EAS Journal of Veterinary Medical Science
*Abbreviated Key Title: EAS J Vet Med Sci*
ISSN: 2663-1881 (Print) & ISSN: 2663-7316 (Online)
Published By East African Scholars Publisher, Kenya
OPEN ACCESS
Volume-6 | Issue-2 | May-Jun, 2024 | DOI: 10.36349/easjvms.2024.v06i02.002

**Review Article**

# Review on Probiotic and Health Benefit in Dairy Cattle

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**Article History**
**Received:** 18.04.2024
**Accepted:** 13.05.2024
**Published:** 16.05.2024

**Journal homepage:**
https://www.easpublisher.com

**Quick Response Code**

**Abstract:** Probotics are non-pathogenic living microorganism which can be used in food in order to improve the normal flora of host intestine. Therefore, it is essential to select species that have the ability to survive a long time to maintain their role in industrial process. Probotic microorganism are isolated from gastrointestinal system lactobacillus and bifidobacterum species are widely known. Probotic supplemented animals have benefical effect on increase in milk production, improvement in productivity of animal due to probotic can be associated with an increase in digestion and absorption of nutrients. Probotic strains administered separately or in combination, significantly improved feed intake, feed conversion rate, daily weight gain and total body weight. Health benefit of probiotic are maintaining normal flora, protection of digestive tract, improvement of immune system, reduction in blood cholesterol levels and blood pressure, anti-cancer activity and improvement of nutrient absorption. Probotics are involved in treatment of disease. The improvement in metabolic process where due to improved development of gut and increased microvillus height which led to enlargement of the microvillus absorptive surface and enabled the optimal utilization of nutrient. The mechanisms of action of probotic bacteria and their effect in combating digestive disorders in animal and human has been demonstrated and supported in numerous scientific studies. Probotic bacteria are used in wide range of nutritional technique in order to support the host organism. The improvement in productive performance of livestock's and poultry species fed with probiotics was mostly due to promoted the metabolic processes of digestion and nutrient utilization, exerting enzymatic activities, increasing the passage rate of digestion and deconjugating bile salts and acids. The improvement in metabolic processes were due to improved development of the gut and increased microvillus height which led to the enlargement of the microvillus' absorptive surface and enabled the optimal utilization of nutrients. The use of probiotics could be a potentially viable solution to address the issue of increasing antibiotic resistance; the effect, mechanism of action and safety of probiotics, to obtain consistent effects and a similar economic benefit to animal growth promoter.

**Keywords:** Bifidobacterium, Lactobacillus Acidophilus, probiotics microbes.



## 1. INTRODUCTION

Probiotics are live microorganisms that may beneficially affect the host upon ingestion by improving the balance of the intestinal micro flora (Fuller, 2003). They are non-pathogenic microbes that occur in nature and gastrointestinal tract of ruminants (Dunnel *et al.*, 2004). These living microorganisms in the gastrointestinal tract of both humans and animals form an enormous microbial community that includes both aerobic and anaerobic bacteria, as well as yeast or fungi (McNulty, *et al.*, 2005) The intestinal micro biota contributes to health in the host by fermenting unused energy substrates, preventing growth of harmful pathogenic bacteria (Guarner and malaqelada, 2003); assisting the host immune system (Hand, *et al.*, 2012; Rudin and candell, 2012), and inflammatory bowel disease (IBD) (Manichanh, *et al.*, 2012).

Probiotic foods are a group of functional foods with growing market shares and large commercial interest (Arvanitoyannis, *et al.*, 2005). Commercial probiotics for animal use are claimed to improve animal performance by increasing daily gain and feed efficiency in feedlot cattle, enhance milk production in dairy cows, and improve health and performance of young calves. (Krehbiel, *et al.*, 2003) and in improving growth performance of chickens (Kalavathy, *et al.*, 2003). Currently, the use of probiotic additives has been developed as alternatives to antibiotics to improve animal health and productivity (Allen *et al*., 2013).

Probiotics, in general have the ability to enhance intestinal health by stimulating the prevent of enteric pathogens from colonizing the intestine (Casas and Dobrogosz, 2000), increase digestive capacity and their bio-availability (Oyetayo, 2005), restore the gut micro flora (Musa *et al.,* 2009), the development of a healthy microbial ecosystem ( Uyeno *et al*., 2015 ), lower pH, and improve mucosal immunity and nutrient absorption (Timmerman *et al*., 2005); Probiotics are supposed to improve the productivity and the general health of ruminants (Uyeno *et al*., 2015).

Probiotics are capable of decreasing the risk of cancer by inhibition of carcinogens and procarcinogens, inhibition of bacteria capable of converting procarcinogens to carcinogens (Vasiljevic and Shah, 2008). Probiotics display numerous health benefits beyond providing basic nutritional value (FOA/WHO 2001).

In the meantime probiotics are applied as feed supplements, pharmaceuticals, dairy products, fruit juices, chocolates and even meat products (Musa, *et al*., 2009). Clinical trials have evaluated the use of probiotics in the prevention and treatment of gastrointestinal (GI) diseases caused by pathogenic microorganisms or by disturbances in the normal micro-flora (Sullivan and nord, 2005). The conventional use of probiotics to modulate gastrointestinal health such as: improving lactose intolerance, increasing natural resistance to infectious diseases in the gastrointestinal tract, suppressing traveler's diarrhea and reducing bloating, has been well investigated and documented (Musa, *et al*., 2009).

Studies have documented probiotic effects on a variety of gastrointestinal and extra intestinal disorders, including inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), vaginal infections and immune enhancement (Guarner, *et al.,* 2008). Probiotic strains inhibit the pathogenic organisms by competing for the limited substrates required for fermentation or the receptors. They prevent the adherence of the pathogenic bacteria to the host cells by strengthening the barrier effect of the intestinal mucosa (Eizaguirre *et al*., 2002; Mangell *et al*., 2002) and release of gut-protective metabolites (arginine, glutamine, short-chain fatty acids and conjugated linoleic acids). Probiotic acts as antimicrobial by secreting the products called bacteriocins and substances such as organic acids (lactic, acetic and butyric acid) and H2O2 (De Keersmaecker *et al*., 2006).

Therefore the Objectives of this a seminar paper is to summated health benefit of probiotic in human and animal, role of probiotic in growth promotion, increase production.

## 2. HISTORICAL DEVELOPMENT OF PROBITICS

Probiotics are considered live microbial feed supplements that can benefit the animal, otherwise known as the host. The word 'probiotic' means 'for life' and originated from the Greek language (Fuller, 1992).

Humans have consumed food with live microbial activity for thousands of years. Most likely, the first fermented food consumed was milk. However, the intentional practice of eating fermented foods, which contain microorganisms to produce beneficial properties, started during the 20th century (Morelli and Capurso, 2012). Yogurts are a popular source of probiotics and the public sees them as a benefit to a healthy lifestyle (Lourens-Hattingh and Viljoen, 2001).

The first investigator in the area of fermentation and probiotics was Eli Metchnikoff who worked at the Pasteur Institute in Paris. He reported the existence of increased human longevity by drinking large amounts of soured milk in Bulgarian peasants. This strengthened Metchnikoff's belief that the lower gut and overall health would be affected by microbes from the soured milk. Following this realization, he tested cultures of milk that were fermented by the Lactobacillus genus. For instance, *Lactobacillus bulgaricus* later became the strain popular for fermenting yogurt (Fuller, 1992).

They described probiotics as microorganisms which would aid in the growth of other beneficial microorganisms in the gut (Vila *et al*., 2010). Guarner and Schaafsma (1998) described probiotics as the consumption of sufficient live microorganisms with the ability to contribute health benefits to the host (Morelli and Capurso, 2012). This added even more refinement on the term probiotic. Effectiveness of probiotic supplementation can be attributed to the species of microbes and the form of supplementation used, such as wet or powdered (FOA and WHO, 2001). Furthermore, scientific experts concluded that properties, benefits, and purposes of identified probiotics are individualized and specific to each strain. Also, unique strains ingested by the host have induced effects which may cause other reactions in the body (Morelli and Capurso, 2012).

The main two sources of probiotics isolated from traditional fermented products are species of lactic acid bacteria and bifidobacteria, but many other probiotic sources can be identified and used commercially (Morelli and Capurso, 2012). Sources of probiotics vary but they can be isolated from milk, fermented foods, feces, or the gut micro biota of different animals (Fontana *et al*., 2013). Species of lactic acid bacteria have become popular for human use because they can improve the ability to digest lactose if the individual is lactose intolerant. These lactic acid species have other proposed benefits, but none have been completely proven. Still, suggested benefits include prevention of certain cancers, decreased intestinal infections, and decreasing serum cholesterol levels. Furthermore, species of lactic acid bacteria have been utilized to improve health and growth of food animals (Gilliland, 1990). Bifidobacteria has health promoting functions which include lowering blood cholesterol levels, attacking malignant cells, decreasing blood ammonia levels, and producing many B vitamins (Gibson and Roberfroid, 1995), which can directly affect metabolism of proteins, carbohydrates, and lipids. The technological use of fermentation to produce final probiotic products has made it possible to produce large scale quantities for commercial companies (Ghani *et al*., 2013).

The bacterial strain Bacillus licheniformis under aerobic conditions can produce a natural polypeptide antibiotic called bacitracin (Kayalvizhi and Gunasekaran, 2008; Anthony *et al*., 2009). Bacillus licheniformis also has the ability to produce bacitracin under anaerobic conditions and can thrive with little oxygen (Pattnaik *et al*., 2001). Aerobic strains of Bacillus subtitles can reproduce anaerobically when they use nitrate or nitrite as an electron acceptor. The other mode of anaerobic proliferation is by fermentation (Zhang *et al*., 2002; Feng *et al*., 2003; Hmidet *et al*., 2009).

## 3. PROBIOTICS MICROBES AND THER CHARACTERISTICS

### 3.1 Probiotics Microbes

Probiotic microorganisms are isolated from human gastrointestinal system (Guldas and Irkin, 2010). Lactobacillus and Bifidobacterium species are widely known. *Entreroccus. faecium*, *Entreroccus.* faecalis, *Streptococcus.thermophilus*, *Lactococcus lactis subsp. lactis*,*Leuconostoc mesenteroides*, *Propionibacterium freudenreichii*, *Pediococcus acidilactici*, *Sporolactobacillus Inulinus*, *Esherichia.* coli, bacteria such as some Bacillus species, other lactic acid bacteria species, yeast such as Saccharom in relation to the addition of *Bifidobacterium*, *Lactobacillus acidophilus*, *Lactobacillu*s *rhamnosus*, *Lactobacillus casei*, *Lactobacillus reuteri* to the fermented dairy products such as yoghurt (Guldas and Irkin, 2010).

Lactobacillus acidophilus and *Bifidobacterium animalis subsp. lactis* are the lactic acid bacteria that are most frequently used as probiotics. These bacteria grow slowly in milk because they lack essential proteolytic activity and for this reason they are usually combined with Streptococcus thermophilus (Casarotti *et al*., 2014).

### 3.2 Characteristics of Probiotics

#### 3.2.1 Lactobacillus acidophilus

Lactobacillus acidophilus is a gram positive, anaerobic or facultative anaerobic, nonmotile, catalase (-), rod-shaped bacteria. It is a homofermentative bacteria which has an optimum growth temperature of 35-38 °C and optimum pH interval of 5,5-6 (Tamime and Marshall, 1997; Ozbas, 2004).

*Lactobacillus acidophilus* has an antimicrobial effect due to the formation of organic acids (lactic acid, acetic acid, etc.), H2O2 and antibiotic substances (Lactocidin, Acidophilin, Acidolin, Lactocin B). As a result of L. acidophilus traits, intestinal infections and disesases can be brought under control and negative effects of antibiotic treatment can be eliminated. Lactobacillus.acidophilus is resistant to bile acid and has a strong antibiotic effect on fecal E. coli strains and other intestinal pathogens (Uzun, 2006; Ahmed *et al*., 2010).

*Lactobacillus acidophilus* is used in number of fermented products (Gilliland *et al*., 2002). The most common are yoghurt and sweet acidophilus milk. Sweet acidophilus milk is manufactured by inoculating L. acidophilus bacteria in milk. After that, the milk sets for 24 hrs and yields a type of buttermilk having low content of lactose (Tsen *et al*., 2004). Mostly, sweet acidophilus milk is consumed by those individuals having problem of lactose maldigestion and intolerance, a condition that effect approximately 75% of the world population. This condition prevails when lactase enzyme unable to break down lactose in the intestine, thus failure to digest lactose results in the occurrence of discomfort, cramps and diarrhea (Sanders, 2000).

Foods in which L. acidophilus is used in adequate amounts include live yoghurt cultures, miso, and tempeh. These products vary greatly concerning the type of bacteria used and their individual potencies. L. acidophilus and L. casei were added as adjuncts to yoghurt and cultured buttermilk and their viability was checked during 28 days of refrigerated storage at 50 to 7°C. For the enumeration of L. acidophilus and L. casei, modified LBS (Lactobacillus selection) agar was used that helped in the colony formation of the adjunct bacteria only while preventing colony formation of the traditional yoghurt or buttermilk starter cultures. In both cultured products, some strains of L. acidophilus survived well but others loss their viability but there was no viability loss of L. casei GG in any of the cultured products during storage (Nighswonger *et al*., 1996). Probiotics are available in dried or liquid cultures of living bacteria and used in a variety of nutritional supplements. These cultures are often marketed as freeze-dried powders, granules, or capsules and suppositories. Once these probiotic products are consumed, L. acidophilus begins to colonize the digestive tract (Admin, 2010). In microencapsulation, microcapsules are formed to support the growth of the probiotic and provide protection from harsh external environments.

#### 3.2.2 Lactobacillus casei

*Lactobacillus*. casei is in Streptobacteria subgenus and has a diameter smaller than 1.5 µm, has tendency to form chains and does not have flagella, it is rod shaped, nonmotile and homo fermentative. By metabolising pentose, it occasionally forms L(+) lactic acid and acetic acid. L. casei shows rapid growth in media containing % 4 gluconate and forms CO2. It has an optimum growth temperature of 28-32°C and can grow under 15°C and in some conditions can even show growth at 6-7°C. L. casei can utilize sorbitol and sorbet but shows low fermentation rates with maltose and saccharose. It requires riboflavine, folic acid, Ca pantothenate and niacin for growth. It doesn't form gas and shows strong proteolytic effect after lyses (Kilic, 2008; Ernas & Karagozlu, 2013; Wu *et al.*, 2009).

### 3.2.3 Lactobacillus gasseri

Lactobacillus gasseri is a rod shaped, non spore forming lactic acid bacteria. This bacteria is a prolific autochthonous microorganism that colonizes the gastrointestinal tract (GIT), oral cavity, and vagina in humans.The niche-related phenotypes involved in colonization of the human mucosa, including the oral cavity, GIT, and vagina are exhibited by lactic acid bacteria (LAB) such as L. gasseri and may contribute to or potentiate probiotic activity (Selle and Klaenhammer, 2013).

*Lactobacillus gasseri* shows to be beneficiary to gastrointestinal system and is stated to have the capability to reduce fecal mutagenic enzymes due to its probiotic activity. It has the ability to adhere to intestines and has a role in bacteriocin formation and macrophage stimulation. In the view of it's probiotic traits, it can be used in the production of fermented dairy products and in commercial preparations (Uzuner, 2012).

### 3.2.4 Streptococcus thermophiles

Streptococcus *thermophilus i*s a gram-positive bacterium showing ovoid cells occurring in pairs or in short chains. It is a thermophilic bacterium with an optimal growth temperature of 42 C and an aerotolerant anaerobe organism. S. thermophilus belongs to the salivarius group which also includes Streptococcus *salivarius* and S. *vestibularis* (Facklam, 2002; Gao *et al*., 2014). S. *thermophilesis* the only Streptococcus species used in food industry. Because it has been consumed by humans for centuries without giving any disease, it is also the only Streptococcus species to be recognized as a generally recognized as safe bacterium by the Food and Drug Administration (FDA). S. thermophilesis one of the basic starter bacteria of yogurt and is the second most important species of industrial LAB after Lacto coccus lactic (Avonts *et al*., 2004). The characteristics of probiotics is summarized in Table 1.

**Table 1: Characteristics of probotics**

| Dairy probiotic foods | Probiotic strains | Characteristics | References |
|---|---|---|---|
| Probiotic ice cream | Lactobacillus casei (Lc01) and Bifidobacterium lactic (Bb12 | Highest resistance to simulated acidic, alkaline and ice cream conditions | Homayouni *et al.*, 2008<br>Homayouni *et al.*, 2008 |
| Petit-Suisse cheese | Bifidobacterium and lactobacilli | The presence of the prebiotics insulin and oligo fructose can promote growth rates besides increased lactate and short chain fatty acids production | Cardarelli *et al.*, 2007 |
| Conventional yoghurt | L. acidophilus and B. bifidum | Add extra nutritional and physiological values | Homayouni *et al*., 2012 |
| Bio-yoghurt | L. acidophilus and B. bifidum | Have to retain viability and activity in yoghurt as a probiotic at consumption time. | Dave and shah, 1997 |
| Probiotic milk | Lactobacillus acidophilus | Remained viable in sweet acidophilus milk over 28days at 7°C | Vedamuthu, 2006 |

## 4. APPLICATION OF PROBIOTICS IN DAIRY CATTLE INDUSTRY

### 4.1 Feed intake, digestion and feed conversion efficiency

Probiotic supplementation has been found to increase feed intake and growth rate is known to influence the ruminants is due to improved cellulolytic bacteria in the rumen-fed probiotics fortified diets (Wallace and Newbold, 2003) and their positive effect on ruminal pH, leading to improved fiber degradation and dry matter intake (Tager and Krause, 2011). The increase in growth is often associated with an increase in feed intake (Fiems, 2005). Probiotic strains administered separately, or in combination, significantly improved feed intake, feed conversion rate, daily weight gain and total body weight in sheep, goat and cattle (Stein, *et al*., 2006).

Probiotics improve microbial ecology (Musa, *et al*., 2009), nutrient synthesis and absorption, nutrient bioavailability and stabilized ruminal pH and lactate resulting in better weight gain in farm animals (Oyetayo, 2005; Mountzouris, *et al*., 2007). Probiotics increase activity of intestinal enzymes and digestibility of nutrients(Dhawan and Kaur, 2007). Similarly that use of *Aspergillus oryzae* increase digestibility of dry matter with the production of amylolitic and proteolytic enzymes (Schneitz, 2005).

Probiotics supplemented animals have a beneficial effect on increase in milk production, milk

Solids-Not-Fat and milk protein percentages in dairy cows were associated with the numbers of cellulolytic bacteria, fiber degradation and changes in volatile fatty acid in the rumen (Martin and Nisbet, 2001). The average addition of *S. cerevisiae* to the diet leads to a 3.9% response in milk yield in lactating cattle (Fiems, 2005). When feeding cows with a mixture of *Lactobacillus acidophilus, Lactobacillus casei* and *Enterococcus faecium* increase in milk production (Gomez-Basauri *et al.*, 2001). An increased dry matter intake (2.6 kg/day) and increased milk yield (2.3 kg/day) (Nocek *et al.*, 2003). Dietary supplementation with a combination of *L. acidophilus* NP51 and *Propionibacterium freudenreichii* NP24 (4 ×109 cfu/animal/day) resulted in a 7.6% increase in average daily milk yield in cows (Boyd and Bernard, 2011).

Improvement in productivity of animals due to probiotics can be associated with an increase in digestion and absorption of nutrients. A combination of L. acidophilus (NP52) and P. freudenreichii (NP24) improved the digestibility of crude protein, neutral detergent fiber and acid detergent fiber in lactating Holstein cows resulting in increased milk production per day by 7.6% without increasing dry matter intake (DMI) (Boyd J, *et al*., 2011) and it was suggested that this was due to a change in the rumen microbial ecology. Similarly, supplementation of dairy cows with Probios (containing 2 strains of *Enterococcus faecium*) at the rate of 5 x 109 cfu per day as well as 2 x 109 viable yeast cells per day from 21 days prior to expected calving date through 10 weeks of postpartum, has increased milk yield by 2.3 kg per cow per day, no difference in 3.5% fat corrected milk.

The *Enterococcus faecium* strains were thought to act by producing lactic acid, which supports a rumen microbial population, in enhancing digestion of roughages (such as maize silage and haylage) and increase DMI (Nocek and Kautz, 2006).

**4.2 Growth promotion**

Probiotic strains administered separately, or in combination, significantly improved feed intake, feed conversion rate, daily weight gain and total body weight in sheep, goat and cattle (Casey *et al*., 2007; Stein *et al*., 2006). Probiotics improve microbial ecology (Musa *et al*., 2009), nutrient synthesis and absorption, nutrient bioavailability and stabilized ruminal pH and lactate resulting in better weight gain in farm animals (Mountzouris *et al*., 2007, Oyetayo, 2005). Probiotic supplementation in lambs resulted increased weight gain (Jang *et al*., 2009). Higher weight gain as compared to the control could be due to improved microbial protein synthesis leading to more amino acids supply at post-ruminal level (Erasmus *et al*., 1992) or it might be related to higher consumption and better feed efficiency in the probiotics supplemented group (Antunovic *et al*., 2006). Better weight gain in ruminants might be also due to more cellulolytic activity resulting in improved fiber degradation (Russell and Wilson, 1996) because of reduced activity of more ammonia producing microbes that made the protein available for absorption at the post ruminal level. Bacillus licheniformis and Bacillus subtilis fed cows showed a higher average daily gain and final live weight gain (Kowalski *et al*., 2009).

**4.3 Health Benefits**

4.3.1 Reducing inflammation and irritable bowel syndrome

Probiotics act through the induction of regulatory T-cells that suppress inflammation-inducing effectors cells. Probiotics have the potential characteristics to interact with the mucosal immune system that does not arouse an inflammation inducing innate response, and the consequent induction of master inflammatory cytokines (Amiya, *et al.*, 2011). The non-pathogenical strain E. coli showed to be efficient in the Crohn's disease maintenance therapy. This microorganism was able to adhere to intestinal epithelial cells in addition to its inhibitory effect observed against pathogenic strains isolated from patients with the disease (Boaventura, *et al.*, 2012). Inflammatory bowel diseases (IBD), such as pouchitis and Crohn's disease, as well as (IBS), may be caused or aggravated by alterations in the gut flora including infection (Shanahan, 2000).

**4.3.2 Probiotic and Management of diarrhea.**

One of the main applications of probiotic microorganisms is at preventing or in the treatment of gastrointestinal disturbances (Boaventura, *et al.*, 2012). Many types of diarrheal illness with many different causes disrupt intestinal function. The ability of Probiotics to decrease the incidence or duration of certain diarrheal illnesses is the most substantiated health effect of probiotics. Lactobacillus is safe and effective as a treatment for children with acute infectious diarrhea. Probiotics have also been shown to decrease traveler's diarrhea and recurring colitis due to Clostridium difficile. Consumption of high levels (~ 1010 per day) of certain strain of probiotic may shorten the duration or decrease the incidence of certain diarrheal illnesses (Shinde, 2012). A significant effect was observed in a study carried out with patients who presented diarrhea caused by antibiotics, in which intake of a probiotic drink containing L. casei, L. bulgaricuse and S. thermophilus reduced the incidence of diarrhea (Boaventura, *et al.*, 2012).

**4.3.3. Probiotics in inflammatory bowel disease**

Inflammatory bowel disease (IBD) is a collective term, used for ulcerative colitis (UC), Crohn s disease (CD) and Pouchitis. IBD is an abnormal immune response against luminal antigen of commensal bacteria in genetically predisposed individuals (Sartor, 2004; Fedorak and madsen 2004; Gionchetti *et al*., 2005; Marteau *et al*., 2009). Traditionally known medication used in IBD includes 5-aminosalicylic acid (5ASA) and corticosteroids. Limited clinical trials suggest that selected probiotics species, alone or in combination, can prevent recurrent intestinal inflammation and possibly treat active IBD, with best results in pouchitis, and, to a lesser extent, ulcerative colitis and Crohn s disease (Sartor, 2004).

**4.3.4 Hypercholesterolemia, Allergy and cancer control**

Saturated fat rich diets can increase serum cholesterol rates, which is one of the main risk factor for cardiovascular disease (Vasiljevic and Shah, 2008). The hypocholesterolemic activity of nonpathogenic bacteria through mechanism of hydrolysis of biliar salt (Noriega *et al*., 2006; Parvez *et al*., 2006; Nguyen *et al*., 2007). consumption of probiotic yogurt with *Lactobacillus acidophilus* and *Bifidobacteria* cepas by people with hypercholesterolemia resulted in the reduction of total cholesterol and LDL (Low Density Lipoproteins: these are the Harmful class to human beings) and in the increase of good cholesterol, HDL (High Density Lipoproteins: it is believed that they are able to absorb cholesterol crystals which are deposited in arteries/veins wall, so delaying arteriosclerotic process) in the blood (Baroutkoub *et al*., 2010).

The fight against cancer is one of the biggest challenges faced by humanity so consumption of probiotic-supplemented *Bacillus poly fermenticus* products can prevent and even suppress tumor growth (Ma *et al*., 2010), Probiotic strains of *E. faecium*RM11 and *L. fermentum*RM28 have anti proliferative properties against colon cancer cells, (Thirabunyanon, *et al*., 2009). can be effective in preventing development of liver cancer and other types of cancer caused by environmental factors (ElNezami, *et al*., 2006). The potential utility of probiotic-derived factors in cancer therapy represents a new frontier fatty acids such as butyrate have anti-carcinogenic properties and *Clostridium butyricum* produces high levels of butyrate that induced apoptosis and cytotoxic effect on cancer cells, and may synergistically assist the action of certain chemotherapy drugs, such as camptothecin, to kill cancer cells (Cousins *et al*., 2012).

The administration of *Lactobacillus* GG in pregnant women, nursing mothers and babies in the first months of life was associated with a decrease in the occurrence of topic eczema in children at the end of a year of life (Kalliomäk*i*, *et al*., 2003). It efficacy with *Bifidobacterium* Bb-12 in treatment of atopic eczema(Isolauri *et al*., 2002).The intestinal micro flora is an important constituent of the gut mucosal barrier and in the absence of intestinal micro flora antigen transport are increased (Kaur, *et al*., 2002). Improvement of atopic dermatitis in children after use of *L. rhamnosus* and *L. reuteri*, and children with atopic eczema and allergy to cow's milk responded more effectively to hydrolyzed formula supplement (Rosenfeldt, *et al*., 2003).

**4.3.5 Immuno Stimulation**

Probiotics have biological effect in immunological functionality. The immunological benefits of probiotics can be due to activation of local macrophages and modulation of IgA production locally and systemically, to changes in pro/anti-inflammatory cytokine profiles, or to the modulation of response towards food antigens (Kabeerdoss, *et al*., 2011). The intrinsic properties of lactobacilli to modulate the immune system make them appealing for wellbeing applications. The proposed systems engaged with reinforcing of nonspecific and antigen-specific defense against infection and tumors, adjuvant impact in antigen-particular immune responses, Regulating/affecting Th1/Th2 cells, production of anti-inflammatory cytokines, improving phagocytes action of granulocytes, cytokine discharge in lymphocytes, and increases immunoglobulin-emitting cells in blood in order to scale up antibody production. This is ordinary reactions of probiotics, which are all demonstrative of changes in the immune system. An inflammatory immune response delivered cytokine-actuated monocytes and macrophages, causing the arrival of cytotoxic particles fit for lysine tumor cells

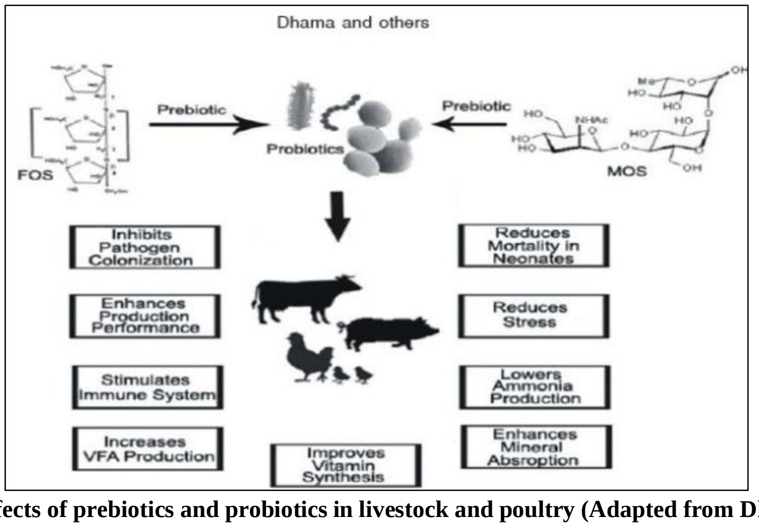


**Fig 1: Beneficial effects of prebiotics and probiotics in livestock and poultry (Adapted from Dhamal, *et al*., 2008)**

## 5. PROBIOTIC MODES OF ACTION

The potential mechanisms by which probiotic agents might exert their protective effect include: inactivation of microbial toxin (Brandao, *et al.*, 2001); antagonism by the production of substance that inhibit or kill the pathogen (Servin, 2004); immunomodulation of the host (Ezendam and Louesen, 2006); stimulating mucus production(Caballero, *et al.*, 2007); competition with the pathogen for adhesion site or nutritional sources (servin and Coconnier, 2003; momose, *et al* 2008) and other mechanisms by which probiotics may exert production is through a recuperation of mucosal barrier function when disturbed (penna, *et al.*, 2008); and trapping pathogens on their surface (martins, *et al.*, 2010).

Mechanisms of probiotic action described to date include adhesion to the intestinal-lumen interface; and colonization(martins and Nisbet, 2001). Enhancement of mucosal barrier function; promotion of innate and adaptive immune response; elaboration of bacteriocins; and modulation of cell kinetics, with further mechanisms of action likely to be indentified (Howarth, 2010). Probiotic administration has the potential to shift the micro biota composition from a pathogenic predominance towards a more beneficial micro biotic ecosystem (Yang, *et al.*, 2012); in addition a new surface mucin-binding protein, identified on the surface of *Bifidobacterium bifidum* species and referred to as “transaldolase”, has been to act as an important colonization factor, potentially assisting adhesion of B. bifidum to the gut(Gonzalez-Rodrigue, *et al*., 2012).

Probiotic adhesion ability is also determined by ph and temperature levels during fermentation (Lukic, *et al.*, 2012); the dietary supplementation with lactobacillus delbrueckii subsp.bulgaricus 8481 for 6 months enhanced the immune response in elderly people, by [i]increasing numbers of circulating natural kill cells and immature T cell subsets (Moro-Garcia, *et al*., 2012); Probiotics may enhance cell diffraction and cytoprotective activities (Lin, *et al.*, 2008). Stimulus to the immune system: some bacteria of the probiotics are directly linked to the stimuli of immune response by increasing antibodies production, activation of macrophage, T-cell proliferation and interferon production (fuller, 2003).

Several probiotics mechanisms of action, relative to inflammatory bowel disease, have been elucidated: (1) competitive exclusion, whereby probiotics compete with microbial pathogens i. e. colonization resistance-occupy ecologic niche, (2) immuno modulation and/or stimulation of an immune response. Alter immune regulation by induce IL-10, transforming growth factor expression and secretion, stimulate secretor immunoglobulin A production, decrease tumor necrosis factor expression; (3) antimicrobial activity and suppression of pathogen growth, inhibit pathogenic enteric bacteria via decrease luminal pH, secrete bacteriocidal proteins, (4) enhancement of barrier activity. Improve epithelial and mucosal barrier function, (Produce short chain fatty acids, including butyrate. Enhance mucus production and increase barrier integrity; and (5) induction of T cell apoptosis, block epithelial binding induction of MUC 2 inhibit epithelial invasion (Rioux and Fedorak, 2006; Marteau *et al*., 2009).

## 6. CONCLUSION AND RECOMMENDATIONS

Microorganisms used as probiotics in animal feed are relatively safe, precautions should be taken to protect animals, humans and the environment from potentially unsafe microorganisms.

Live microorganisms have been used as probiotics for a long time, and as an alternative to antibiotic growth promoters in animal production. Several probiotics have been found effective in improving animal performance and preventing disease and the spread of the enteric pathogens in monogastric and ruminant livestock industries as well as human health. With the advancement in knowledge in gastrointestinal microbial ecology and mode of action of probiotics, the number of probiotic available for use in animal nutrition is increasing. Increasing intensification of animal agriculture with consequent imprudent use of antibiotic growth promoters poses risks to human and animal health in terms of increasing antibiotic resistance in pathogenic microorganisms. The beneficial effects of probiotics in animal production have been related to different modes of action. The improvement in productive performance of livestock's and poultry species fed with probiotics was mostly due to promoted the metabolic processes of digestion and nutrient utilization, exerting enzymatic activities, increasing the passage rate of digestion and deconjugating bile salts and acids. The improvement in metabolic processes were due to improved development of the gut and increased microvillus height which led to the enlargement of the microvillus’ absorptive surface and enabled the optimal utilization of nutrients. The use of probiotics could be a potentially viable solution to address the issue of increasing antibiotic resistance; the effect, mechanism of action and safety of probiotics, to obtain consistent effects and a similar economic benefit to animal growth promoter.

Therefore based on the above conclusion the follows recommendations are suggested:

- ✓ The use of probiotics in the day-to-day medicine in the treatment of gastrointestinal disorders increasing with the discovery of the beneficial effects of these agents.
- ✓ Probiotics should be used as food ingredients, medical foods, and supplements and are in development as drugs with treatment or prophylaxis
- ✓ Probiotics should be used as biotherapeutic and as synergistically assister in the action of certain

chemotherapy drugs, such as camptothecin for kill of cancer cell.

## ACKNOWLEDGMENTS

Above all loving, blessing and kindness and faith of GOD the lord of all creatures, who supplied health, patience, strength, protection, and mind, to understand throughout my life is gratefully appreciated.

Next to this, thanks to my advisor Dr Anwar Nuru for his intellectual guidance, provision of Advice, comments and experience sharing.

Then, I would like to thanks my family and friends for unreserved moral and material support.

## REFERENCES


- Admin. (2010): Lactobacillus acidophilus Side Effects and Health Benefits, 157(4), 598-602
- Ahmed, Z., Wang, Y., Cheng, Q., & Imran, M. (2010). Lactobacillus acidophilus bacteriocin, from production to their application: an overview. African *Journal of Biotechnology*, 9(20), 2843-2850.
- Akhtar, N. S. A. M. (2010): Enhancement of probiotics survival by microencapsulation with alginate and prebiotics. MMG445 Basic Biotech. *Journal*, 6, 13-18.
- Allen, H. K., Levine, U. Y., Looft, T., Bandrick, M., & Casey, T. A. (2013). Treatment, promotion, commotion: Antibiotic alternatives in food-producing animals. *Journal Trends Microbial*, 21, 114-119.
- Amiya, K., Rautray, R., Patra, C., Sardar, K. K., & Sahoo, G. (2011). Potential of Probiotics in Livestock Production, 1, 20-28.
- Anthony, T., Rajesh, T., Kayalvizhi, N., & Gunasekaran, P. (2009): Influence of medium components and fermentation conditions on the production of bacteriocin by Bacillus licheniformis AnBa 9. *Bioresour Technol*, 100, 872–877.
- Antunovic, Z., Speranda, M., Amidzic, D., Seric, V., Steiner, Z., Doma-Cinovic, N., & Boli, F. (2006). Probiotic application in lambs nutrition. *Crimea*, 4, 175-180.
- Arvanitoyannis, I.S., Van Houwelingen-Koukaliaroglou, M. (2005): Functional Foods: a Survey of Health Claims, Pros and Current Legislation. *Journal food science. nutrition*. 45:385-404.
- Avonts, L., Uytven, E. V. and Vuyst, L. De. (2004): Cell growth and bacteriocin production of probiotic Lactobacillus strains in different media. *International*. Dairy. *Journal.* 14: 947-955.
- Baroutkoub, Roushan, Zamir, Mehdi, Razmik Beglarian, Julayi Hassan, Sohrabi Zahra, Mazloomi Seyed Mohammad and Eskandari Mohammad hadi. (2010): Scientific Research and Essays Vol. 5(16), pp. 2206-2209,
- Boaventura, C., Rafael, A., Ana, U., Jacques, N., Luis, G. (2012): The Benefits of Probiotics in Human and Animal Nutrition. NAB Clinical Gastroenterology. International Tech, Europe, 75-100.
- Boyd, J., West, J., Bernard, J. (2011): Effects of the addition of direct-fed microbial and glycerol to the diet of lactating dairy cows on milk yield and apparent efficiency of yield. *Journal of Dairy Science.* Volume 94, P4616-4622,
- Boyington, J.E., Schoster, B., Martin, K.R., Shreffler, J., Callahan, L.F. (2009): Perceptions of individual and community environmental influences on fruit and vegetable intake, North Carolina, 2004. Prevent Chronic Disease, 6:pp, 4.
- Brandão, R., castro, I., bambirra, E., amaral, S., fietto, L., tropia, m.and nicoli, J. (2001): Intracellular signal triggered by cholera toxin in Saccharomyces boulardii and saccharomyces cerevisiae. *Journal Applied and environmental Microbiology*, vol. 64, no. 2, pp. 564-568.
- Cardarelli, H.R., Saad, S.M.I., Gibson, GR.(2007): Functional petit-suisse cheese: Measure of the prebiotic effect. Anaerobe, 13(5-6):200–207
- Casarotti, S. N., Monteiro, D. A., Moretti, M. M. S., & Penna, A. L. B. (2014): Influence of the combination of probiotic cultures during fermentation and storage of fermented milk. Food Research International, 59, 67-75.
- Casas, IA., Dobrogosz, W.J. (2000): Validation of the probiotic concept: LAB broad spectrum protection against disease in humans and animals. *Journal Microbial. E.coli.* Health Disease,12:247285.
- Casey, P.G., Gardiner, GE., Casey, G., Bradshaw, B., Lawlor, PG., Lynch, PB., Leonard, FC., Stanton, C., Ross, RR., Fitzgerald, GF., Colin, H .(2007): A five-strain probiotic combination reduces pathogen shedding and alleviates disease signs in pigs challenged with Salmonella enteric Serovar typhimurium. Appl. Environ. Microbial, 73:1858-1863.
- Chau, C.F., Wu, SH, Yen, GC. (2007): The Development of Regulations for Food Nanotechnology. *Journal Trends food science. technology*, 18:269-280.
- Cousin, F.J., Jouan-Lanhouet, S., Dimanche-Boitrel, M.T., Corcos, L., Jan, G. (2012): Milk fermented by Propionate bacterium induces apoptosis of human gastric cancer cells. *Journal*,7: 92.
- Dave, R., Shah, N.P. (1997): Viability of probiotic bacteria in yoghurt made from commercial starter cultures. *International Dairy Journal*,7(1):31–41.
- De. Keersmaecker, SC., Verhoeven, TL., Desair, J., Vanderleyden,j., Nagy, I.(2006): Strong antimicrobial activity of Lactobacillus rhssamnosus GG against Salmonella typhimurium is due to accumulation of lactic acid. FEMS Microbial Letts, 259: 89-96.

- Dhamal, k., Mahendran, S. Tomar and R. Chauhan. (2008): Beneficial Effects of Probiotics and Prebiotics in Livestock and Poultry: *Journal of Applied livestock and Poultry Research,* Vol. 9 : 1-12.
- Dhawan, S., Kaur, J. (2007): Microbial mannanases: an overview of production and applications. Critical Reviews in Biotechnology,27:197-216.
- Divya, P. (2016): Benefits of probiotics in oral cavity A detailed review. Annals of International Medical and Dental Research, 2(5):1-8.
- Dunnel, C., O'Mahony, L., Murphy, L., O'Halloran, S., Feeney, M., Flynn, S., Fitzgerald, G., Daly, C. (2004): Probiotics; from myth to reality-Demonstration of functionality in animal models of disease and in human clinical trials. *Journal Antonia Van Leeuwenhoek,*76:279-292.
- Eizaguirre, I., Urkia, NG., Asensio, AB., Zubillaga, I., Zubillaga, P., Vidales. C.(2002): Probiotic supplementation reduces the risk of bacterial translocation in experimental short bowel syndrome .*Journal Pediatric Surgery*, 37: 699-702.
- El-Nezami, H., Polychronaki, N., Ma, J., Zhu, H., Ling, W., Salminen, (2006): Probiotic supplementation reduces a biomarker for increased risk of liver cancer in young men from Southern China. *The American Journal of Clinical Nutrition*, Vol. 83, pp. 1199–203.
- Erasmus, L.J., Botha, P.M., Kistner, A. (1992): Effect of yeast culture supplement on production, rumen fermentation and duodenal nitrogen flow in dairy cows. *Journal* of *Dairy Science,* 75:3056-3065.
- Ernas, M., & Karagozlu, C. (2003): Probiotic properties of Lactobacillus casei. *Journal of Food*, 3.64 -69.
- Ezendam, j. and van loveren, h. (2006): Probiotics immuno modulation and evaluation of Safety and efficacy. *journal Nutrition reviews, vol*. 64, pp. 1-14
- Facklam, R. (2002): What happened to the streptococci: Overview of taxonomic and nomenclature changes. Clinical Microbiology Reviews, 15(4), 613–630.
- FAO/WHO. (2001) :Health and Nutritional Properties of Probiotics in Food including Powder Milk with Live Lactic Acid Bacteria. Cordoba, Argentina: Food and Agriculture Organization of the United Nations and World Health Organization Expert Consultation Report.
- Fedorak, R.N. and Madsen, K.L. (2004): Probiotics and the Management of Inflammatory Bowel Disease. *Inflammatory Bowel Disease*.10 (3): 286-299
- Feng, Y. Z. He, S. L. Ong, J. Hu, Z. Zhang, and W. J. Ng. (2003): Optimization of agitation, aeration and temperature conditions for maximum β-mannanase production. Enzyme. Microbial. Technol. 32:282 – 289.
- Fiems, LO. (2005): The use of yeast in practical diets for ruminants. In: Microorganisms and enzyme preparations in animal nutrition Directorate-General for Agriculture, Brussels, pp. 159-173.
- Fontana, L., M. Bermudez-Brito, J., Plaza-Diaz, S., Munoz-Quezada, and A. Gil. (2013): Sources, isolation, characterization and evaluation of probiotics. *British Journal of Nutrition,*109:35 – 50
- Food and Agricultural Organization and World Health Organization, (2001): Health and nutritional properties of probiotics in food including powder milk with live lactic acid bacteria. United Nations.http://isappscience.org/wp-content/uploads/2015/12/FAO-WHO2001-Probiotics-Report.pdf
- Fuller, R. (1992): Chapter one: History and development of probiotics. In: R. Fuller. Probiotics the scientific basis, London: Chapman & Hall. Springer, Netherlands. p. 1 – 7.
- Fuller, R. (2003): Problems and prospects. In probiotics *Journal scientific basis, Chapman and hall, London.*V0l 45: Pp. 377-386.
- Gao, X.-Y., Zhi, X.-Y., Li, H.-W., Klenk, H.-P., & Li, W.-J. (2014): Comparative genomics of the bacterial genus streptococcus illuminates evolutionary implications of species groups. Plops ONE, 9(6), 101-229.
- Ghani, M., A. Ansari, A. Aman, R. R. Zohra, N. N. Siddiqui, and S. A. U. Qader. (2013): Isolation and characterization of different strains of Bacillus licheniformis for the production of commercially significant enzymes. Pakistan. *Journal of Pharmaceutical Sciences,* 26(4): 691 – 697.
- Gibson, G. R., and M. B., Roberfroid. (1995): Dietary modulation of the human colonic micro biota: introducing the concept of prebiotics. *Journal Nutrition*. 125(6):1401 – 1410
- Gilliland, S. E. (1990): Health and nutritional benefits from lactic acid bacteria. FEMS Microbial. Review. 87: 175 – 188.
- Gilliland, S. E., Reilly, S. S. Kim, G. B. and Kim, H. S. (2002): Viability during storage of selected probiotic lactobacilli and bifidobacteria in a yoghurt-like product. *Journal. Food. Science*. 67: 3091-3095.
- Gionchetti, P., Lammers, K. M., Rizzello, F. and Campieri, M. (2005): Probiotics and barrier function in colitis, Gut. 54(7): 898- 900.
- Gomez-Basauri, J., de Ordanza, MB., Siciliano-Jones, J. (2001): Intake and milk production of dairy cows fed lactic acid bacteria and manna oligosaccharide. *Journal. Dairy Science.*84:283.
- Gonzalez-Rodrigue, Sanchez, B., Ruiz, (2012): Role of extracellular transaldolase from Bifidobacterium in mucin adhesion and aggregation. *Journal Applied. Environmental. Microbial* 78, 3992–3998.
- Guarner, F., Aamir, G., Khan, JG., Ram, E., Alfred, G. (2008): Probiotics and probiotics World.

Gastroenterology Organism. Practical. Guideline, 2:1-22.
- Guarner, F., Malagelada, J.R. (2003): Gut flora in health and disease. *Journal Lancet* Vol 361, 512–519
- Guldas, M., & Irkin, R. (2010): Influence of Spiraling platen sis powder on the micro flora of yoghurt and acidophilus milk. Mljekarstvo, 60(4), 237-243.
- Hand, T.W., Dos Santos, L.M., Bouladoux, N.,Molloy, (2012): Acute gastrointestinal infection induces long-lived micro biota-specific T cell responses. *Journal clinical Science*, 337, 1553–1556.
- Hmidet, N., N. E. Ali, A. Hadder, S. Kanoun, S. K. Alya, and M. Nasri. (2009): Alkaline proteases and thermo stable α-amylase co-produced by Bacillus licheniformis NH1: characterization and potential applications as detergent additive, Biochemical. Engineer Journal, 47: 71 – 79.
- Holzapfel, W. P., Haberer, R., Geisen, J., Björkroth, and U. Schillinger (2001): "Taxonomy and important features of probiotic microorganisms in food and nutrition," American *Journal of Clinical Nutrition*,73:365-373
- Homayouni, A., Alizadeh, M., Alikhah H. (2012): Functional dairy probiotic food development: trends, concepts, and products, Everson Cid Rigobelo editors. Immunology and Microbiology, Probiotics, p 200-207
- Homayouni, A., Azizi, A., Ehsani MR. (2008): Growth and survival of some probiotic strains in simulated ice cream conditions. *Journal of Applied* Sciences, 8(2):379–380
- Howarth, G.S. (2010): Probiotic-derived: Probiotaceuticals. *Journal. animal Nutrition*,140, 229–230.
- Isolauri, E., Rautava S., Kalliomaki, M. (2002): Role of pro-biotics in food hypersensitivity. *Journal Current Opinion in Immunological Clinical Allergy*,2:263-271.
- Jang, D., Oh. Y., Kyong, Piao, H., Guo Choi, L., Bong Yun, H., Hyeon Kim, J., Yong, Y. (2009): Evaluation of Probiotics as an Alternative to Antibiotic on Growth Performance, Nutrient Digestibility, Occurrence of Diarrhea and Immune Response in Weaning Pigs. *Journal. Animal. Science. Tech*, 51:751-759.
- Kabeerdoss, J., Devi, RS., Mary, RR. (2011): Effect of yoghurt containing Bifidobacterium lactis Bb12 on fecal excretion of secretory immunoglobulin A and human beta-defense 2 in healthy adult volunteers. Nutrient *Journal*. 10:138
- Kalavathy R, Abdullah N, Jalaludin S, and Ho YW (2003): Effects of Lactobacillus Cultures on Growth Performance, Abdominal Fat Deposition, Serum Lipids and Weight of Organs of Broiler Chickens. *Journal Broiler. poultry. science,* 44, 139-144.
- Kalliomaki, M., Salminen, S., Arvilommi, H., Kero, P., Koskinen, P. and Isolauri, E. (2001): Probiotics in primary prevention of a tropic disease: a randomized placebo controlled trial. Lancet: *Journal Biomedical*.357: 1076–1079
- Kaur, IP., Chopra K, Saini A (2002): Probiotic pharmaceutics applied. *Journal Pharmaceutics Science*15: 1–9.
- Kayalvizhi, N., and P. Gunasekaran. (2008): Production and characterization of a low molecular-weight bacteriocin from Bacillus licheniformis MKU3. Lett. Applied. Microbial, 47: 600 –607.
- Kilic, S. (2008): Lactic acid bacteria in dairy industry. Born ova: Edge University Press. Agriculture Faculty Publications, pp, 542.
- Kowalski, Z.M., Gorka, P., Schlagheck, A., Jagusiak, W., Micek, P., Strzetelski, J. (2009): Performance of Holstein calves fed milk-replacer and starter mixture supplemented with probiotic feed additive. *Journal. Animal. Feed Science*. 18:399-411.
- Krehbiel CR, Rust SR, Zhang G, & Gilliland SE (2003): Bacterial Direct-fed Microbial in Ruminant Diets: Performance Response and Mode of Action. *Journal. animal. science*. 81. Pp 120.
- Lin, P. W., Nasr, T. R., Kumar, A., Neish, A. S. (2008): The probiotic LAB intestinal host defense by regulating apoptosis and promoting responses in the gut. *Journal Pediatric. Research*. 64, 511–16.
- Lourens-Hattingh, A. & Viljoen, B. C. (2001). Yogurt as a probiotic carrier food. International Dairy *Journa*l, 11 (1-2) 1–17.
- Lukic, J., Strahinic, I., Jovcic, B., Filipic, B., Topisirovic, L., Kojic, M., Begovic, J. (2012): Different roles of lactococcal aggregation factor and mucin binding protein in adhesion to gastrointestinal mucosa. *Journal*, 78(22*):*7993-8000.
- Ma, E., Choi, Y., Choi, J., Rhee, S., & EunokIm. (2010): the anticancer effect of probiotic Bacillus on human colon cancer cells. *Inhibition International Journal of Cancer*, Vol. 127, pp. 780–790.
- Mangell, P., Nejdfors, P., Wang, M., Ahrne, S., Westrom, B., & Thorlacius, H. (2002). Lactobacillus plant arum 299v inhibits Escherichia coli induced intestinal permeability. Dig Disorder and Science, 47: 511-6.
- Manichanh, C., Borruel, N., Casellas, F., Guarner, F. (2012): The gut micro biota in Inflammatory Bowl Disease. Nature. *Journal Review. Gastroenterology. Hepatic*, 9: 599–608.
- Marteau, P., Sokol, H., Dray, X. and Seksik, P. (2009): Bacteriotherapy for inflammatory bowel disease: therapeutic tool and/or pharmacological vectors?.Gastroenterology .Clinical. Biology. 33 (3): 228-234.
- Martin SA, Nisbet D.J. (2001): Effects of *Aspergillus* fermentation extract on fermentation of amino acids and starch by mixed ruminal microbial. *Journal Animal. Science.*68:2142-2149.

- Martins, F., elian, S., vieira, A., Tiago, F., martins, (2011): Oral Treatment with saccharomyces cerevisiae modulates immune Response *journal of medical Microbiology*, vol. 301, no. 4, pp. 359-364.
- McNulty, C.A., (2005): Wise, R. Gastric micro flora. *Journal. Broiler. Medical*. 291, 367–368.
- Michail, S., Sylvester, F., Fuchs, G. and Issenman, R. (2006): North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) with focuson children. *Journal of Pediatric Gastroenterology and Nutrition*, Vol. 43, pp.550-557.
- Momose, y., hirayama, k. and Itoh, k. (2008): competition for praline between indigenous Escherichia coli associated with infant Intestinal micro biota and its contribution to the colonization resistance against E.Coli o157:h7. *Journal of microbiology*, vol. 94, pp. 165-171.
- Morelli, L., and L. Capurso. (2012): FAO/WHO guidelines on probiotics:10 years later. *Journal. Clinical. Gastroenterology. Supp*.137(3*)*:850–853
- Moro-Garcia, M.A., Alonso-Arias, R., Baltadjieva, M., Fernandez Benitez, C., Fernandez Barrial, M.A. (2012): Oral supplementation with Lactobacillus delbrueckii subsp. *bulgaricus* 8481 enhances systemic immunity in elderly subjects. *Journal Age Medine:*10. Pp. 11357-11012.
- Mountzouris, KC., Tsistsikos, P., Kalamara, E., Nitsh, S., Schatzmayr, G .and Fegeros, K. (2007): Evaluation of the efficacy of a probiotic containing Lactobacillus, Bifidobacterium, Enterococcus, and Pediococcus strains in promoting broiler performance and modulating cecal micro flora composition and metabolic activities. Poultry. Science. 86:309-317.
- Musa, HH., We, SL., Zhu, CH., Ser,i HI., Zhu. GQ. (2009): The potential benefits of probiotics in animal production and health. *Journal.Animal.Veternary. Advance*,8:313-321.
- Nguyen, T., Kang, J. & Lee, M. (2007): potential-probiotic bacterium with cholesterol-lowering effects. *International Journal of Food microbiology* vol. 113, pp. 358-361.
- Nighswonger, B. D., Brashears, M. M, and Gilliland, S. E. (1996): Viability of Lactobacillus acidophilus and Lactobacillus casei in fermented milk products during refrigerated storage. *Journal. Dairy Science*., 79: 212-219.
- Nocek, JE., Kautz, WP., Leedle, JAZ, Block, E .(2003): Direct-fed microbial supplementation on the performance of dairy cattle during the transition period. *Journal. Dairy Science* 86:331-335.
- Nocek, J., Kautz, W. (2006): Direct-fed microbial supplementation on ruminal digestion, health, and performance of pre-and postpartum dairy cattle. *Journal. Dairy Science*, 89(1):260-266.
- Noriega, L., Cuevas, I., Margolles, A. & Reyes-Gavilán, C. (2006): Deconjugation and bile salts hydrolase activity: *International dairy Journal*, Vol.16, pp. 850–855.
- Oyetayo, FL. (2005): Potential of probiotics as biotherapeutic agents targeting the innate immune system. *Africa. Journal. Biotechnology*. 4:123-127.
- Ozbas, Z. Y. (2004): Bifidobacteria and Lactobacillus: behavior, using for dietary purposes, beneficial effects and applications of products. *Journal of Food*, 18(4), 247-251.
- Parvez, S., Kim, H., Lee, H. & Kim, D. (2006): Bile salt hydrolase and cholesterol removal effect *World Journal of Microbiology &Biotechnology*, Vol. 22, pp. 455-459.
- Pattnaik, P., J. K. Kaushik, S. Grover, and V. K. Batish. (2001): Purification and charecteriztion of a bacteriocin-like compound (Lichenin) produced an aerobically by Bacillus licheniformis isolated from water buffalo. *Journal. Appl. Microbial*. 91(4): 636 – 645.
- Penna, F., peret, L., vieira, L. & nicoli, J. (2008): Probiotics and mucosal barrier in children. *Journal.Current opinion in clinical nutrition and metabolic care*, vol. 11: 640-644.
- Rioux, K.P. and Fedorak, R.N. (2006): Probiotics in the treatment of inflammatory bowel disease. *Journal. Clinical. Gastroenterology*. 40(3):260-300.
- Rosenfeldt, V., Benfeldt, E., Nielsen, S., Michaelsen, K., Jeppesen, D., Valerius, N. and Paerregaar, A. (2003): Effect of probiotic Lactobacillus strains in children with atopic dermatitis. *Journal of Allergy and Clinical Immunology*, Vol. 111, No. 2, pp. 389-95.
- Rudin, A., Lundell, A.C. (2012): B cell memory and gut bacterial colonization. Gut Microbes 3, 474–475.
- Russell, J.B., Wilson, D.B. (1996): Why are ruminal cellulolytic bacteria unable to digest cellulose at low pH *Journal* of *Dairy Science*. 79:1503-1510.
- Sanders, M. E. (2000): Considerations for use of probiotic bacteria to modulate human health. *Journal. Nutrition*. 130: 384-390.
- Sartor, R.B. (2004): Therapeutic manipulation of the enteric micro flora in Inflammatory Bowel Diseases: Antibiotics, Probiotics, and Prebiotics. Gastroenterology 126:1620 -1633.
- Schneitz, C. (2005): Competitive exclusion in poultry research. *Journal. Food Control,*16: 657-667.
- Selle, K., & Klaenhammer, T. R. (2013): Genomic and phenotypic evidence for probiotic influences of Lactobacillus gasseri on human health. FEMS Microbiology Reviews,37(6),915-935.
- Servin, a. (2004): antagonistic activities of lactobacilli and bifidobacteria against microbi.65:19-23.
- Servin, L. and Coconnier, M. (2003): Adhesion of probiotic strains to the intestinal mucosa and interaction with pathogens. *Journal. Research Clinical Gastroenterology*, Vol. 17, pp.74

- Shanahan, F. (2000): Probiotics and inflammatory bowel disease, 6:107-15.
- Shinde, P.B. (2012): Probiotic An Overview For Selection And Evaluation. International *Journal Pharmaceutical science*,4: 14-50.
- Sozer, N., Kokini, J.L. (2009): Nanotechnology and its Applications in the Food Sector. Trends in Biotechnology, 27:82-89.
- Stein, DR., Allen, DT., Perry, EB., Mertz, K., Jones, D.(2006): Effects of feeding *propionate bacteria* to dairy cows on milk yield, milk components, and reproduction. *Journal. Dairy Science* 89:111-125.
- Sullivan, A., Nord, C.(2005): Probiotics and gastrointestinal diseases. *Journal International Medicine* 257: 78-92.
- Tager, L.R. and Krause, K.M. (2011): Effects of essential oils on rumen fermentation, milk production, and feeding behavior in lactating dairy cows. Journal of Dairy Science, 95: 2455-2464.
- Tamime, A. Y., & Marshall, V. M. E. (1997): Microbiology and technology of fermented milks .In B. A. Law (Ed.), Microbiology and biochemistry of cheese and fermented milk, 2nd ed., pp.57-152.
- Timmerman, H. M., Mulder, L., Everts, H., Hartemink, R., Rombouts, F. M., & Beynen A. C. (2005): Health and growth of veal calves fed milk replacers with probiotics. *Journal. Dairy Science*.88:2154-2165.
- Tsen, J. H., Lin, Y. P., & King, V. A. (2004): Fermentation of banana media by using k- carrageen an immobilized Lactobacillus acidophilus. *International*. *Journal*. Food Microbial, 91: 215–20.
- Uyeno, Y., Shigemori, S., Shimosato, T. (2015): Effect of Probiotics/ Prebiotics on Cattle Health and Productivity: *Journal review. Microbial. Environ*, 30, 126-132.
- Uzun, Y. S. (2006): A study on viability of Lactobacillus acidophilus La-5 and Bifidobacterium bifidum BB-12 against scalding and dry salting during caser cheese making (Master's thesis). Harran University, Şanlurfa, 3(1*):*48–55
- Uzuner, E. (2012): Use of rice milk in probiotic yogurt production. Born ova: Edge University. Scientific Research Projects 2009-ZRF009.
- Vasiljevic, T., & Shah, N. (2008). Probiotics— from Metchnikoff to bioactive. *International Dairy Journal*, 18, 714–728.
- Vedamuthu, E. R. (2006). Other fermented and culture-containing milks. In: RC Chandan. editors. Manufacturing Yogurt and Fermented Milks. UK: Blackwell Publishing. p. 295–308
- Vila, B., Esteve-Garcia, E., & Brufau, J. (2010). Probiotic microorganism: 100 years of innovation and efficacy; modes of action. *Poultry Sciences*, 65, 10-17
- Wallace, R.J., Newbold, C.J. (2003): Rumen fermentation and its manipulation: The development of yeast culture as feed additives. In: *Biotechnology in the Feed Industry, Lyons, T.P*. (Ed.), pp. 173-192.
- Wu, R., Wang, W., Yu, D., Zhang, W., Li, Y., Sun, Z., Wu, J., Meng, H., & Zhang, H. (2009):Proteomics analysis of Lactobacillus casei Zhang, a new probiotic bacterium isolated from traditional home-made Koumiss in Inner Mongolia of China. Molecular and Cellular Protecteomics, 8(10), 2321-2338.
- Yang, C. M., Cao, G. T., Ferket, P. R., Liu, T. T., Zhou, L., Zhang, L., Xiao, Y. P., Chen, A. G. (2012). Effects of probiotic, Clostridium butyricum, on growth performance, immune function, and cecal micro flora in broiler chickens. *Journal. Poultry. Science.* 91, 2121–2129.
- Zhang, J., He, M., & He, Z. (2002). Operational and storage stability of neutral βmannanase from Bacillus licheniformis. *Biotechnology Letts*, 24, 1611–1613.


**Cite this Article:** Chala Ahmed Mumme & Mohammed Abrahim (2024). Review on Probiotic and Health Benefit in Dairy Cattle. *EAS J Vet Med Sci*, *6*(2), 32-43.