

Health Benefits of Probiotics from Fermented Foods in Bangladesh

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Abstract

In Bangladesh various types of fermented foods are available like fermented rice, chepa shutki, lona ilish, shidal, kumrabori, jilapi, various achar, chutney and a number of dairy products. Fermented foods are prepared by using bacteria, yeasts and other microbes. These microbes are called probiotics or good bacteria which are beneficial to health. Although people of all stages of the society usually consume the fermented foods but the concept of probiotics present on those foods are not familiar. Probiotics in the fermented foods exert their beneficial effect through improvement of digestive disorder, reduction of cholesterol level, amelioration of the immune response and maintaining oral hygiene. They also have reported antihypertensive and anti-diabetic properties. Fermented foods and probiotics are considered as a natural protective barrier against infections. Apart from the fermented foods, probiotics can also be obtained from commercially available supplements. In Bangladesh there are enormous scopes for development of fermented food containing probiotics. But due to lack of appropriate knowledge and scientific research in this field the common people are not concerned about the potential benefits of probiotics. Therefore, evidence based study and investigations are required to establish the effective use of probiotics from fermented foods as well as from supplements. In this current review various potential benefits of probiotics are articulated along with their sources and safety.

Keywords: Probiotics, Fermented foods, health benefit of probiotics.

Introduction

Traditional fermented foods have been consumed all over the world for thousands of years. The recipe and popularity has been passing down through generation to generation. In the beginning, food fermentation occurred naturally by some microbes like bacteria, yeast and others. Later this technique was used for food preservation, making delicious and healthy foods. Nowadays various fermented foods and drinks are consumed across the world such as fermented cabbage like kimchi are popular in Korea and sauerkraut and cortido in European countries. Kombucha, a drink produced by fermenting tea using a symbiotic culture of bacteria and yeast is popular in Russia and China. Fermented sausages are also common in most of the areas in Greece and Italy (Chilton, Burton and Reid, 2015). In Bangladesh, various types of fermented foods are consumed such as fermented rice which is commonly known as pantavat taken as a breakfast by rural people, cereal-based fermented food like jilapi and amitri and dairy foods like curd, yogurt,

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cheese, ghee, borhani, lassi, matha prepared throughout the country. Apart from these, some processed fish like different types of dried fish, chepa sutki, lona ilish, shidal and various types of achar and chutney made from fruits and vegetables are other traditional fermented foods consumed by rural, tribal and urban people. These traditional foods are not only confined in the home kitchen but also have reached in business arena. Many local companies as well as large national manufacturers like Pran foods, Arong dairy & foods, Square foods & beverage limited are producing fermented dairy products like lassi, matha, yogurt, cheese, ghee and achar, chutney in commercial scale. Some of these products also enter into the export chain. All of these fermented food products contain different probiotics with potential health benefits. Without having the knowledge of probiotics of fermented food and their health benefits people are taking these foods. Therefore, in this study an attempt has been taken to review the potential health benefits of probiotics and fermented foods.

Fermented foods

Fermentation is one of the oldest processes used to produce desired product using microbes. It is used to prepare foods and beverages from ancient history of the civilization. Indigenous fermented foods and beverages have been an integral component of the dietary culture. Fermented foods are those food products where mostly carbohydrate breakdown is occurred by the presence of microorganisms (Hasan, Sultan and Mar-E-Um, 2014). Lactic acid bacteria, yeasts and other microorganisms are used for food fermentation (Blandino *et al.*, 2003; Moslehi-Jenabian, Pedersen and Jespersen, 2010). Fermented food products are common source of probiotics. Along with its nutritional values fermentation promotes stability, preservation and improves aesthetic properties like flavor, texture and aroma (Campbell-Platt, 1994; Hansen, 2002; Geisen and Holzapfel, 1996; Steinkraus, 1996; Tamang *et al.*, 2007). Hossain and Kabir (2016) reported that lactic acid bacteria, *Bacillus* and yeast are responsible for fermentation of some local foods and beverages in Bangladesh (Table 1).

Table 1: List of Common Fermented Foods and probiotic microbes in Bangladesh

Fermented Food Name	Probiotic microbes
Breakfast	
Pauruti	Yeasts
Pantavaat	Lactic acid bacteria
Curry	
Chepa Shutki	Lactic acid bacteria, Yeasts
Lona ilish	Lactic acid bacteria
Shidal	Lactic acid bacteria, <i>Bacillus</i> sp., <i>Micrococcus</i> sp., <i>Staphylococcus</i> sp., yeast
Dessert	
Dahi/Doi	Lactic acid bacteria, Yeasts
Drinks	
Lassi	Lactic acid bacteria, Yeasts
Matha	Lactic acid bacteria
Bangle maad	Yeast

Fermented Food Name	Probiotic microbes
Tari	Yeast
Borhani	Lactic acid bacteria, Yeast
Snacks	
Jilapi	Yeasts, Lactic acid bacteria
Amitri	Yeasts, Lactic acid bacteria
Papad	<i>Candida krusei</i> and yeast
Others	
Aachaar	<i>Leuconostoc mesenteroides</i> , Lactic acid bacteria
Chutney	<i>Leuconostoc mesenteroides</i> , Lactic acid bacteria, yeast
Ghee (cooking)	Lactic acid bacteria, Yeasts

Probiotics

The concept of probiotics was established by Eli Metchnikoff about a century ago. He postulated that ingestion of fermented milk products produced by microorganisms had a health benefits impact on longevity. In 1965 Lilly and Stillwell first used the term and defined probiotics as a substance secreted by microorganism that has the capacity to stimulate the growth of another microorganism (Agarwal *et al.*, 2011). According to Food and Agriculture Organization (FAO)/World Health Organization (WHO), probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit on the host. Probiotics are beneficial bacteria most of which are normally found in our gastrointestinal tract remain as a microbial flora. *Lactobacilli* and *Bifidobacteria* are commonly used as probiotic (Macfarlane *et al.*, 2004). A list of probiotic microbes including lactic acid producing bacteria, non lactic acid producing bacteria and some yeasts are given in Table 2 (Leroy, *et al.*, 2008 and Prado *et al.*, 2008).

Table 2: List of Probiotics Microorganisms

Lactobacillus species	Bifidobacterium species	Others
<i>L. acidophilus</i>	<i>B. adolescentis</i>	<i>Bacillus cereus</i>
<i>L. helveticus</i>	<i>B. animalis</i>	<i>Clostridium botyricum</i>
<i>L. brevis</i>	<i>B. breve</i>	<i>Escherichia coli</i>
<i>L. casei</i>	<i>B. bifidum</i>	<i>Lactococcus lactis</i> subsp. <i>cremoriss</i>
<i>L. rhamnosus</i>	<i>B. infantis</i>	<i>Lactococcus lactis</i> subsp. <i>lactis</i>
<i>L. amylovorus</i>	<i>B. lactis</i>	<i>Leuconostoc mesenteroides</i> subsp. <i>dextranicum</i>
<i>L. delbrueckii</i> subsp. <i>bulgaricus</i>	<i>B. longum</i>	<i>Pediococcus acidilactici</i>
<i>L. fermentum</i>		<i>Propionibacterium freudenreichii</i>
<i>L. gasseri</i>		<i>Saccharomyces boulardii</i>
<i>L. crispatus</i>		<i>Streptococcus salivarius</i> subsp. <i>thermophilus</i>
<i>L. johnsonii</i>		
<i>L. lactis</i>		

Lactobacillus species	Bifidobacterium species	Others
<i>L. paracasei</i>		
<i>L. plantarum</i>		
<i>L. reuteri</i>		
<i>L. salivarius</i>		

Health benefits of Probiotics

Different studies show that probiotics promote a healthy balance of gut bacteria and have been linked to a wide range of health benefits. An overview of the key health benefits of probiotics are explained here.

Digestive disorders

Digestive disorders are growing burden in our country. Most of them can be prevented or controlled by maintaining a healthy lifestyle and practicing good bowel habits (Figueiredo *et al.*, 2018). Probiotics in dietary contents like *Lactobacillus casei*, *Bifidobacterium bifidum*, and *Streptococcus thermophilus* can improve the gut health by preserving intestinal integrity and mediating the effects of inflammatory bowel diseases, irritable bowel syndrome, colitis and diarrhea. In developing countries, diarrhea is a major cause of infant death. *L. rhamnosus* GG, *L. reuteri*, *L. acidophilus* LB, *S. boulardii*, *S. thermophilus*, *L. acidophilus* and *L. bulgaricus* are shown to decrease the severity and duration of diarrhea along with oral rehydration therapy (Szajewska and Mrukowicz, 2001). Another study suggested that *B. lactis*, *L. reuteri*, and *L. rhamnosus* decrease the prevalence of acute diarrhea in children (Duggan, Gannon and Walker, 2002). Other Probiotics including *B. bifidum*, *S. thermophiles* and *L. rhamnosus* GG are beneficial for preventing nosocomial diarrhea in infants (Saavedra *et al.*, 1994). Incidence of traveler's diarrhea can also be prevented by *L. rhamnosus* GG that are usually present in healthy human gut (Hilton *et al.*, 1997; Oksanen *et al.*, 1990).

Spiegel (2009) reported that **about 7-10% populations around the world are suffering from Irritable Bowel Syndrome (IBS)**. Another study showed that probiotics such as *B. infantis* caused reduction of IBS symptoms (O'Mahony *et al.*, 2005). Constipation, another gastrointestinal discomfort of adult was reduced by using fermented milk containing probiotic *B. animalis* (De Paula, Carmuega and Weill, 2008; Guyonnet *et al.*, 2007). Additionally, beneficial effects are also observed for *H. pylori* associated gastritis (Pantoflickova *et al.*, 2003).

Lactose intolerance is a condition where there is a deficiency of lactase enzyme responsible for breaking down the lactose sugar. Therefore, people with lactose intolerance are unable to digest the lactose sugar present in milk and dairy products. Fermented milk products containing *S. thermophilus*, *L. delbrueckii* sub sp. *bulgaricus* and other *lactobacilli* provide bacterial lactase that helps to reduce lactose intolerance symptoms. In addition, the use of probiotics from

fermented milk products also influences calcium absorption in lactose intolerant patients (Singh *et al.*, 2011).

Immune responses

Probiotics from fermented food products can boost both specific and nonspecific immune systems, by activating macrophages, increasing natural killer cell activity, increasing levels of cytokines and increasing levels of immunoglobulins (Singh *et al.*, 2011). Exogenous probiotics are reported to modulate immune response and improve various chronic and acute diseases state (Jankovic *et al.*, 2010). Probiotic combinations containing *L. johnsonii* La1 and *B. lactis* BB12; and *L. fermentum* CECT5716 revealed to booster specific immune response to a *S. typhi* oral vaccine and influenza vaccine (Link-Amster *et al.*, 1994; Olivares *et al.*, 2007). Improved response was also observed against rotavirus vaccine in children receiving *L. rhamnosus* (Isolauri *et al.*, 1995). *B. lactis* HN019 and *L. johnsonii* La1 increase the Natural Killer (NK) and phagocytic cell activity in adults (Arunachalam, Gill and Chandra, 2000; Donnet-Hughes *et al.*, 1999; Schiffrin *et al.*, 1997).

Reduction of cholesterol level

Hypercholesterolemia or increased blood cholesterol has been increased in adults, children and even adolescents. Obesity, hyperlipidemic condition, hypercholesterolemia increase the incidence of hypertension (Yekeen, Sanusi and Ketiku, 2003). Mann and Spoerry (1974) suggested that lactobacillus fermented milk has hypocholesterolemic effects. Another study showed that probiotics are helpful for reducing hypertension by lowering the blood cholesterol level (Goel *et al.*, 2006).

Skin Problems

In recent years, probiotics are being used in allergic disorders. Microbial flora in the gut of people having skin problems is completely different from the others. Skin conditions of allergic patients are shown to be improved using probiotics from food and other sources (Vanderhoof and Young, 2004). *L. rhamnosus* GG has been shown to improve the antigen-specific IgA in response to food antigens (Malin *et al.*, 1997). Probiotics showed their beneficial effect on allergy by improving mucosal barrier function (Singh *et al.*, 2011).

Respiratory Infections

Acute upper respiratory tract infections such as common cold, inflammation of trachea and larynx are usually caused by virus and associated with symptoms like fever, headache, pain and cough (Hao *et al.*, 2011). Analgesics, antipyretics along with antibiotics are used to reduce the symptoms of these types of infection. Apart from these drugs, probiotics e.g. lactic acid bacteria and *bifidobacteria* from fermented foods help to reduce the risk and incidence of upper respiratory tract infections (Iqbal *et al.*, 2014).

Oral health

Fermented foods increase the salivary probiotics level (Ahola *et al.*, 2002). Probiotics inhibit the incidence of dental caries, periodontal diseases, halitosis, candidiasis and improve the oral health (Iqbal *et al.*, 2014; Näse *et al.*, 2001; Cildir *et al.*, 2009). Stamatova and Meurman (2009) reported about 1000 bacterial species present in the oral cavity and other study showed that 1% of them are probiotic species including *L. paracasei*, *L. plantarum*, *L. salivarius*, and *L. rhamnosus*, *B. bifidum*, *B. dentium* and *B. longum* (Ahrné *et al.*, 1998; Haukioja, 2010). Effects of probiotics in metabolic and dental health improvement include modulation of immune response and normalization of oral microflora have been reported (Parvez *et al.*, 2006). Probiotics are also effective for maintaining healthy oral cavity by the interaction in dental plaque, interfering in binding of microorganisms to proteins, inhibition of plaque formation (Nagaraj *et al.*, 2012; Saraf *et al.*, 2010). Some of the probiotics decrease the number of pathogens in periodontal tissues and improve the condition of periodontitis and halitosis (Delanghe *et al.*, 1997; Riccia *et al.*, 2007; Tsubura *et al.*, 2009).

Viral infections

Probiotic foods have reported beneficial effects on rotavirus infection (Hasan, Sultan and Mar-E-Um, 2014). Study showed that *B. lactis* and *S. Boulardii* given in rotavirus mediated gastroenteritis in children has an anti-rotaviral effect (Erdoğan *et al.*, 2012). Anti-herpetic activity of *Thermophilus spp* was also observed in animal study (Liaskovs'kyi *et al.*, 2007). Probiotics are not shown to have direct action on viruses, the antiviral activity is attributed to the immune stimulation effect by them (DeVrese and Schrezenmeir, 2002).

Antihypertensive

Probiotics have been found to reduce blood pressure in hypertensive people. Fermentation of milk using *S. cerevisiae* and *L. helveticus* yield some peptides that inhibit angiotensin-converting enzyme, a potent mediator of hypertension (Maeno, Yamamoto and Takano, 1996).

Diabetes

Probiotics reduce blood glucose in diabetic patients by balancing the microbial flora in gut. *L. acidophilus* and *L. casei* probiotics from low fat yogurt are reported to reduce insulin resistance and to lower blood glucose level (Yadav, Jain and Sinha, 2006). Another study suggested that *Bifidobacterium spp* can be used to treat insulin resistance (Cani and Delzenne, 2011).

Restoration of gut flora after antibiotics therapy

Human gut has a complex ecosystem with thousands of microbial floras. They perform various functions within the intestine and protect the integrity of ecosystem of the gut. Antibiotics typically aimed to kill pathogenic bacteria or inhibit their growth. But while working to eliminate the harmful bacteria, the same antibiotic may disrupt the gut ecosystem by destroying many of the protective microbial floras. Therefore, taking a fermented food containing probiotics may help to restore the protective flora and to maintain a healthy gut environment along with antibiotic treatment (<https://health.usnews.com>).

Safety of Probiotics

Usually probiotics are considered as potentially beneficial bacteria that have not any harmful effects on health. But the proper selection and usage of probiotics from food products are very much essential for safety, health benefits and sensory attributes (Mortazavian, Mohammadi and Sohrabvandi, 2012). The most commonly used probiotics *Lactobacillus* spp., *Bifidobacterium* spp., *Streptococcus* spp. and other lactic acid bacteria that are used for food fermentation are generally safe and in very rare cases have a history of infections and harmful effect (Saarela *et al.*, 2002).

Conclusion

Fermented foods are traditional as well as functional. These foods play an important role in socio-economic aspect of a country by adding to the nutritional requirements of populations. Most of the people of Bangladesh have limited knowledge about the probiotics present in fermented foods and their health benefits. Probiotics containing fermented foods boost the immune system, maintain oral hygiene, reduce cholesterol level, reduce the duration of diarrhea and benefit the human health in many other ways. Besides, the appropriate use of probiotics can help to reduce the dependency on drugs in some cases. Some pharmaceutical companies have probiotics supplements in market and doctors also prescribe these supplements. Due to the availability of raw materials and favorable climate for food fermentation there is enormous scope for development of fermented foods and beverages in Bangladesh by adopting appropriate methodologies. However, despite many benefits of probiotics in fermented foods, their consumption has not been recommended widely in our country due to lack of research and scientific investigation on it. Therefore, evidence based study and investigations are required to establish the effective use of probiotics from fermented foods as well as from supplements.

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