A REVIEW ON FERMENTED MILKS AND MILK PRODUCTS AS FUNCTIONAL FOODS

Dr. Preeti Singh*; Dr. Jigar Haria**

*Associate Professor,
Department of Pharmacology, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA
Email id: drpreetisinghtmu@gmail.com

**Professor,
Department of General Medicine, Teerthanker Mahaveer University,
Moradabad, Uttar Pradesh, INDIA
Email id: dr.jigar.haria@gmail.com
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ABSTRACT

Fermented foods and drinks provide a wide range of nutritional and medicinal benefits. Lactic acid bacteria (LAB) play a critical part in the health benefits of fermented milks and similar products. The use of Lactobacillus acidophilus and Bifidobacteria spp. in probiotic dairy meals is well-known. At the moment of consumption, cultured goods with any claim of health benefits should satisfy the recommended minimum amount of more than 106 cfu/g. Yogurt has been reintroduced as a probiotic carrier food. Several food powders, such as yoghurt powder and curd (dahi) powder, are produced with the amount of organisms that survive after drying in mind. Consumers like such meals, drinks, and powders because of their taste and fragrance, as well as their high nutritional content. Because antitumor activity is linked to the cell wall of the starting bacterium, it persists even after drying. Preventing gastrointestinal infections, lowering serum cholesterol levels, and having antimutagenic action are some of the other health advantages of fermented milks. Lactose intolerant people and those with atherosclerosis should consume the fermented goods. The development of fermented dietetic preparations and specialty goods is a growing field of study. The health advantages of fermented milks, as well as the technology used to make them and the kinetics of lactic acid fermentation in dairy products, are discussed.

KEYWORDS: *Fermented Milks, L. Acidophilus, Bifidobacteria, Probiotics, Lactic Acid Bacteria*

1. INTRODUCTION

One of the most commonly stated reasons for dietary choices in EU nations is health. Individuals are thought to be in charge of their own health. Diseases are increasingly being seen as the outcome of consumer behavior rather than the effect of the environment. Obesity, cardiovascular disease, cancer, and other lifestyle-related illnesses may all be influenced by a person's diet. Traditionally, nutritional variables such as fat, fiber, salt, and vitamin content of food have been linked to health. Food may include single components that have a beneficial effect on our well-being in addition to conventional healthiness**[1].** Functional foods are products that claim to have certain physiological benefits that are helpful to the body. By enhancing or adding a possible health-promoting element to a food, it may be made more functional. Alternatively, unfavorable component concentrations might be decreased, or there could be a partial exchange of harmful and helpful substances.

Without a prescription, functional food may be used as a therapeutic assistance. Stephen De Felice, the founder of the Foundation for Innovation in Medicine, invented the word nutraceutical in 1989. A nutraceutical, according to him, is a food, dietary supplement, or medicinal food that provides a medical or health benefit, such as illness prevention or therapy **[2].** Today, the terms nutraceutical and functional food are often used interchangeably. In the United States and Europe, there is no formal meaning for the phrase functional foods. According to EU concerted action, "a food can be considered functional if it has been satisfactorily demonstrated to affect beneficially one or more target functions in the body beyond adequate nutritional effects in a way that is relevant to either an improved state of health and well-being and/or a reduction of disease risk in a way that is relevant to either an improved state of health and well-being and/or a reduction of disease risk in a way that is relevant to either an improved state of health and well-being and

Functional meals are manufactured in a variety of ways, depending on the technique used to make them or the purpose for which they are intended. Functional meals may be modified or fortified with various chemicals, and the functionality of a product can be tailored to a specific illness or just to enhance general health. Because the health impact cannot be seen from the product itself, knowledge on health effects and methods of disseminating such information are critical. The nutraceutical or functional food business has grown from a market of $20.2 billion in 1989 to a market worth $20.2 billion in 2002.

Functional drinks had sales of $10.35 billion in 2002, increasing 10.7% from the previous year, and are expected to reach $15.9 billion by 2010. A broad range of functional dairy meals are gaining popularity throughout the globe. Probiotic, prebiotic, and symbiotic goods, low cholesterol fresh milk omega-3-milk, low lactose, and lactose-free products, and milk products that can regulate or manage hypertension and immunological functions are only a few examples**[3].** The market for functional foods, nutraceuticals, wellness foods, and beverages is rapidly expanding, and the functional food sector is expected to almost double in size by 2007. As the population ages, a growing segment of the population is turning to functional foods. Weight reduction and management, heart health, eye health, cancer, increased energy and stamina, eye health, and better memory are all priorities for today's customers. To address these difficulties, a variety of functional meals and drinks have been created.

The purpose of this paper is to provide an overview of the kinetics of lactic acid fermentation in dairy products, as well as the technology and nutritional significance of fermented milks popular in various countries, as well as the therapeutic properties of probiotic organisms used in their production.

1.1. Lactic Acid Fermentation:

1.1.1. Fermentation Kinetics:

The biokinetics of functional starting cultures may be mathematically analyzed to learn more about the connection between the food environment and bacterial functionality, which can help with strain selection and process design. This may lead to improved process control, improved food safety and quality, and a decrease in financial losses. To understand the fermentation process and create continuous fermentation systems, kinetic data is required. Lactic acid bacteria (LAB) have long been employed as starting cultures for the production of fermented meat and dairy products in the food industry **[4].** Lactic acid, a commercially important product with uses in the food and pharmaceutical sectors, is the main metabolite generated during such fermentation processes. Lactic acid may be produced using chemical or biotechnological techniques, however lactic acid produced via fermentative procedures has gained market share due to customer desire for natural goods.

The dairy fermentation business, which includes the manufacture of cheeses, fromagefrais, sour cream, and other dairy products, is well-known and ranks second only to alcoholic drinks in terms of economic importance. The methods for using wood may be focused toward the generation of lactic acid. Several researchers have looked at the kinetics of milk fermentation by starting cultures. On the fermentation process of yoghurt, Response Surface Methodology has been effectively utilized in modeling of acidification rate and starter bacteria development as a function of factors such as fermentation temperature, fat and solid content, inoculum size, and cocci/rods ratio.

A pH measuring technique that is frequently used to determine acidification kinetics during gel formation. Several researchers have created models to predict acidification kinetics and attempted to improve the acidification process for the production of fermented goods. The effect of fermentation operating temperatures on cell growth rate, cell concentration, substrate utilization rate, and lactic acid generation rate has been predicted using mathematical models. A variety of models, both fully empirical and partly empirical, have been presented in the literature. Lactic fermentations are well-known for their product inhibition [3].

1.1.2. Common Organisms and Pathways:

LAB is an important component of fermentation processes, with a long and safe history of use and consumption in the manufacture of fermented foods and drinks. The acidity of the milk increases during lactose to lactic acid fermentation, and the growth conditions for bacteria other than LAB become more hostile. In South East Asia, the LAB is found in fermented foods. They spoke about how LAB is distributed and used in different goods including fermented milk, meat, fish, vegetables, and plant items. Many of these bacteria's major technical characteristics have seen significant progress in understanding their genetic, biochemical, and physiological bases. LAB are made up of a diverse collection of Gram-positive bacteria that have a fermentative metabolism **[5].**

The capacity of all LAB to ferment lactose and a variety of other carbohydrates into the main end product, lactic acid, is one of their most significant functional characteristics. LAB are useful for both household and industrial operations due to their capacity to convert food into new products and perform antagonistic activity against dangerous bacteria. Servin is a fictional character (2004). There are many phenotypic and genotypic types of LAB involved in the manufacture of fermented milks. Different dietary needs, physiological, cultivational, and technical characteristics distinguish these groupings. LAB found in fermented milks has been linked to Lactobacillus, Streptococcus, Pediococcus, Leuconostoc, and Lactococcus genera, according to many studies. In African fermented milks, the function of yeasts and LAB interaction.

1.1.3. Fermentation Process and Health:

Fermented milks are an essential component of our diet. Humans first saw fermentation in ancient times, but they didn't understand why it happened. Originally, milk fermented spontaneously, and the reuse of fermentation containers and equipment helped to ensure that the fermentation process was repeatable and stable. As a result, certain microbes were used to produce more or less refined goods. Different nations, or even different regions within a same country, created their unique fermented milks. The most well-known product is yoghurt, a thermophilic fermented milk that has grown in popularity during the past three decades **[6].**

The importance of live microorganisms in fermented dairy products has piqued the attention of both consumers and producers. Through the action of lactic LAB, nature has given a degree of positive connection for humans. These bacteria may be found in a variety of foods as well as agricultural fermentations. These are renowned for their length of human life, in addition to their preservation, nutritional, and therapeutic significance. LAB are natural residents of the gastrointestinal system. These bacteria have a variety of characteristics that make them especially appealing as "probiotics."

The acidity of milk increases during lactose to lactic acid fermentation, and the growth conditions for bacteria other than LAB become more hostile. Fermentation bacteria generate bacteriostatic chemicals in addition to the primary metabolite lactic acid. Ingestion of LAB has been proposed to counteract the impact of Escherichia coli outgrowth via a variety of mechanisms, including anti-E. coli metabolites, detoxification of enterotoxins, inhibition of toxic amine production, and gut adhesion, thereby avoiding harmful bacteria colonization. To generate energy and equilibrate the redox equilibrium, homofermentative LAB convert the available energy source (Lactose) nearly entirely to lactic acid through pyruvate **[7].** Specific LAB strains' fermentation activity may result in the elimination of toxic or antinutritive components like lactose and galactose from fermented milks, preventing lactose intolerance and galactose buildup **[8].**

1.2. Technology of Fermented Milk and Milk Products:

Aside from the conventional goods that are popular in different nations, probiotic products, dairy drinks, dietetic preparations, and dry cultured products are being developed in response to the growing demand for such value added products and convenience based components. Process technology is provided for several types of such goods. Cultured milks containing mesophilic organisms and thermophilic milks are two of the most common types **[6].**

1.2.1. Cultured Milk:

Cultured milk is a term that refers to a variety of mesophilic fermented milks that share a number of features. Mesophilic organisms have a growth temperature range of 20 to 30 degrees Celsius. Aroma producers and homofermentative mesophilic LAB are employed as fermentation starters. Mesophilic lactic cultures include group N streptococci and/or leuconostocs and grow in a temperature range of 10–40C. The final flavor of cultured milk is the consequence of a complex combination of chemicals in a certain proportion[9]. The taste diacetyl is linked with butter and buttermilk, for example. Cultured milk should be somewhat acidic and prickly. To fulfill these criteria, the amount of lactic acid and carbohydrate in the product must be carefully monitored throughout production. Acidification may be controlled by chilling the milk at the appropriate moment, while excess carbon dioxide in the product at the conclusion of fermentation can be eliminated by stirring or vacuum de-aeration **[9].**

Heat treatment of milk used to make cultured milk is required to inactivate native chemicals that are inhibitory to the LAB and to enhance the end product's structure by denaturing whey proteins. 805 or more whey proteins should be denatured to produce a coagulam that can be readily mixed to a smooth and viscous product. This may be achieved by a heat treatment of 90°C for 3 minutes or 85°C for 30 minutes.

Milk hardness is reduced and acidity is delayed when the pasteurization temperature is lowered. In cultured milks, ultra high temperature (UHT) sterilized milk and other high temperature treated milks result in reduced viscosity, thickening with age, and a cooked taste. To achieve a proper distribution of fat, homogenization of milk at 55°C and 20 MPa is adequate. There is a flavor change when the amount of milk solids (not fat) is reduced. The product may become "flat" and "watery," and a "astringent" fault may develop. Increased MSNF in milk results in a more “full” flavor, greater viscosity, and stable cultured milk that does not whine during cold storage[10].

1.2.2. Dry Cultured Milk Products:

Various dry cultured products, such as yoghurt, acidophilus milk, kumiss, and kefir, have undergone extensive study, and are typically coupled with ingredients that improve the nutritional quality of the final product. Streptococcus thermophilus, Lactobacillus bulgaricus, Lactobacillus acidophilus (LA), "Kefir grains," and Bifidobacterium adolescens are among the starter bacteria for dry cultured drinks[4]. In this area, there has been very little scientific work published, and the established methods are protected by patents. In general, the processing of these goods varies from that of traditional cultured products in several ways. Prior to culture, milk is heated to 90–95°C for 20 minutes. A total solids content of 30% has been shown to be the most beneficial. Vacuum evaporation or ultrafiltration are used to concentrate the liquid. The benefit of utilizing concentrated milk for culture is that it saves space and provides bacteria with some stimulation **[7].**

2. DISCUSSION

The growing popularity of fruit-flavored drinkable yoghurt across the globe presents a great potential for whey to be used in the creation of cultured fruit-flavored products. In the production of fermentable cultured dairy drinks, the quantity of stabilizer used, as well as heat processing and homogenization of the components, are critical. The standardized method for making drinks from sweet or acid whey involves adding sugar to filtered whey, pasteurization at 80°C for 5 minutes, homogenization at 70°C, incubation at 43°C with 2 percent Lactobacillus helveticus starter for 15–17 hours to pH 3.8–3.95, repasteurization at 85°C with 5 minute holding, addition of 4–7% fruit juice concentrate, rehomogenization, cooling to 50°C, and paddling The drink had a total solids content of 11.65–13.1 percent, total sugar content of 11.27–11.65 percent, protein content of 0.66–0.78 percent, fat content of 0.2–0.3 percent, and mineral content of 0.42–0.46 percent.

Bifidobacteria culture, whey, and mango juice are all included in the Mango-molke mix, a popular whey beverage sold in Europe. To make fermented whey drinks, LAB's probiotic properties may be used. People with gastro-intestinal problems may benefit from these beverages, which also offer nutritious and therapeutic soft drinks. Cheese whey and milk may be combined to create a high-quality whey-based fermented milk beverage. The fermented milk beverage produced by combining 70% cheese-whey and 0.3 percent CMC with milk yields an appropriate whey-based fermented milk beverage.

Food fortification may be a useful strategy in the fight against micronutrient deficiency. The compatibility of the vehicle, fortificant, and procedure is critical for effective food fortification technology use. Functional foods can include modified foods, such as those fortified with nutrients (ADA reports). Functional foods, such as whole foods, fortified enriched or enhanced foods, offer a potential health benefit when eaten as part of a diverse diet on a regular basis at effective levels, according to the American Dietetic Association (ADA). Iron fortification programs have traditionally utilized fermented dairy products like yoghurt and soft cheeses. Ferrous sulfate, at a concentration of 10 ppm, was shown to be stable over a 12-month period in powdered nonfat dry milk fortification. At a level of 20 ppm iron in the reconstituted product, ferric ammonium citrate and ferric chloride yielded satisfactory results. Enrichment and fortification are sometimes used interchangeably, but it is defined as the replacement of vitamins and minerals lost during processing elsewhere.

3. CONCLUSION

The integration of probiotic organisms into the production process for well-accepted conventional dairy products will be extensively investigated in order to create additional probiotic goods. The development of convenience-based dry cultured goods containing live bacteria using different methods such as microencapsulation, as well as the fortification of such powders or concentrated products with minerals and vitamins, is becoming more important. Preparing appropriate mixes including healthy components like dietary fiber, natural vitamins, and folic acid also opens up new opportunities in this rapidly growing field of study. The beverage sector would undoubtedly benefit from the development of different health beverages and dietetic preparations as value added goods based on traditional fermented products. Apart from the overall nutritional improvement obtained, further study is needed to differentiate the therapeutic effects of viable and nonviable organisms in various fermented products.

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