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# Beneficial Microorganisms in Animal Production and environment

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## ABSTRACT

The aim of this review was to demonstrate beneficial microorganisms in different areas of animal production, including large animals, poultry and fish. Microflora or beneficial microorganisms are well defined by several authors as "effective dietary supplement" which have beneficial effect on host's health. Comparative studies were carried out on several species of animals administered " Beneficial Microorganisms (BM)" active beneficial microorganism-had revealed a bundle of merits and advantages for the host as compared with the flora normally exist in the gastro-intestinal tract. The benefits include food supplementation as well as the protection of the lost against pathologic agent. Moreover, BM act as a biological factor in modulation microbiome of the digestive system as well as the adjustment of the reaction with the environment and to create a useful development of immunity response. The use of effective organisms is a useful strategy that has a clear impact on improvement of growth and increase feed conversion efficiency and body weight ratio and health parameters in animals.

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## INTRODUCTION

Recently, providing safe nourishment is a constant and increasing order from consumers. Therefore, modern supplements have been used to increase animal's production with no reverse consequence on human health **(Higa, 1993).** For a long time, medical drugs have been utilized in animal breeding as curative tools to handle exposure to microbes that decline animal production and give rise to diseases. However, according to the unfavorable outcomes of antibiotics on animals' health and human, because it remains in the meat and other products, the evolution of bacterial impedance, and growing concern in finding alternatives to antibiotics becomes a requirement **(Edens, 2003).** Beneficial microorganisms are treated as live helpful microbial feed and water additives that have a worthy impact on gut microflora equilibrium **(Kabir *et al.*, 2005)**, immunity **(Nayebpor *et al.*, 2007 and Apata, 2008)**, and serum lipids **(Ignatova *et al.*, 2009).** Furthermore, **Awad *et al.*, (2009)** demonstrated that BM improve feed efficiency, performance, manage the animal's intestines, also, decrease the feces odor.

The **Danmap (1997**) revealed that using lower doses of antibiotics in animal ration leads to rising resistance in zoonotic creatures. Over the world, the discussion has cover this information, but The result of the research has led to a novel alteration in the method of animal feeding at present. In the year1999, the European countries prohibit the employment of several antibiotics responsible for growth-promoting in poultry rations. Later in the year 2006, the EU formally stopped the utilization of antibiotics as growth-assistance material in the feed of all animal types. Curative use of suitable antibiotics was permitted through medication only by specialists. So, the using beneficial microorganisms in the poultry enterprises is an option for animal growth boosters **(Baiao and Lara, 2005).**

### Definition of Beneficial Microorganisms:

Over time the term beneficial microorganisms have been utilized in different forms. BM name primarily described materials created by a protozoan **(Lilly and Stillwell, 1965)**, however afterward employed to characterize animal feed complements that had a beneficial impact on animal performance by activating their Digestive flora **(Parker, 1974). Higa, (1993)** gives the term BM to "a culture of defined living beneficial microbes that are given to the livestock to assure the effectiveness of gut populations of beneficial microorganisms. A Live beneficial microorganisms feed addition has dramatically affected animals' performance by supporting the intestinal microbial equilibrium. The United States National Food Component Association offered probiotics as the origin of live microorganisms formed from bacteria, yeast, and fungi **(Miles and Bootwalla, 1991).** The United States National Food Component Association offered probiotics as the origin of live microorganisms formed of bacteria, yeast, and fungi **(Miles and Bootwalla, 1991).** Beneficial Microorganisms was developed in Japan 30 years ago by Beneficial Microorganisms Research organization BMRO Japanese institute Kyushu University - Okinawa - Japan and is now a global technology with an enormous following around the world, formative in a liquid mixed culture made up of multiple beneficial microorganisms, which are divided into anaerobic and oxybiotic.

BM is composed of five groups of micro-organisms: Lactic acid bacteria, Yeasts, Actinomycetes, Photosynthetic bacteria, and Fungi, with more than 80 strains (lactic acid bacilli(LAB), *Lac. Plantarum*; *Lac. casei*; *S. lactis*; photosynthetic bacteria: *R. sphaeroides; R. palustris*; yeast: *saccharomyces cerevisiae; Candida utilis torula; Pichia Jadinii;* Actinomycestes: *Streptomyces albus; S. griseus* and fermenting fungi: *Mucor hiemalis*; *Aspergillus oryzae* which has been carefully examined and assured guarantee for humans and animals, they are the basis for all multi-Kraft products, which are created by fermentation. the fermentation process of organic substances (such as herbs, sugar cane molasses) is happened by enzymes or microorganisms. The addition of microorganisms enables organic substances to be changed, which would be very difficult or even impossible to produce chemically **(Higa, 1993).**

The strength of BM is that it is a diverse combination of microbes, which will give it flexibility in terms of the vast scope of applications that it can use in and working by getting the natural processes as nature intended. The basic concept to understanding how microbes work is that they work as teams and rely on each other to perform individually to be effective as a combination **(Kalbasiet *et al.*, 2006).**

After entering animals' bodies as a feedstuff, these microbes can proliferate rapidly, they limit the development of other pathogenic microbes and create a natural microbial population within the gut to provide vital vitamins for the animal body, produce nutrients and stop the aggression of the harmful microbes **(Li Wei-Jionge *et al.*, 1994); Kengo and Hui-lian 2000).** More accurately, the probiotics are nonpathogenic and nontoxic live microorganisms that when have been given through the digestive system are beneficial to animal health (Guillot, 1998). Currently defined by **FAO/WHO (2001),** probiotics are living microorganisms that if given in appropriate quantities award health to the animal body.

## General description

Lactic acid bacteria, phototrophic bacteria, and yeast, that formed the BM can ferment organic materials. Manure fermented and decomposed by BM is broken down in the soil and absorbed by plants. Also, BM includes plenty of elements to boost plant growth. In an aquatic environment, BM will decompose the sludge by fermentation and ease for other microorganisms and protozoans to live on the decomposition products **(Jin *et al.*, 1996)**. BM possesses metabolites generated by several microorganisms that stimulate other microorganisms which earlier located in the soil and assist in diversifying the microbiome **(Nahanshon *et al.*, 1996**; **Walker, 2000).** Microorganisms shape the foundation of the environmental pyramid, so when microorganisms in soil are varied, the ecosystem in the ground could be improved in different ways, such as an increase in the number of earthworms. A healthy and diverse ecosystem will aid shape rich soil (Kalbasi *et al.,* 2006).

## Mode of action of BM

### 1. Keeping natural intestinal microflora (Kizerwelter-swide and Binek, 2009) through:

#### 1.1. Competitive exception

Lactobacillus has the inadequate ability to stick to the inner surface of the intestine and differs among varieties and strains.

#### 1.2. Hostile vigor

Lactobacillus's Hostile effectiveness versus various pathogenic microorganisms has correlated to the secretion of bacterial materials such as bacteriocins, hydrogen peroxides, and organic acids.

### 2. Changing metabolic rate by rising digestive enzymes action and reducing pathogenic microbe's enzymes efficiency (Yoon *et al.,* 2004) through

#### 2.1.Digestive enzyme efficiency

Lactobacillus makes up the bulk of beneficial microorganisms. The BM has shown the ability of digestive enzymes production in vitro, and these enzymes may raise the concentration of the animal intestinal enzymes **(Szylit *et al.*, 1980),** such as amylase, lipolytic, and proteolytic **(Jin *et al.*, 1996).**

#### 2.2. Enzymatic efficiency

**Goldin and Gordbach (1977)** revealed that the effectiveness of nitroreductase, 3-glucuronidase, and azoreductase in the intestine of rats, could be decreased by feeding complementary of *L. acidophilus*, similar effects obtained in humans. A remarkable depression in glucuronidase was noticed in chickens given 30% yogurt in the water **(Coloe *et al.*, 1984).**

### 2.3. Ammonia emission

Reducing ammonia emission and urea's action can be useful for animal health and improving performance, as ammonia can induce harm to the superficies of cells. **Chiang and Hsien (1995)** assured that probiotics comprising *L. acidophilus, S. faecium,* and *B. subtilis* lower the ammonia emission from broiler feces.

### 3. Feed consumption and digestion improvement

The gut flora of animals has a remarkable turn in the break down and absorption of feed. It takes part **(Awad *et al*., 2006)** in the metabolism of the dietary components like proteins, carbohydrates, lipids, minerals, and vitamins synthesis. **Nahanshon *et al.* (1996)** mentioned that the supplement of BM to corn, soybean, and wheat diets prompted feed consumption and raised fat, nitrogen, phosphorus, calcium, manganese, and copper, detention in layer chicken.

### 4. Activation of the immune system. (Brisbin *et al.,* 2008)

The immune response happened due to of exposure digestive canal to different antigens type, so the dietary protein is necessary for keeping animals versus enteric diseases **(Perdigon *et al.*, 1995). Dunhan *et al.*, 1993)** indicated that chicken handled with *L. reuteri* showed deeper crypts and longer ileal villi, this is a reaction linked with improved T cells mission and increasing formation of anti-Salmonella IgM antibodies. **Nahanshon *et al.*, (1994)** revealed activation of the mucosal immune system that reacted to antigenic stimuli by immunoglobulin (IgA) secretion.

## Beneficial application of BM in Animal production

### 1. Animal Husbandry

The BM was efficiently used to reduce odor, decrease disease incidence, maintain livestock health, and Reduce ammonia emissions due to animals overcrowding **(Dahal, 2006).** BM decrease, the decomposition processes prevent the buildup of odors. BM can improve animal enclosure climate.

### The yields of BM in animal welfare

The advantage of employing BM products in animal welfare is that the different microorganisms found in BM and metabolites created by these microorganisms enhance the microflora in shelters and animals' bodies. Splashing BM inside the brans will raise the animal's hygiene. Also, the addition of BM into their drinking water to repair the intestinal environment of animals will maintain them in good health. **(Dahal, 2006).**

### 2. Advantages of using BM products in animal breeding

### 2.1. Amelioration of malodors

BM could reduce accumulated odors from trimethylamine and ammonia of alkaline nature, while organic acids included in BM of acidic qualities, sprinkling BM will equalize them, and the aroma will have repressed quickly. Spraying BM orderly will settle beneficial bacteria, which will put down the increase of harmful bacteria. Also, adding BM to animals' feed will ameliorate their internal microbes and decrease the smell emissions from their feces **(Dahal, 2006).**

### 2.2. Reduction dosages of antiseptics and antibiotics

Spraying BM on shelter ground, besides adding BM to diet, and drinking water for livestock will enhance the environment of the shelter, as well as the intestinal flora of the animals, and protect the soundness of the entire process. Therefore, BM will minimize the usage of antiseptics and antibiotics to prevent diseases **(Safalaoh and Smith 2001).**

### 2.3. Stress Reduction

Animal health is affected by stress, which leads to suppressing maturing, increasing morbidity rates, and generating a decrease in economic output. Spraying BM inside shelters can improve the animal's environment, by minimizing orders and reducing the digit of insects **(Dahal 2006).**

### 2.4. BM for increased productivity

Usage of BM orderly for livestock welfare will enhance animals' health, reduce the diseases happening and raise productivity. In animals breeding, the infection with diarrhea will decline growth rates and is one of the reasons for animal's mortality. Employing BM will adjust the intestinal environment and mend diarrhea. also, upgrade the digestion efficiency and improve feed conversion ratio (FCR), thereby raising animal's production **(Jwher, *et al.*, 2013** and **Dahal, 2006).**

### 2.5. Improved animal products quality (meat, eggs, milk)

As mentioned earlier, BM will improve malodor, in addition to the intestinal ambiance, thereby sustaining animal health and reducing the chance of disease incidence. Consequently, fat quality will get better, no abnormal meat smell, the products will remain fresh for a more extended time and enhance the savor and products quality of livestock. Also, it reduces the employment of antibiotics and vaccines, thus supporting securer production from the viewpoint of both clients and producers (**Ouwehand, 1998; Dahal, 2006). Mohammad *et al.*, 2018**, revealed that supplementing Lactobacillus spp. lead to improving the milk production, milk fat contents, health of dairy cows, lowering the production wages, and reducing odor inside animals' houses. The economic estimation for utilizing BM in dairy farms implies that BM is an inexpensive product and can achieve profitably on dairy farms.

In another investigation done by **Deribe *et al.*, (2017)** on the impact of the supplement of beneficial microorganisms (BM) on lambs growth fed on minimum protein rate, the researcher gained lambs of heavier weight. The productivity evaluated in this trial is valuable for the livelihood of small-scale breeders. So, 5% BM could have applied as a financially profitable percentage for lambs fed on a low protein ratio under smallholder breeders' management conditions. In another work carried on goats in Nepal, it was concluded that the use of BM had an essential role in improving the quality of feed, which in turn reflected on performance **(Dahal, 2006).**

## 2.6. Further advantages

### 2.6.1. Composting of livestock manure

Utilizing Beneficial Microorganisms products decreased odor so make it simpler to manage manure. Beneficial Microorganisms also accelerate up fermentation and compost production, due to the fast feces' dryness time. Also, using BM enables to manufacture of high-efficiency manure which has a soil-improvement impact **(Taher, 2009; Zuraini *et al.*, 2010).**

### 2.6.2. Fix drainage problems and improve wastewater treatment

Animals' manure sprayed with BM, will be of less odor, and spoilage suppressed, which makes wastewater handling achieved effectively. Also, running BM into septic tanks will elevate refining. Besides, BM raises the decomposition of wastewater, reduces sludge, and effectively employs slurry **(Karthick Raja *et al.*, 2011).**

### 2.6.3. poultry production

#### 2.6.3.1. Growth performance

Many investigations assure that BM has favorable influences on chicken productivity, the addition of either mix of BM containing lactobacilli cultures or a blend of lactobacilli and other microorganisms to broilers' ration as shown fluctuating effects, where **Mohan *et al.*, (1995)** and **Jwher *et al.*, (2013)** revealed that chicken weight increased by 6 % to 10 % when their feed provided with BM including a blend of Bifidobacterium bifidum, L. acidophilus, and L. Casei. A report by **(Jin *et al.*, 1996b)** mentioned that using Lactobacilli in chicks' feed under a humid and hot environment resulted in significantly better feed efficiency and higher weight gain. **Yeo and Kim (1997)** assured that chicken feed having BM leads to increased average daily weight gain and higher feed consumption **(Zulkifli *et al.*, 2000). Kalavathy *et al.*, (2003)** confirmed that a blend of 12 *lactobacillus* varieties significantly improved daily weight gain, body weight, and feed efficiency. **Huang *et al.*, (2004)** and **Jwher *et al.*, (2013)** mentioned that lactobacillus acidophilus addition resulted in an improvement in broiler chickens' productivity.

#### 2.6.3.2. Mortality average

**Abd-Elsamee and Abd El-Hakim (2002)** found no mortalities when BM was added based on lactobacillus culture over the testing interval**. Eglal (2006)** mentioned that the mortality ratio declined in broiler chicks provided with BM as a probiotic-based on lactobacillus culture. While **Zulkifli *et al.*, (2000)** indicated that broiler chicks given a feed including Lactobacillus culture (1gm/kg feed) had no impact on mortality rate.

#### 2.6.3.3. -Performance index

Numerous researchers demonstrated that the usage of BM in drinking water improved feed efficiency, feed consumption, and entire body weight **(Jwher *et al.*, 2013).**

#### 2.6.3.4. Modifying intestinal microbes

**Fuller, (1977)** noticed that host-specific Lactobacillus varieties can reduce *E. coli* in the digestive canal of chicken. **Francis *et al*., (1978)** assured that the supplemented Lactobacillus varieties at 75 mg per 1kg of ration declined the pathogen enumerations in the turkey's gut and ceca. Also, the usage of BM in drinking water has a Clear effect on increasing goblet cell count, crypts depth, and villi height **(Jwher *et al.*, 2013).**

#### 2.6.3.5. Immune reaction

**Havenaar and Spanhaak (1994)** and **Dahal, (2006)** have mentioned that BM promotes poultry immunity in two methods:

Probiotics flora emigrates throughout the gut and reproduces for a short period, absorption of antigens that are emitted from the dead organisms, therefore promoting the immune system. Also, the advancement of the immune system happened in three ways: Improved production of antibodies of interferon, IgM, and IgG. Promote macrophage vigor and increase the power of microorganism's Phagocytose, and rise number of domestic antibodies at the interior mucosal surface, like the gut coliforms suppression by the digestive wall flora.The use of BM led to an increase in relative weights of spleen, thymus, and bursa of Fabricius Increased lymphocyte percentage of necropsied birds **(Jwher *et. al.*, 2013).**

### 2.6.3.6. Serum cholesterol, triglycerides and total lipids

A report by **(Jin *et al*., 1998)** mentioned that blood cholesterol was remarkably minimized in broilers chicken given feed having lactobacillus cultures at 3-4 weeks of feeding. **(El-Gendy, 1993)** revealed that broiler fed on ration included yeast as a probiotic-based on lactobacilli had a notable influence on blood cholesterol and triglyceride.

### 2.6.3.7. The chemical composition of carcass

Increasing interest noticed over the last years in the modification of the fatty acid composition and cholesterol level in poultry meat and eggs due to the spread of cardiovascular heart and blood pressure diseases are related to the diet rich in saturated fat and cholesterol contents **(Sacks, 2002)**., There is a crucial requirement to go back to equiponderant fatty acid food by reducing the consumption of saturated fats and cholesterol **(Evans *et al*., 2002)**. there is a possibility to minimize lipids content in poultry meat throughout the feeding on high-quality feed **(Wang *et al*., 2005).**

### 2.6.4. BM in fish

The results of several studies showed the great BM on the hygienic status of the fish **(Stephens *et al*., 2015).** It follows that these bacteria may form a fraction of the intestinal microflora, hence it may serve as a substitution to decrease the application of antibiotics in fish farms **(Ismail and Alhamdani 2019).** The supplementation of these organisms may aid in the restoring of the disturbed and abnormal microflora to their healthy situation **(Liu *et al*., 2016).** It is worthy to say that the effect of BM in fish farms does not include their impacts on the intestinal tract but also in improving fish hygiene. The health development can be attributed to the modulation of BM on the causative agents as well as their ability to improve water quality by the adjustment of the various microbes in the water and sediment **(Verschuere *et al*., 2000).**

## CONCLUSION

The employment of beneficial microorganisms can contribute extensively to the general progress in our condition of health and support this in many ways: by providing good environmental protection and assuring an economical food supply of safe and high-quality, through its benefits in agriculture and animal production by cracking problems of environmental pollution using big-scale recycling processes, which would reduce oppressive use of our valuable natural resources; and, ultimately, by improving our capability to heal ourselves.

### Declaration of Conflicting Interests

The authors declare that they have no competing interests.

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