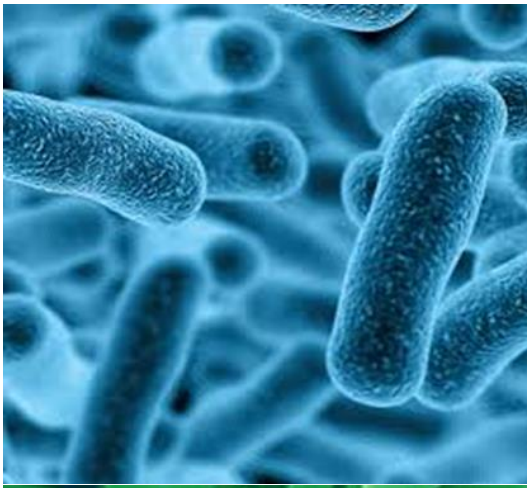
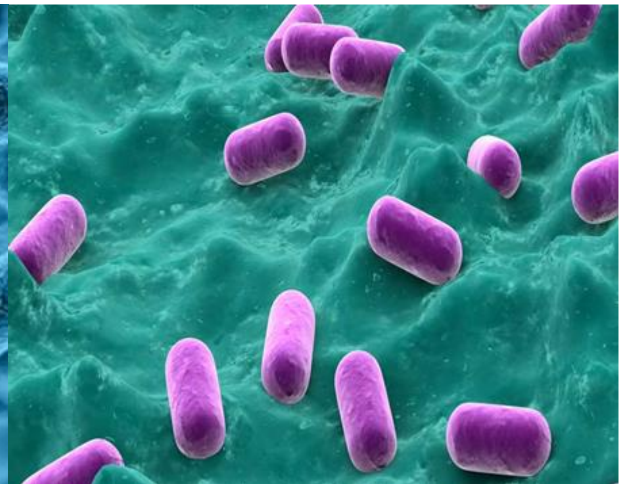
Bioprospecting Potential of *Lactobacillus plantarum* for Access and Benefit Sharing in Ethiopia





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1. Introduction

Ethiopia, a country endowed with rich biodiversity and traditional knowledge, promotes bioprospecting activities, which are important in the search for potentially valuable genetic resources and useful biochemical compounds in nature. However, like many other developing countries, the country lacks technical expertise and adequate monetary expenditures to explore the potential biological resources significantly. In order to explore and utilize the biological diversity strategically and wisely for commercial purposes, Ethiopia needs to collaborate with developed nations, local investors and any interested parties in the spheres of pharmaceuticals, cosmetics and other companies.

The Ethiopian Biodiversity Institute (EBI), acting as the National Competent Authority, has structured the Genetic Resources Access and Benefit Sharing Directorate, which plays a pivotal role in the implementation of the Nagoya Protocol on Access and Benefit Sharing of Genetic Resources and Associated Community Knowledge. Furthermore, through legal frameworks of the Proclamation No. 482/2006 and Regulation No. 169/2009 (Access to Genetic Resources and Community Knowledge and Community Rights), Ethiopia has been exercising the implementation of the access and benefit sharing objectives of the Nagoya Protocol, that were emanated from Convention on Biological Diversity (CBD). The Proclamation and Regulation includes a range of issues for example: ownership, user rights, conditions for access, benefit sharing, and types of benefits, powers and responsibilities among others.

The objective of this review is to encourage any bioprospecting Company or interested individuals or groups to work on the genetic resource, *Lactobacillus plantarum* for a variety of industrial food fermentations and antimicrobial property**.**

2. *Lactobacillus plantarum*

Lactobacillus plantarum is a bacterium scientifically classified in the Class Bacilli and Order Lactobacillales. It belongs to the Family *Lactobacillaceae* and Genus *Lactobacillus***.** *Lactobacillus* is the largest genus of the lactic acid bacteria group, which produces lactic acid as result of carbohydrate fermentation. *Lactobacillus plantarum* (LAB) is one of more than 50 *Lactobacillus* species (da Silva *et al.*, 2014). It is a lactic acid bacterium (LAB) used as starter, adjunctive and/or probiotic culture in the production of many fermented and functional foods to improve shelf-life, organoleptic properties and human health (Siezen *et al.,* 2011). It is one of the most versatile species, including several strains with valuable technological skills and recognized probiotic features (Guidone *et al.,* 2014).

Based on their mode of fermentation they can be classified as homo-fermentative, producing mainly lactic acid, and hetero-fermentative, which yield lactic acid as well as a large variety of fermentation products such as acetic acid, ethanol, carbon dioxide and formic acid (Kleerebezem and Hugenholtz, 2003).

3. Ecology and Distribution

Lactobacillus plantarum is a widespread member of the genus *Lactobacillus*, commonly found in many fermented food products as well as anaerobic plant matter. They are able to grow in a wide range of temperatures, salt concentrations and pH (Doyle and Meng, 2006).

4. Major Benefits of *Lactobacillus plantarum*

Lactobacilli are widespread microorganisms which are extensively used in the food field both as technological starters in the fermented products and as probiotics due to their strain-specific healthy properties (Altay *et al*., 2013). They contribute primarily to the rapid formation of lactic acid from the available carbon source resulting in acidification of the food raw material, which is a critical parameter in the preservation of these products. Most of *Lactobacillus plantarum* (LAB) are non-pathogenic and generally recognized as safe microorganisms.

4.1. Role in Food Industry

They are used widely in the industry worldwide in a variety of industrial food fermentations. The high levels of *L. plantarum* in food make it an important strain for the development of probiotics (Nybom *et al.,* 2008), which are defined as live microorganisms. Nowadays, these probiotics represent a key fast growing section of the food industry and are added to a number of products on the market, including yogurts, cheeses, ice creams and other desserts (Granato *et al.,* 2010).

Lactobacillus plantarum is commonly found in many cultural fermented food products in different parts of the world. Some of these include sauerkraut, pickles, brined olives, Korean kimchi, Nigerian Ogi, sourdough, and other fermented plant material, and also some cheeses, fermented sausages, and stock fish. This bacterium is commonly used for food fermentations like dairy products (fermented milk and cheeses), vegetable (pickles, table olives, sauerkraut, sourdough, etc.) and meat and fish sausages (Nybom *et al.*, 2008).

4.2. Nutrient Uptake and human health functioning

Lactobacillus plantarum has the encoded capacity for the uptake and utilization of many different sugars, uptake of peptides and formation of most amino acids. Some strains of *L. plantarum* have the ability to survive in the human gastrointestinal tract and has been proved for their capacity to adhere to the epithelium cells of the small intestine where they aid in nutrient uptake. *L. plantarum* strains hold multipurpose features as they can both carry out appreciable fermentative and metabolic processes, e.g., increasing the amount of specific micronutrients such as vitamins in the fermented food products.

The bacteria harbouring in human gut help in keeping pathogenic disease-causing microorganisms from flourishing. It creates a healthy barrier in the colon to keep dangerous bacteria from penetrating the lining of our intestines and entering the blood stream (Mayo *et al.*, 2010). Moreover, they promote the maintenance of consumers' health, due to their capacity to modulate the host immune response and to produce *de novo* vitamins in the human gut (Arena *et al.,* 2014). Regular consumption of lactic acid bacteria in fermented foods has a role in enhancing health and longevity. They can be administered in adequate amounts as probiotics for enhancing health in humans (Granato *et al.*, 2010).

4.3 Antimicrobial Property

Their ability to produce antimicrobial substances helps them to survive in the gastro-intestinal tract of humans. The antimicrobial substances produced by *L. plantarum* are reported to show significant effect on Gram-positive and Gram-negative bacteria (Silvestri *et al.,* 2014). The use of probiotics to produce antimicrobial metabolites, including organic acids, has been proposed as part of effective biocontrol strategies to contrast the contamination of animal feed by spoilage and pathogenic microorganisms and to reduce pathogen loads in livestock (Gerbaldo *et al.,* 2012).

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