CHAPTER 1

INTRODUCTION

The Indian food and beverage industry has witnessed drastic changes in recent years. Healthier product alternatives, including beverages specifically designed to provide energy, nutrition and health to the human body, are becoming top priority (Federation of Indian Chambers of Commerce & Industry, 2015). The desire for health and concern for ill-health has driven consumers towards these beverages. Healthier product alternatives, including beverages specifically designed to provide energy, nutrition and health to the human body, are among becoming top priority. The consumers for health beverages are people from the different walks of life but majority of them come from the younger and older generations.

The rise in health-consciousness is also reflected in the growth of health care spending, which is growing at a Compound Annual Growth Rate (CAGR) of 14 percent, from 5.5 percent of the GDP in 2009 to 8 percent in 2012. The figure is expected to grow to US$ 280 billion by 2020. Concomitantly, the market for health beverages is beginning to pick up speed and volume. There is a huge opportunity in the packaged beverage market being fuelled by a rise in disposable incomes, changing lifestyles and a burgeoning younger middle class priority (Federation of Indian Chambers of Commerce & Industry, 2015).

In spite of all the health awareness among the population, the availability of health beverages in Indian markets is still scarce. The Indian market for beverages has been segmented on the basis of types of products that is carbonated and non- carbonated. Carbonated products account for nearly 61-62% of the total soft beverages market. The brands that fall in this category are Pepsi, Coca-Cola, Parle, etc. Non- carbonated segment which constitutes 36% can be divided into 2 categories

that is dairy based products like lassi, curd, flavored milk, buttermilk etc and fruit based on the types of flavors available like orange, lime, lemon and mango, etc. Due to the trend of health-consciousness of consumers, the Indian noncarbonated beverage segment has become one of the fastest growing businesses currently valued at Rs 20,000 crore (FnB news, 2013). It is likely to grow at a healthy CAGR of 35 per cent, and touch 54,000 crore by 2018 (Associated Chambers of Commerce and Industry of India, 2013)

According to the The Euromonitor International report (2014), Indian consumers are spending more and more on nutritional supplements to combat the effects of health problems. This indicates that people are concerned about their health. Flavored milk, energy beverages, liquid-meal replacements, weight-directed products, ready-to beverage meals and functional beverages could act as substitute of carbonated beverages in Indian market. The non-carbonated beverage industry has tremendous potential for future developments in India.

Recent trends in final food demand show that the concept of food has undergone a radical transformation. In addition to the nutritional and sensory properties of food, consumers are also well aware about their important role in the maintenance of health, on psycho-physical well-being and prevention of certain diseases. Today foods are not intended to only satisfy hunger and to provide necessary nutrients for humans but also to prevent nutrition-related diseases and improve physical and mental well-being of the consumers (Azzurra and Paola, 2009).

Significant predictors of functional food consumption are related to consumers' health motivation, perceived diet effectiveness of products, and knowledge about nutrition. There is evidence that consumers most likely to have a positive attitude toward functional foods are the ones who have faced illness among relatives or have experienced illness themselves (Dowd and Burke, 2013).

There is no doubt that the functional food industry is growing steadily worldwide. However, successful commercialization of new products is proving to be challenging especially due to the need for a strategic approach to product development processes (Shamal et al, 2017).

Increasing urbanization, growing awareness and affluence continued to drive consumers to make healthy choices and hence, increasingly switch to packaged beverage milk products over the review period. Which is expected to grow by Compound Annual Growth Rate (CAGR) 7% in the coming years.

In today's modern world, due to urbanization, the change in dietary habits and lifestyle pattern has itself forced the health conscious consumers to search for an alternative treatment regime for various ailments caused by lifestyle related diseases. In this direction, probiotics and probiotic based food supplementation have drawn interest of consumers (Parvez et al, 2006; Raguvanshi et al, 2015). The consumption of probiotics exerts myriad of beneficial effects which is evidenced by rigorous scientific evaluation. It is a major focus of attention of scientists across the world due to their promising health benefits and their applications offers an innovative approach for development of novel probiotic formulations (Bagchi, 2014).

In the late 19th century, microbiologists identified micro- flora in the gastrointestinal (GI) tracts of healthy individuals that differed from those found in diseased individuals. These beneficial microflora found in the GI tract were termed probiotics. Probiotics, literally meaning ‘for life’, are micro-organisms proven to exert health-promoting influences in humans and animals (Rijkers et al. 2011).

1.1 Indigenous fermented foods

1.1.1 International status

Indigenous fermented foods have been prepared and consumed for thousands of years, and are strongly linked to culture and tradition. The traditional fermented foods are mainly obtained from dairy products viz. yoghurt, dahi, kefir, cheese (after long storage), and fermented vegetable or from vegetable juices and from non-fermented fruit and berry juices. Amongst Asian countries, the most prominent ones which consume probiotics are Japan, Korea, Indonesia, India, Nepal, Sri Lanka. Reports of fermented foods such as Kefir (Russia), Calpis (Japan), Tofu (Southeast Asia), Kimchi (Korea), Kaymak (Turkey) which are used for health benefits, characteristic of various societies have existed in the literature (Tamang and Kailasapathy, 2010).

It is, therefore, not surprising that fermented foods and beverages make a big contribution to people's diets worldwide (Sanni, 1993). It is reported that fermented foods globally contribute 20 to 40% of the food supply and usually, a third of the food consumed by man is fermented (Campbell-Platt, 1994). This renders fermented foods and beverages a significant component of people's diets globally.

1.1.2 National status

In the Indian subcontinent, fermented food and beverages, prepared using local food crops and other biological resources have been going on since time immemorial and is a common practice even today (Roy et al., 2004). Idli, dosa, dhokla, khaman, handva, etc are certain popular traditional fermented foods which are consumed throughout India, particularly in southern and western parts of India. A variety of region specific fermented foods and beverages are traditionally produced

and consumed, and even locally marketed in North-East India (Das and Deka, 2012). At certain times, sour buttermilk or yeast is added in order to enhance fermentation.

In eastern Himalayan regions of Darjeeling hills and Sikkim, Kinema, a product of fermented soybean is consumed (Nagai and Tamang, 2010). In certain parts of India, fermented rice was mixed with buttermilk and salt for direct consumption. The jalebies and kanji are mainly consumed in northern India (Sekar and Mariappam, 2007). Amongst the dairy products, dahi, rabdi, paneer, shrikhand, misti dahi and chhurpi, are used in northern, western, eastern and Himalayan region of India, respectively (Nehal, 2013).

1.2 Importance of Fructooligosaccharide (FOS) as a prebiotic

FOS has been recognized for its great potential which is becoming apparent as a considerable food element in increasing the bacterial bionomics which might have a concrete role in reducing the burden of CVDs. Many recent researches have documented that consumption of FOS reduces the incidences CVDs by regulating hypertension, improving glycemic, lipemic control and reducing the expression of inflammatory markers (Ooi and Liong, 2010, Dehghan et al 2014, Asemi et al, 2013). FOS supplementation in pre hypertensive type 2 NIDDM subjects have also lead to significant reduction in Fasting Blood Sugar (FBS), Post prandial blood glucose(PP2BS) and glycated haemoglobin by 6.3%, 9.8% and 10.6% respectively. Another study conducted with FOS added milk revealed significant reduction of 5.2% and 7.8% for FBS and PP2BS respectively (Parnami et al, 2011). Studies have also documented significant reduction in TG, TC, LDL-C, VLDL and increase in HDL-C with consumption of FOS (Sheth et al, 2015). Significant reduction in ha-CRP levels and BMI had also been reported in many studies (Sheth and Asudani, 2014; Jain

and Sheth 2014). FOS is now being considered worldwide and has a great potential for future. Many international industries and organizations are now coming up with new and innovative products using FOS.

Probiotic foods are those foods that contain a single or mixed culture of micro-organisms that affect beneficially the consumer's health by improving their intestinal microbial balance (Fuller, 1989, 1991). Probiotics aid in the digestion of food and nutrients and help the body's immune system by protecting it against pathogens that may cause disease. Some of their nutritional functions include synthesis of vitamins (vitamin B and vitamin K) and the absorption of key nutrients (calcium, magnesium, and iron), providing a protective mechanism by preventing harmful bacteria, viruses, and other pathogens from crossing through the intestinal lining into the bloodstream and stimulating the immune system. Potential benefits may result from growth and action of the bacteria during the manufacture of cultured foods (Kechagia, 2013). A therapeutic benefit also includes prophylaxis against some types of intestinal infection (Mach, 2006), improved digestion of lactose against lactose maldigestion lactose-containing foods (Sanders, 2000). Lactose malabsorption may compromise their intake of protein and calcium (Saikali et al. 2004) and these microflora are capable of providing numerous health benefits beyond basic nutritional value (Kumar et al, 2012; Khalesi, 2014; Benchimol and Mack 2004; Naidoo K 2011).

Most probiotic foods at the markets worldwide are milk based and very few attempts are made for development of probiotic foods using other fermentation substrates such as cereals.

Cereal based foods are a major source of inexpensive calories and other nutrients worldwide. Whole grains are also sources of many phytochemicals, including phytoestrogens, phenolic

compounds, antioxidants, phytic acid and sterols which make them important in developing functional foods.

Cereals contain water-soluble fibre (such as b-glucan and arabinoxylan), oligosaccharides (such as galacto-and fructo oligosaccharides) and resistant starch, and thus have been suggested to fulfil the prebiotic concept (Shah, 2001). Cereal grains readily support the growth of microorganisms, including lactic acid bacteria, provided the presence of water and hydrolytic enzymes. Lactic acid fermentation usually improves nutritional value and digestibility of cereals (Charalampopoulos et al 2002). Lactic acid fermentation of different cereals, such as soya, sorghum, finger millet, has been found effective in reducing the amount of phytic acid, tannins and improve protein digestibility (Panesar et al, 2009; Chen et al 2010; Correia 2010, Singh et al 2012).

Fermented dairy products have long been an important component of nutritional diet. The role(s) of probiotic bacteria in dairy fermentations is to assist in: (i) the preservation of the milk by the generation of lactic acid and possibly antimicrobial compounds; (ii) the production of flavour compounds (e.g. acetaldehyde in yoghurt and cheese) and other metabolites (e.g. extracellular polysaccharides and volatile compounds) that will provide a product with the organoleptic properties desired by the consumer; (iii) to improve the nutritional value of food, as in, for example, the release of free amino acids or the synthesis of vitamins; and (iv) provision of special therapeutic or prophylactic properties such as production of immuno nutrients useful for cancer patients (Panesar, 2011; Shida and Nomoto, 2013; Kumar, 2015) and control of serum cholesterol levels (Ranasinghe et al, 2013; Ooi and Liong 2010; Jones et al 2012)

Buttermilk is a dairy ingredient widely used in the food industry because of its emulsifying capacity and its positive impact on flavor. Depending on the processing conditions, either sour cream or sweet cream buttermilk is obtained. Only a very limited number of scientific reports have been published on the use of buttermilk as a vehicle of probiotic cultures. However it can be assumed that the buttermilk does contain several species of beneficial microorganisms which are dependent upon the specific cultures used for manufacture of butter in the dairy industries. The determination of these microbes needs to be done. Leroy and Vuvst, 2004 have documented that *Lactococcus lactis* subsp. cremoris is a lactic acid bacterium commonly associated with buttermilk. Lactobacillus and Bifidobacterium are the probiotic genera most widely used in the food industry. It is estimated that over 70 products containing *Lactobacillus acidophilus* and Bifidobacterium subsp., including yoghurt, buttermilk, frozen desserts and milk powder are produced worldwide (Shah 2007)

With this background, the present study was planned with the aim of utilizing cereal grains and millets namely rice, barley, pearl millet, finger millet and buttermilk to develop a dairy based fermented drink with traditional and modern food flavors.

The proposed fermented beverage is a modification of the traditional fermented beverage which has been used in India since ages. Commercialization of this beverage will help easy access of probiotics to the entire population. Consumption of this fermented beverage will be beneficial for all the age groups and will help to: Improve bowel movement and aid digestion, Maintain balance of good and bad bacteria, Reduce toxins in our body and Help build the immune system (reduce risk of infections)

The technological application of the proposed fermented beverage aims to combine the potential health benefits of the good bacteria with their ability to grow in with cereals, resulting in a nutritionally healthy and desirable product for the consumers. Another important fact is the increasing demand for consumer convenience. Present day consumers prefer foods that promote good health and prevent disease. Furthermore, these foods must fit into current lifestyles providing convenience of use, good flavor, and an acceptable price value ratio. Such foods constitute current and future waves in the evolution of the food development cycle. Development and marketing of this fermented beverage will not only conserve the traditional fermented beverage but will also be a ready to consume probiotic product for the consumers readily available in the markets.

The proposed research study is related to a fermented product development using a prebiotic FOS, studying its probiotic and market potential and its commercialization, so that it is available to the population.