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EFFECT OF SOLUBLE AND INSOLUBLE DIETARY FIBER SUPPLEMENTATION ON GROWTH PERFORMANCE, NUTRIENT DIGESTIBILITY OF *LACTOBACILLUS* SPECIES: A REVIEW

Kumar Yash[1], Mayami Das[1] and Minhaj Ahmad Khan[*]
1Department of Microbiology, School of Bioengineering and Biosciences, Lovely Professional University, Punjab
*Corresponding Author, Department of Biochemistry, School of Bioengineering and Biosciences,
Lovely Professional University, Punjab
Corresponding Author : Dr. Minhaj Ahmad Khan
Email: minhajahmad21@gmail.com

ABSTRACT

The health benefits of dietary fiber have long been appreciated. High fiber intake is linked to lower heart disease and fiber contributes to intestinal health, while many effective drugs actually separate fiber sources. High fiber intake is associated with low body weight. Not only are polysaccharides included in the dietary fiber in the first place, but later definitions have included oligosaccharides as a dietary fiber, not based on their chemical dosage as fiber (TDF) method, but on their physical effects. Dietary fiber and lactobacilli can also be responsible for stimulating immune cells that will continue to benefit the immune system. The use of dietary fiber and beneficial microorganism has been associated with health benefits. The use of lactobacilli is related to the addition of prebiotic species to products, which will further improve human or animal health in the microflora of the gastrointestinal tract. Studies have provided evidence that inulin and oligofructose (OF), lactose, and starch-resistant starch (RS) me*et al*l aspects of the definition, including the promotion of *Bifidobacterium* and *Lactobacillus* a type of beneficial bacterium.
Keywords **:** dietary fiber; prebiotics; microbiota; microflora; lactobacilli

Introduction

The *lactobacillus* species is very important in modern food and nutrition technologies due to the increased interest rate of active structures. *Lactobacillus* are members of the lactobacillaceae family, which are gm + ve facultative anaerobes. It is psychrophilic in nature, deliberately important in many food products and plays a key role in the production of probiotics that include many strains of lactobacillus. Primarily lactobacilli and bifidobacterials are targeted prebiotic agents.

Fibers from various sources are added to products to increase their cooking yield and water management capacity, reduce lipid or calorie content by acting as a bulking agent. (Elleuch *et al*., 2011) However, in some studies the effect of Oligosaccharide including fiber on the growth of dietary lactobacilli was investigated and the ability of Lactobacilli to stimulate prebiotic carbohydrate by substrate species. In the case of lactobacillus, changes in gut microbial values occur at the level of species and species. The Symbiotic effect between dietary fiber and lactobacilli is often explained by fluctuations in the gut microbiota consistency (Sydney Finegold *et al*., 2014).

Dietary fiber is defined as the indigestible carbohydrates of less than equals to 3 monomeric units found in food. Fiber-containing compounds are subunits, which promote specific body growth leading to the production of various metabolites including SCFA (Goldsmith *et al*., 2014).

The use of dietary fiber and lactobacilli can lower circulating cytokines. Homofermentative lactobacillus species can continue to add sugar to lactic acid and do not produce any gases and heterofermentative lactobacillus species can boil sugar in lactic acid and will produce CO_2 over time (Slavin, 2013).

In the case of probiotics, they should live in an acidic environment in order to pass on their benefits after reaching the small intestine and putting the host somewhere. To increase the probiotic survival rate during diarrhoea there are certain active ingredients such as Milk, Milk protein, cheese and yogurt cereal extracts. However, more information is available to maximize the effects of individual diets and the mechanism of action to increase the survival of Lactobacilli.

The gut microbiota is a very diverse and overactive organ with ~ 3.9×10^{13} microbial cells (Daniel So *et al*., 2018). These microbes play a key role in a wide range of activities that will be of great benefit to management, including the breakdown of digestive nutrients, vitamin synthesis and antibodies. A various no. of disorders can be caused by having disorders in the formation of gut microbiota such as irritable bowel syndrome and type 2 diabetes (Greenblum *et al*., 2012) (Bijkerk *et al*., 2004).

The discovery and collection of gut microbiotas in a variety of ways from culture to the next generation can also be attributed to the prevalence of the bacteria. Specific bacteria have been shown to be relatively healthy compared to the disease status including Bifidobacterium and lactobacillus species (De Vuyst *et al*., 2011).

The current structure of evidence regarding the effects of dietary fibers on microbiota was informed by various prebiotic interventions and complete dietary interventions are also cross-sectional interventions with different phases. However, these probiotic fibers represent only a complete subset of food fibers that include other disease-related substances and the uptake of other fermentable substrates.

Therefore, there is a gap in research regarding the effect of dietary fiber on the gut microbiota of a healthy person and this is the main focus of this review.

Modulation of the Microbiota

❖ **Dietary fiber**:

Fiber is flexible in terms of its nutritional properties in its structural and physical properties.

There are many ways to define the quantity, composition and quality of fiber in a diet that some fibers can be divided into 3 groups: the most fermented vegetable fiber with low undigested residues. Brans: They are not very fertile. Chemically purified fibers: unavoidable as wood cellulose (Graham *et al*., 1994) (Zielinski *et al*., 2013).

Proper dietary intervention is an attractive, safe, and non-invasive method for bacterial intestinal function and subsequent immune function and has been proposed as a repository for microbiome homeostasis during aging (Slavin, 2013).

The use of probiotics, such as small organic food additives, is one such approach. Experimental and clinical studies have suggested that probiotic support may have beneficial effects on serum lipid profiles (Holscher *et al*., 2017).

Human studies have reported that certain types of probiotics increase cell and phagocytic functions in healthy volunteers and may have positive effects on inflammatory and atopic diseases, possibly by altering cytokines that work against inflammation (Salon *et al*., 2014).

However, there are few studies examining the effect of probiotic activity on the immune system of the elderly persons. Evidence exists in the antimicrobial effect of certain probiotic antibodies and the ability to use prebiotics to increase the levels of such bacteria, the latter of which is the selected micro-organism.

Performance of dietary technology

❖ **Solubility**

Food fiber is generally classified as soluble or insoluble based on whether it forms a solution when mixed with water (soluble) or insoluble. Soluble food fibers include substances such as gums, mucilage and other hemicelluloses as well as lignin.

Melting is directly related to the formation of polysaccharide where a substitute group such as COOH or SO_4^{2-} increases the solubility.

Solubility is affected by heat and ionic energy. The type of soluble and insoluble fibers includes differences in their technical performance and physical effects. Soluble fibers are characterized by their ability to increase viscosity and reduce glycemic and plasma cholesterol reactions and insoluble fibers are characterized by their quantity and ability to increase faecal bulk and decrease intestinal mobility.

Compared to food-soluble fiber in food soluble dietary fiber shows great strength in providing viscosity, the ability to act as an emulsifier and has no adverse texture or bad taste and is easy to incorporate into processed foods and beverages (Larrauri *et al*., 1999).

❖ **Prebiotics and probiotics**:

Prebiotics are defined primarily as a substrate used selectively by the host microorganism that provides health benefits.

This definition was later refined to include other areas that could benefit from the selection of specific microbial selectively acceptable ingredients that allow for specific changes, both in structure and / or function in the intestinal microflora, which provide benefits.

Probiotics have been described as 'a small organic nutrient that is beneficial to health' (Schrezenmeir *et al*., 2001). Probiotic diets are effective if they are shown to be beneficial in affecting one or more functions in the body rather than the adequate effect of a healthy diet, in a positive way in improved health and well-being or to reduce the risk of disease.

Microbiota tested by carbohydrate or fermentable diet fiber because it is found as an antiseptic in the stomach.

PRINCIPLE FOR DESIGNING FERMENTABLE DIETARY FIBER:

❖ **Fermentation rate**:

The fermentation of dietary fiber by gut microbiota produces short chain fatty acids (SCFAs) through a specific range of reactions and metabolic processes (Gibson *et al*., 1995).

SCFAs (90-95%) are acetate, propionate and butyrate but their ratios vary in type of fiber, are considered a major source of nutrients and colonic strength and are generally thought to be beneficial for intestinal health by increasing mineral absorption and also preventing bacteria by reducing the pH of the gut lumen that will continue to help maintain the integrity of the intestinal barrier (Wang *et al*., 2019).

SCFAs act as signalling molecules on G-protein couple receptors that will provide a bridge between the intake of certain oligosaccharides and antibodies under lamina propria.

Animal model can help identify gut microbes & mechanism and in human observation studies they can show a distinctive link between germs and health factors.

The gut microbiota provides vital energy for the fermentation of an indigestible substrate such as dietary fiber and chronic intestinal tissue.

❖ **In vitro static fermentation models:**

Normally closed anaerobic environments in closed tubes or reactors where single or mixed types of bacteria or gut microbiota cultures in animals or humans are re-tested for their ability to combine different fiber components of food (Charteris *et al*., 1998).

These fermentation species usually use wild samples from a single donor or combined samples from several donors as inoculars and run for at least 24h to ensure the stability of microbes and metabolites (Bourquin *et al*., 1996). Some models such as batch models are easy to set up and are useful in assessing the fermentation rate of different fiber ingredients and their metabolites profile.

However, a few studies based on this model use pork or human faeces further investigated for fermentation and the size of various dietary supplements such as cellulose, c glucan, arabinoxylan, inulin etc. It is investigated that pigs are better able to digest food fibers than humans as their gut microbiota contains more cellulolytic bacteria (Cummings *et al*., 1991).

There are other models such as the TIM-2 model, an invitro model of proximal colony made by TNO, which consists mainly of 4 connected glass chambers that contain a membrane that improves the condition of the intestinal mucosa (Charteris *et al*., 1998) (Zielinski *et al*., 2013).The physiological form of insoluble dietary fiber also plays a key role in its fermentability.

The fermentation process of several food fibers was performed using this model and the result has been consistent with in vivo data.

Immuno recognition of lactobacilli

Lactobacilli can release an immune response to a host by binding to pattern recognition receptor (PRR) expressed in immune cells and many other tissues (Conway *et al*., 1987).

The introduction of lactic acid bacteria was first suggested by Metchnikoff as a means of reducing intestinal cleansing and longevity that has been investigated as a beneficial dietary component for animal and human intestinal disorders (Havenaar *et al*., 1992).

Use of lactobacillus to prevent and treatdiarrhoea induced by E. coli, Salmonella & Shigella additional invitro studies show bacteriocin production by different types of lactobacillus and many antitumor properties have been shown by lactobacilli (Chen *et al*., 2007).

With regard to the successful insertion of imported lactobacillus bacteria must function within the intestinal tract and have certain adhesion areas to avoid temporary passing as in the human in vivo study (Sydney Finegold *et al.*, 2014).

Increased use of lactobacilli as a dietary supplement has shown the need to prepare all those cultures that have the ability to resist cell and bile function and have the ability to establish the intestinal tract.

Concluding remarks and future facts

This review summarizes mainly In vitro batch fermentation models and many other models and using animal and human faces such as bacterial inoculates and continuous cultural systems are often used to mimic the fermentation of large intestines, in which fermentation of various food fibers is performed.

Many additional studies from dietary fiber, on the involvement of Lactobacillus species were also selected to investigate specific species or novels and to evaluate their colon function including the effect of prebiotic & short chain fatty acids (SCFA) values and profiles as well as other systemic and metabolic effects.

However, it is not easy and it is possible that such studies could be done together to create a fraudulent framework for the proper management of the colon microbiota with dietary fiber. These studies do not provide many details regarding the interaction of several bacteria with different types of building fibers.

The classification of dietary fiber as 'soluble' or 'insoluble' may not be sufficient to elicit different digestive functions and activities. In addition, an in-depth understanding of the various fermentation sites, in vivo fermentation pathways, how to regulate the fiber fermentation immune system and fecal fermentation areas also requires further investigation.

A variety of educational and research approaches to the workings of various microbes in humans and animals are needed, and this will require collaboration between researchers from various fields including microbiology, nutrition, immunology and nutrition and dairy technology to name a few.

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