead to new insights and techniques for preventing pathogen invasion and enhancing animal health and output (Teng and Kim, 2018).

The foregut and hindgut contain millions of different types of microflora, including bacteria, fungus, yeasts, phage particles, archaea, and so on with the exception of protozoa, which are considered to be present solely in the foregut and absent in the hindgut. Prebiotics are fermented by a variety of rumen bacteria and used as an energy source. The positive effects of prebiotics on animal health, particularly gut microbial ecology, have encouraged ruminant researchers to investigate their potential in several livestock species such as cattle, buffalo, and sheep.

Ruminants are subjected to various types of stress at various times, such as when they are weaned, transported, and so on. This has a negative impact on animal health, causing diarrhea, off-feeding, growth depression, and altered intestinal morphology, among other things. In such cases, ecological treatment with prebiotics could be a viable option for alleviating livestock stomach issues.

Prebiotics must be indigestible by gastrointestinal enzymes but categorically used by a certain group of gut microorganisms. Prebiotics, unlike other functional foods, have multiple functions ranging from gut microbiota modification to mineral absorption and pathogen excretion. As a result, in order to maximize its good impact on the cattle system, the channel of activity should be extensively dispersed over a variety of systems, including the gastrointestinal, immunological, and skeletal systems, among others. According to the literature, prebiotics are gaining popularity as a supplement for gut health and gastrointestinal problems management (Samanta et al., 2013).

TYPES OF PROBIOTIC AND PREBIOTIC

Lactic-acid bacteria strains like Lactobacillus, Bifidobacterium, Bacillus, Saccharomyces, and Enterococcus are typical probiotics found in functional foods and animal feed. Enteric infection resistance has been demonstrated in Lactobacillus and Bifidobacterium species. These beneficial microbes are made up of a variety of microorganisms, including bacteria and yeast, and can be utilized as single or multi-strains. Because of their synergistic adhesion effect, multi-strain probiotics have a broad spectrum effect against infections from diverse strains and could improve the therapeutic benefits of probiotics (Adjei-Fremah et al., 2018).

None-absorbable carbohydrates such as oligosaccharides and polysaccharides, peptides, proteins, and lipids are all examples of prebiotic compounds. Prebiotics are naturally found in legumes, fruit, and grains. However, commercial chemical and enzymatic processes are used to make numerous comparable compounds. When those compounds reach the big intestine, they become nutrients for helping intestinal bacteria.

Prebiotics are classified as indigestible (or just partially digestible), none-absorbable substances in the small intestine, poorly fermented by oral bacteria, well fermented by supposedly benign intestinal bacteria, and poorly fermented by possible pathogens in the bowel. FOS, GOS, inulin, isomalto-oligosaccharides (IMO), xylo-oligosaccharides (XOS), lacticol, lactulose, and cereal fibre are the most commonly utilized prebiotics in animal nutrition. The determination of an optimum dosage is critical when designing the composition of prebiotic formulations. Prebiotic overdose can cause flatulence and diarrhea (Markowiak and Sliżewska, 2018).

YEAST AS PROBIOTICS AND PREBIOTICS

Yeast has been commonly used as probiotic in ruminant nutrition, and it was shown to help restore gut microbial balance, particularly in the case of digestive diseases. It is mainly added into ruminant diets to improve feed efficiency and prevent rumen acidosis by competing with other microorganisms in the rumen during fermentation (Amin and Mao, 2020).

Yeasts are single-celled eukaryotic microorganisms with a diameter ranging from 3 to 40 microns. Saccharomyces cerevisiae has been the most widely used yeast species in animal nutrition as a prebiotic. Saccharomyces cerevisiae makes enzymes like glucanases, mannanases, amylases, proteases, and lipases, as well as nutrients like amino acids and vitamins. The matrix of the yeast cell wall (YCW) is primarily composed of -mannan (31% dry mass), manno-proteins (mannan + protein), which combined account for about 40% dry mass, -glucan (about 60% dry mass), and chitin (about 2 percent dry mass) (Ahiwe et al., 2021).

The primary goal of include such additions in ruminant diets is to prevent rumen flora disorders and disturbances, particularly those linked to high-energy concentrate consumption. The addition of yeast to ruminant diets increases dry matter consumption, fiber utilization, and other nutritive component use, as well as daily gains. Minerals like phosphorus, magnesium, calcium, copper, potassium, zinc, and manganese are also better digested and absorbed using to yeast cells. The main objective of feed additives use in the ruminant diets is to boost productivity. In addition to addressing customer concerns about animal product safety, quality, and environmental issues, the addition of feed additives into diets may also reduce the risk of human diseases being transmitted through ruminant digestion and releasing of nitrogen-based compounds and methane into environment (Sontakke, 2012).

The Food and Drug Administration (FDA) considers S. cerevisiae to be generally recognized as safe, making it suitable for use in animal feeds. The strain of S. cerevisiae used, as well as the number and vitality of cells present, vary greatly among available products. Some goods are offered as live yeast, containing both yeast cells and the media on which they are grown, while others are sold as yeast cultures, containing both yeast cells and the media on which they are produced (Sontakke, 2012).

In conclusion, it is important to know how the animal's digestive system works when making decisions about why and how to use feed additives. In ruminant animals, unlike the monogastrics, feed additives, especially pre-and probiotics, are utilized to affect fermentation in the rumen. In addition, it is seen that it is used to increase immunity in pre-ruminants. However, it is obvious that more studies are needed on these issues.

Conflict of Interest

The authors declared that there is no conflict of interest.

Authorship contributions

Concept: M.A.S.H., M.A.K., Design: M.A.S.H., M.A.K., Processing: M.A.S.H., M.A.K., Interpretation: M.A.S.H., M.A.K., Literature Search: M.A.S.H., M.A.K., Writing: M.A.S.H., M.A.K.

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