1. INTRODUCTION

Food fermentation is one of the oldest food processing and preservation methods. As effective preservation methods were not available in ancient times, food fermentation played a pivotal role in preserving food quality. There has been a growing interest in traditional fermented foods, both at national and international levels and various advancements are made in food science and technology. This led changes in the diet habits of the mankind. After entering in the new millennium, people are aware of spending a healthy life style. Many of the ready to eat and novel food types represent the diet around the world. The consumers are concerned about safety in food than in any other products, including medicines. The general public demands high quality, preservative free, safe, and minimally processed foods with extended shelf-life. The use of natural antimicrobials in the food industry can help to reduce the addition of chemical preservatives, offering an alternative to satisfy the increasing consumer demand for safe foods and to develop novel food products (Deegan et al., 2006).

The discovery of new groups of antimicrobial substances in bacteria, lower eukaryotes and plants has attracted the researchers. Peptides with antimicrobial properties are produced by eukaryotes and prokaryotes and serve as important components of their defence against microorganisms. Among the bacteria producing antimicrobials, lactic acid bacteria (LAB) has attracted researchers very much as they are considered GRAS (generally recognized as safe) organisms. The genus *Lactobacillus* contains a diverse assemblage of 140 species and various lactobacilli are being explored around the world from various fermented foods (Euzeby, 1997).

Identification of the various lactobacilli from various sources is important for exploring the isolates for various applications. The identification of lactobacilli using conventional biochemical methods is not sufficient for inter- and intra-species
differentiation. Various sensitive and reliable molecular methods have now replaced the conventional characterization methods. Non-PCR based, PCR based approaches, and methods based on the combination of these two approaches and sequencing based approach are widely employed in the characterization studies. In fact, many *Lactobacillus* species have been reclassified based on the information from advanced molecular techniques and their correct taxonomic status has been determined (Dellaglio et al., 2004).

*Idli* is a natural yeast-lactic fermented product, mainly used as a breakfast snack in southern India. In the majority of fermented foods, particularly traditional foods of India, which are based on cereals and legumes, the nature of fermentation is by involving LAB (Agrawal et al., 2000). The primary antimicrobial effect exerted by lactobacilli is by the production of lactic acid and reduction of pH. However, there are other metabolic products such as hydrogen peroxide, diacetyl, propionic acid, acetic acid, carbon dioxide, reuterin and bacteriocins reported to contribute to its antimicrobial activity. The antimicrobial compounds from LAB are of special interest with regard to the health acceptability and potential use in bio-preservation. Since the discovery of the first bacteriocin by Gratia in 1925 (Garneau et al., 2002), bacteriocin production has been found in numerous species of bacteria.

Nisin is the only bacteriocin approved in several countries for use as a food preservative. Nisin in combination with potassium sorbate and sodium benzoate was studied to eliminate pathogens in foods. Compared to nisin, pediocin has been shown to be more effective against some of the foodborne pathogens (Cintas et al., 1998). Moreover, the evaluation of antibacterial efficacy of the bacteriocins, nisin and pediocin AcH revealed that they had better antibacterial property in combination due to synergistic effect than when used individually. The bacteriocins have been extensively
studied as potential bio-preservatives. The bacteriocins from lactobacilli isolated from other traditional foods of India have proven its applicability in bio-preservation. Bacteriocins of LAB are defined as ribosomally synthesized proteins or protein complexes usually antagonistic to genetically closely related organisms (Klaenhammer, 1988; Nes & Johnsborg, 2004). A number of bacteriocins have been described for Lactobacillus plantarum isolated from fermented meat products, other food sources and fermented beverages (Powell et al., 2007). Since the majority of bacteriocinogenic lactobacilli are natural food isolates, their antimicrobial peptides could be exploited by the food industry as a tool to control undesirable bacteria in a food-grade and natural manner.

There are at least three ways in which bacteriocins can be incorporated into a food to improve its safety. Purified/semi-purified bacteriocin preparation can be used as an ingredient in food, by incorporating an ingredient previously fermented with a bacteriocin-producing strain, or by using a bacteriocin-producing culture to replace all or part of a starter culture in fermented foods to produce the bacteriocin in situ (Parada et al., 2007). Studies have been conducted on the effect of various media components on the production of bacteriocins. Bacteriocins are generally low molecular weight proteins that gain entry into target cells by binding to cell surface receptors. The modes of action of bacteriocins are generally by targeting the cytoplasmic membrane. They dissipate the proton motive force through the formation of pores in the phospholipids bilayer. This action results in the inhibition of protein or nucleic acid biosynthesis and loss of ions (Bauer & Dicks, 2005).

The antimicrobial metabolites produced by LAB can be divided into low molecular mass compounds (below 1000) and bacteriocins (molecular mass over 1000). The biologically active non proteinaceous low molecular mass compounds produced by
LAB are poorly characterized. These compounds differ from the bacteriocins having wide spectrum of activity against gram positive, gram negative bacteria and fungi. Purifying the compound was difficult because several compounds were involved in the cooperative action and because the concentration of the compound was quite low. All the compounds have several interesting potential applications in the food, feed and pharmaceutical industries. Their common features were small size and aromatic or heterocyclic structure. Synergistic activity among these compounds is also promising for variety of application in industries (Niku-Paavola et al., 1999).

The increase in bacterial resistance to various antibiotics has stimulated investigations around the world to improve disease control strategies which led to the discovery of new vaccines and non-specific immune-stimulants (Balcazar et al., 2008). Thus, there is a growing interest in the use of probiotic bacteria worldwide for their various beneficial influences on animal and human health. The term probiotic is a relatively new word meaning “for life” and it is currently used to name bacteria associated with beneficial effects for humans and animals. Probiotics are defined as ‘live microorganisms that, when administered in adequate amounts, confer a health benefit on the host’. Members of the genera *Lactobacillus* and *Bifidobacterium* are mainly used as probiotic microorganisms in probiotic foods and are made available to the consumer (Reid et al., 2003).

Bacteria are normal inhabitants of humans (as well as the bodies of animals and insects) including the gastrointestinal tract (GIT), where more than 500 bacterial species are found. For use in foods, probiotic microorganisms should not only be capable of surviving passage through the digestive tract but also have the capability to proliferate in the gut. This means that they must be resistant to gastric juices and be able to grow in the presence of bile in the intestines. On considering the harmful effect that antibiotics
can have on the gut microbiota, the potential of probiotic bacteria act as mediators of antibacterial agents to the GIT (Leeber et al., 2008).

Various reports have described their health benefits on gastrointestinal infections, antimicrobial activity, improvement in lactose metabolism, reduction in serum cholesterol, immune system stimulation, anti-mutagenic properties, anti-carcinogenic properties, anti-diarrheal properties, improvement in inflammatory bowel disease and suppression of *Helicobacter pylori* infection by addition of selected strains to food products (Gomes & Malcata, 1999; Agerholm-Larsen et al., 2000; Gotcheva et al., 2002). Traditionally, probiotics have been added to yogurt and other fermented dairy products (Laroia & Martin, 1991; Young, 1998; Hagen & Narvhus, 1999; Lourens-Hattingh & Viljoen, 2001).

Nowadays there is an increasing consumer demand for non-dairy probiotic products. There are several probiotic products on the market but the documentation is often based upon case reports, animal studies or uncontrolled small clinical trials, and few products declare the content of microorganisms. Fermented foods are best suited to promote the positive attributes of probiotics because consumers are familiar with the fact that they contain living bacteria. There is a growing need of evidence documenting the beneficial health effects of probiotics while there is a lack of research on the application of probiotics in product development and the probiotic characteristics of fermented food (De Vries et al., 2006).

The capacity to produce different antimicrobial compounds may be one of the favourable characteristics for effective competitive exclusion of various pathogen survivals in the intestine and expression of a probiotic effect for the host (Ouwehand & Salminen, 1998). Although there is a large quantity of traditional fermented food
produced from different substrates, we still lack information about the identity and the source of some probiotic strains.

Thus, the present study deals with various beneficial attributes of lactobacilli including their probiotic properties and the characterization of the antimicrobial substances produced by them in an approach for its applicability in biomedicine and food preservation.