FERMENTED BEVERAGES AS A TOOL FOR SOCIAL INCLUSION AND PUBLIC HEALTH

Anastasiia Hirina*, Natalia Gregirchak
National University of Food Technologies, Kyiv, Ukraine
**Corresponding author: anastasiia.girina07@gmail.com*

Fermented foods have a long history of development, dating back to 8000 BC. Archaeological findings show that even then, the indigenous people of China were already producing fermented beverages. Since ancient times, they have been not just a source of high nutritional value, but also a means of social integration, a means of communication between people, and a cultural heritage of each nation. This article examines the historical context of the emergence, development, and utilisation of fermented beverages. Particular attention is paid to their socio-cultural significance in various nations, both past and present. It is known that fermented beverages have played a key role in religious rites, celebrations and everyday life of many countries. The article also highlights the current state of development in the fermented beverage industry, particularly in the area of functional fermented beverages, which are very popular and offer significant health benefits to consumers. These beverages contain microorganisms that provide a specific functional effect. To a large extent, the growing popularity of functional fermented drinks is due to the possibility of producing them using non-dairy raw materials, which are suitable for vulnerable groups of people with food allergies or certain religious restrictions. In addition, consumers' interest in these drinks brings together people with similar views on life and personal values. The use of local raw materials can contribute to sustainable development and support local businesses.

Keywords: fermented beverages, social inclusion, cultural heritage, healthy eating, probiotics

DOI: 10.24263/EDSD-2025-7-10

Received 14.05.2025
Received in revised form 08.09.2025
Accepted 22.09.2025

Introduction

For thousands of years, fermented foods and beverages have played a key role in the development of human civilisation. They have been a tool for cultural identification within society, promoting social integration, and, of course, are part of the diet. The first mention of the production of fermented beverages dates back to over 8000 BC. This data was obtained after archaeological excavations in Asia. Since then, humanity has made significant progress in terms of formation and historical development. Today, fermented beverages are used less frequently in religious or traditional ceremonies, but they have become an integral part of each country's cultural heritage, reflecting its history and traditions. They remind us who we are and bring people together around the world (Cuamatzin-Garca et al., 2022).

Initially, the production of fermented food was a method of extending the shelf life of raw materials. Currently, the growing interest in fermented beverages, including functional fermented drinks, is attributed to their potential health benefits. They have probiotic, prebiotic, anti-inflammatory, antimicrobial, antitoxic and immunomodulatory effects, which is appreciated by the

modern consumer. An additional advantage of functional fermented beverages is their convenient form of release, which is particularly beneficial for those who lead an active lifestyle (Alexandre et al., 2023).

Historical background, social and historical significance of fermented beverages

Traditional fermented foods and beverages play a crucial role in the modern diet. They have a significant positive impact on consumer health and are an integral part of the cultural heritage and identity of each nation. Fermented beverages have a long history of existence and consumption in every region. The first recorded mention of the production of fermented drinks dates back to approximately 8000 BC, originating in Asia. This conclusion was made possible after archaeological excavations in the region and the discovery of ancient vessels used for the production and storage of beverages.

For thousands of years, humanity has been discovering new horizons and opportunities for making fermented foods. This was primarily due to practical considerations, such as the need to satisfy hunger and the requirement for long-term storage of raw materials. Over time, it became clear that fermented foods and beverages not only have a longer shelf life, but also have unique organoleptic and structural properties. They also have specific physiological effects and greater nutritional value compared to the raw materials used. For this reason, throughout various periods of history and in different regions of the world, a diverse range of fermented products has emerged, some of which remain popular today. And some have remained only on the pages of history and scientific publications because they have not retained their popularity over the centuries. However, all of them are a symbol of the cultural heritage of each nation (Cuamatzin-García et al., 2022).

Recipes for fermented beverages were essential knowledge and were passed down from generation to generation, adapting to the culinary traditions of each community and the resources available. These drinks were usually relatively easy to prepare, but because of their simplicity, they are deeply rooted in cultural practices. For example, the production of chicha by the indigenous people of Latin America remains an essential aspect of preserving their history, cultural identity, and unity (Lasso García et al., 2024). In ancient times, residents of the Caucasus Mountains passed down kefir grains and recipes to their descendants, which was considered an indicator of the family's wealth and well-being. This could grant the family a special status, garnering attention and respect from the entire community. People sought to get closer to them, which led to the formation of new social ties and interactions among individuals. This, in turn, encouraged people from diverse families and communities to share their experiences, knowledge, and even technologies. And with the development of trade routes, fermented beverage recipes, as well as the raw materials for their production, spread around the world, introducing peoples to each other's cultural traditions and facilitating their exchange (Chong et al., 2023).

Additionally, there are a significant number of references to the use of fermented beverages in traditional or religious rites and celebrations, both past and present. These events attract many people, and one of the reasons that unites them is the traditional fermented beverage. An example of such beverages is Cauim, a traditional fermented drink in Brazil that is common among the indigenous peoples of the region and has been consumed during rituals or general celebrations since ancient times. Brazil has many indigenous peoples and all of them have their traditional drinks. However, the most widespread of these is Cauim, which has spread across the regions. In other nations, fermented beverages were consumed by all segments of society to celebrate significant

events, such as religious holidays. The ‘upper class’, who had to constantly hold feasts and receive guests, especially appreciated such drinks and even had special dishes for them. Drinking such drinks demonstrated the status of the hosts and their respect for their guests. In addition, for a long time, fermented food served as a form of currency that could be used to pay for work or exchanged for other goods. Alcoholic fermented beverages and the people who produced them were especially valued because they were used as medicinal remedies (Lasso García et al., 2024).

Fermented beverages have been widely consumed in Europe and Ukraine since ancient times and remain a significant part of the modern consumer's diet to this day. For Ukrainians, their traditional dishes, as well as traditional fermented food, are a source of pride and national heritage. That is why Ukrainian diasporas living outside of Ukraine often unite at joint meetings, where traditional dishes and drinks are prepared. And at multicultural events, it is not uncommon to find a variety of fermented foods and beverages from different countries that people want to introduce to others. This usually leads to lively discussions and sharing of experiences (Dulka et al., 2024). This is especially important to understand nowadays, when Ukrainian statehood and national unity are under threat and subject to external pressure. A good example of the importance of this issue is the reminder issued by the USA Department of Health on the peculiarities of Ukrainian culture and food habits. The aim was to help people from other countries better understand the Ukrainians who were coming to them. It was also intended to help them integrate into society more quickly. In this document, food habits and traditions are listed alongside significant issues such as language and culture, which once again demonstrate the importance of food, including fermented food, for cultural and social integration (Minnesota Department of Health, 2023).

The primary factors influencing the active development of the fermented foods sector are their health benefits, nutritional value, taste characteristics, ethnic integration, and local traditions. Over the past ten years, consumption of functional fermented beverages in Europe has risen by 55%. This enables us to establish new production facilities, create employment opportunities for workers, and foster social connections among specific groups of people (Dulka et al., 2024).

Fermented beverages to support public health

In addition to their cultural and social significance, fermented foods and beverages play a crucial role in maintaining public health through nutrition. They have a good nutritional value, a balanced composition and a significant amount of biologically active substances that support the state of our body. Undoubtedly, one of the most influential and popular groups of fermented products is functional fermented beverages, which are in great demand today. A large group of consumers prefers functional beverages due to their convenient form, which ensures a long shelf life and ease of consumption. These drinks are intended for consumption by all population groups, from children to adults. They are particularly appreciated by athletes or individuals with a fast-paced lifestyle that requires quick consumption of nutritious food without requiring time-consuming cooking or interrupting their activities (Dulka et al., 2024).

Functional fermented beverages have specific physiological effects that must be confirmed through clinical studies and can positively influence and improve consumer health. The impact of functional drinks depends on the microorganisms used for fermentation, fermentation conditions and the raw materials used as a matrix for the beverage. The primary desired effect of many drinks is the presence of probiotics and prebiotics (Dahiya & Nigam, 2022a).

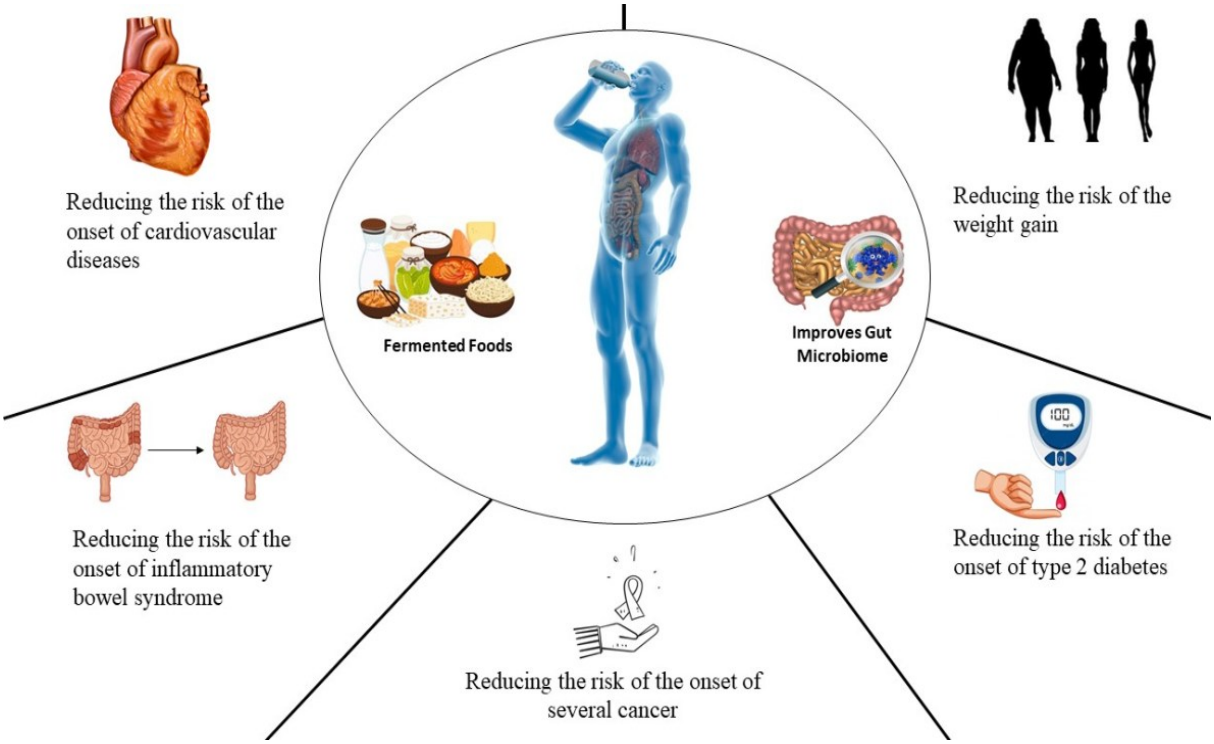

Figure 1. The main impact of fermented foods on human health (Patel, Butani, Kumar, Singh & Prajapati, 2023)

Beverages made with probiotic microorganisms have a beneficial effect on the gut microbiome, which is desirable among consumers. Therefore, a significant number of manufacturers already producing beverages or researchers developing new beverages are focusing their technology on this. For the production of such drinks, lactic acid bacteria or certain yeast strains with probiotic effects are utilised (Dahiya & Nigam, 2022b; Kumar et al., 2022).

According to the WHO recommendation, the concentration of viable cells in a functional drink should be at least 10^6 CFU/ml to achieve a certain physiological effect. The probiotic effect of functional drinks is based on the direct content of viable microorganisms, which, when they enter the gastrointestinal tract, have a positive impact on the microflora and overall health. They contribute to the growth of favourable intestinal microflora, produce biologically active compounds, and have antibacterial, antiviral and anti-inflammatory effects. In addition, functional fermented beverages can have an anti-tumour effect, influence immune formation, and even have a positive impact on mental health, reducing anxiety and depression, depending on the microorganisms used (Dahiya & Nigam, 2022b; Kumar et al., 2022).

Certain probiotic microorganisms, such as the probiotic yeast strain *Saccharomyces boulardii*, can inhibit the development of pathogenic microorganisms by either directly inhibiting their growth or indirectly affecting them. They have appropriate mechanisms by which they can neutralise the toxins released by pathogens by 'sticking' to the cells of these microorganisms and inhibiting their activity and reproduction. It also reduces the permeability of pathogenic bacteria to intestinal

Table 1. Microorganisms used in the development of new functional fermented products

Microorganism	Functional action	Reference
Bacteria		
Lactobacillus plantarum	Neutralize free radicals; have anti-inflammatory and immunomodulatory, antimutagenic and antioxidant effects; antimicrobial potential and antigenotoxicity	Garcia-Gonzalez, Battista, Prete & Corsetti, 2021
Lacticaseibacillus rhamnosus	Immunomodulatory effect, improved digestion and positive effect on the intestinal microbiota. They improve mental state, memory, cognitive functions, and reduce stress and anxiety	Al Kassaa & Fuad, 2024
Lactobacillus reuteri	Supports general well-being and healthy intestinal microflora. Anti-inflammatory, antipathogenic, immunomodulatory and anti-osteoporosis effects	Wang,, Zhou, Huang, Kuai & Shao, X, 2020
Propionibacterium freudenreichii	Antimicrobial, anticancer and antipathogenic effects; immunomodulatory ability (mechanisms of influence on innate and adaptive immunity); form bioactive metabolites and short-chain fatty acids	Dikeocha, Al-Kabsi, Ahmeda, Mathai &Alshawsh, 2023
Pediococcus acidilactici	Probiotic, anti-inflammatory, antimicrobial, antioxidant effect. Affect the reduction of fatty liver	Todorov et al., 2022
Yeast		
Streptococcus thermophilus	Improves lactose absorption in dairy products, hydrolysed soy protein; has anti-inflammatory effect, immunomodulatory function	Boulay, Haddad & Rul, 2020
Saccharomyces boulardii	It has antimicrobial, antitoxic, anti-inflammatory, probiotic, immunostimulating effects. It activates migration of monocytes and granulocytes, T-cells, changes lymphocyte adhesion, enhances immune response of the mucosa; trophic effect on intestinal mucosa, stabilisation of gastrointestinal barrier functions	Abid et al., 2022
Yarrowia lipolytica	Is a producer of a number of organic and fatty acids; antioxidant properties; has a positive effect on the cardiovascular system	Sørensen, Harholt & Arneborg, 2023
Schizosaccharomyces pombe	Anti-inflammatory, neuroprotective effect, improves memory	Huh et al., 2018
Saccharomyces cerevisiae	Can colonise intestinal cells anti-inflammatory, immunostimulatory and antimicrobial effects; antibiotic resistance	Siesto et al., 2022

epithelial cells, which can lower the risk of developing several serious diseases, and accelerates the elimination of pathogenic microorganisms from the human body, thereby speeding up the normalisation of its condition. The antiviral effect of a significant number of probiotic microorganisms is based on the reduction of oxidative stress in cells, which significantly improves consumer health (Manoj, Mohan, Khasherao, Shams, & Dash, 2023).

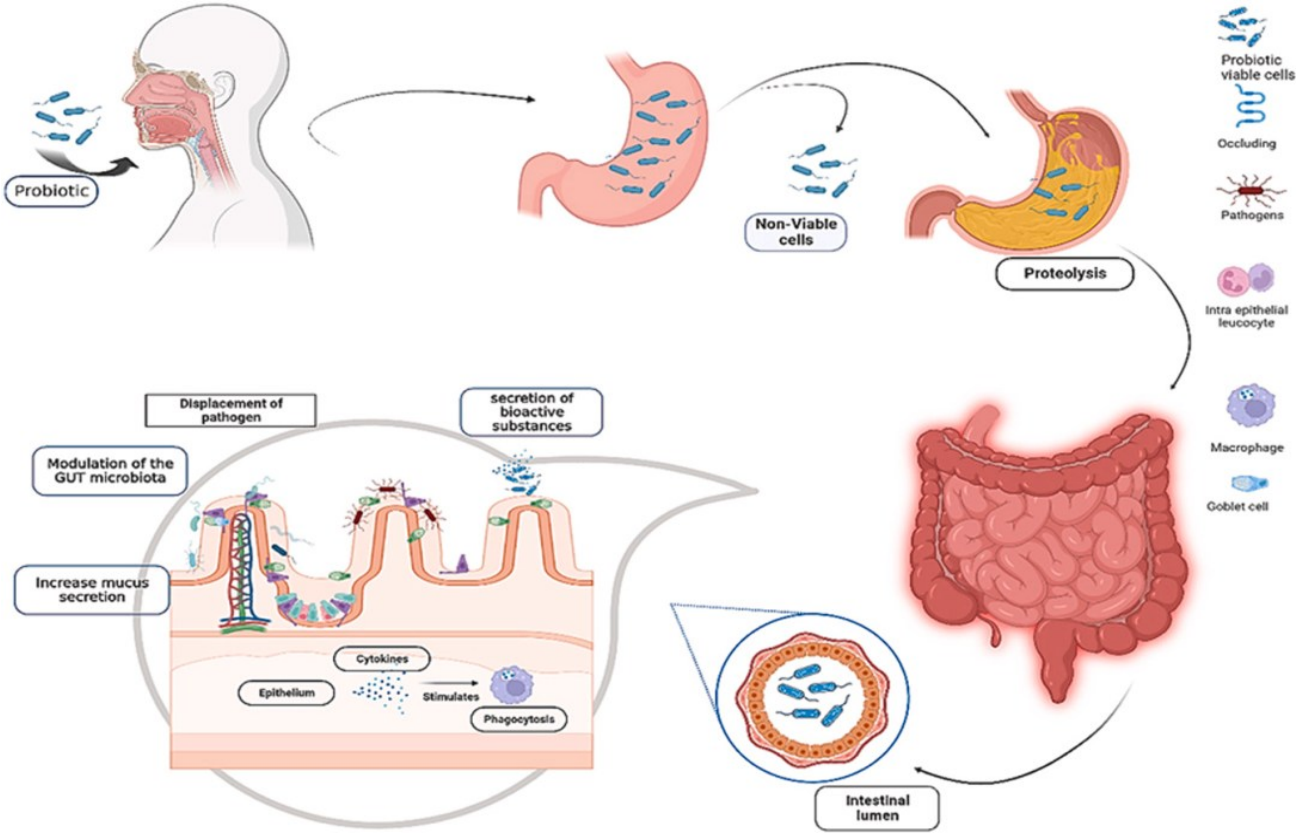

Figure 2. The Mechanism of Probiotics in the human digestive system (Manoj, Mohan, Khasherao, Shams & Dash, 2023)

Some microorganisms actively used in the development of new functional fermented beverages are capable of exhibiting antitoxic effects by producing specific antibodies and proteases that can break down certain toxins. They also have anti-inflammatory effects, reducing the manifestations of inflammatory processes in the gastrointestinal tract (Abid et al., 2022). Additionally, they can contribute to immune modulation by inducing various types of immune responses, thereby affecting both innate and adaptive immunity. This effect is possible through direct stimulation of immune activity, stimulation of immune cell development, or production of cytokines and immunoglobulins. This process occurs in the cells of the gastrointestinal tract, thereby enhancing the immune response of the mucous membrane (Tomičić et al., 2024).

Of course, the benefits and functional effects of each beverage are determined by the raw materials and microorganisms used in the fermentation process. Various factors, such as fermentation parameters and the concentration of cells in the finished product also influence this. However, fermented beverages generally have a positive effect on the digestive system, improving the mental

state and overall well-being of the consumer, which has a positive impact on the nation's health as a whole (Manoj, Mohan, Khasherao, Shams, & Dash, 2023).

Non-dairy functional fermented beverages

A significant number of people suffer from lactose intolerance or other food allergies. According to statistics, approximately 75% of the population has varying degrees of lactose intolerance, meaning they are unable to consume dairy products. It's worth noting that a significant number of fermented beverages are made from dairy raw materials. This has a historical background and practical aspects. However, given the following statistics, more attention should be paid to the production of non-dairy beverages, which lags behind the dairy industry (Dahiya & Nigam, 2022a).

Today, the production of non-dairy, functional, fermented beverages has excellent prospects and can help solve several economic and social problems. Firstly, local raw materials or even waste from other industries can be utilised for the production of beverages. In general, the choice of raw materials is influenced by several key factors, such as economic, environmental, or climatic. Cereals, legumes, vegetables, and fruits are commonly used raw materials in Ukraine. In addition to being non-dairy, which makes them ideal for individuals with specific physiological characteristics or religious beliefs, these raw materials offer several other benefits that positively impact consumer health (Mokoena, Mutanda, & Olaniran, 2016).

For example, cereals are a source of bioactive compounds, carbohydrates, proteins, vitamins and essential fatty acids. They have a high nutritional value and dietary fibre, which has a positive effect on the intestines, cardiovascular system and helps with weight loss. Some varieties have a low glycaemic index, making them suitable for people with diabetes (Salmerón, 2017).

Legumes serve as carriers for the delivery of bioactive substances, probiotics, and prebiotics. They contain indigestible oligosaccharides that are metabolised by microorganisms. They are a source of carotenoids, flavonoids, phenolic compounds, organic acids, carbohydrates, vitamins, high-quality proteins, and minerals. Due to their isoflavones, they can reduce the incidence of osteoporosis and affect menopause (Valero-Cases et al. 2020).

Fruits and vegetables are the most promising non-dairy raw materials for functional beverages today. The use of juices for fermentation improves the nutritional and functional properties of beverages by producing biologically active compounds. This makes the fermented beverage much healthier than the original raw material. Bioactive substances support the state of the human gastrointestinal tract, enhance antioxidant capacity, and improve the viability of microorganisms during fermentation. The dietary fibre contained in the raw materials also increases the survival of probiotic microorganisms during their passage through the gastrointestinal tract, which is unfavourable, thereby maximising the positive impact on the consumer's health. An additional advantage of this raw material is its abundance, as well as the possibility of using waste from other industries with a properly constructed technological scheme or fruit that does not have an attractive or marketable appearance. This will further support local producers and contribute to sustainable development (Dahiya & Nigam, 2022a; Damián et al., 2022).

Thus, non-dairy functional fermented beverages are a good alternative to beverages made from dairy raw materials. They are especially suitable for individuals with restrictions on dairy product consumption. At the same time, they have a functional effect and are beneficial for the body. In addition, the production of such beverages can be more cost-effective, depending on the raw

materials and technologies used, than the production of dairy fermented products, making these beverages more affordable for vulnerable, low-income groups (Dahiya & Nigam, 2022a).

Conclusions

Fermented beverages, including functional fermented drinks, have a long history, reflecting the traditions, values and cultural significance of these beverages for our ancestors. Today, they play a crucial role in modern society, serving as an integral part of social integration and national identity in every nation, while combining ancient traditions with innovative approaches to healthy eating. In the modern world, this is as important as the language or other traditions that unite a nation. Modern research confirms the health benefits of functional fermented beverages. The use of local raw materials can reduce production costs and support local producers, contributing to the sustainable and economic development of regions and increasing the availability of beverages for vulnerable groups.

Acknowledgment

Supported by Erasmus+ projects 101085243-ProEU-ERASMUS-JMO-2022-HEI-TCHRSCH and 101127449-EcoEurope-ERASMUS-JMO-2023-HEI-TCH-RSCH.

Conflict of interest

The authors state no conflict of interest.

References

Abid, R., Waseem, H., Ali, J., Ghazanfar, S., Muhammad Ali, G., Elasbali, A. M., & Alharethi, S. H. (2022). Probiotic Yeast *Saccharomyces*: Back to Nature to Improve Human Health. *Journal of fungi (Basel, Switzerland)*, 8(5), 444. https://doi.org/10.3390/jof8050444

Alexandre, E. M. C., Aguiar, N. F. B., Voss, G. B., & Pintado, M. E. (2023). Properties of Fermented Beverages from Food Wastes/By-Products. *Beverages*, 9(2), 45. https://doi.org/10.3390/beverages9020045

Al Kassaa, I., & Fuad, M. (2024). Effects of *Lacticaseibacillus rhamnosus* HN001 on happiness and mental well-being: Findings from a randomized controlled trial. *Nutrients*, 16(17), 2936. https://doi.org/10.3390/nu16172936

Boulay, M., Al Haddad, M., & Rul, F. (2020). *Streptococcus thermophilus* growth in soya milk: Sucrose consumption, nitrogen metabolism, soya protein hydrolysis and role of the cell-wall protease PrtS. *International Journal of Food Microbiology*, 335, 108903. https://doi.org/10.1016/j.ijfoodmicro.2020.108903

Chong, A. Q., Lau, S. W., Chin, N. L., Talib, R. A., & Basha, R. K. (2023). Fermented Beverage Benefits: A Comprehensive Review and Comparison of Kombucha and Kefir Microbiome. *Microorganisms*, 11(5), 1344. https://doi.org/10.3390/microorganisms11051344

Cuamatzin-García, L., Rodríguez-Rugarcía, P., El-Kassis, E. G., Galicia, G., Meza-Jiménez, M. L., Baños-Lara, M. D. R., Zaragoza-Maldonado, D. S., & Pérez-Armendáriz, B. (2022). Traditional Fermented Foods and Beverages from around the World and Their Health Benefits. *Microorganisms*, 10(6), 1151. https://doi.org/10.3390/microorganisms10061151

Dahiya, D., & Nigam, P. S. (2022). Nutrition and Health through the Use of Probiotic Strains in Fermentation to Produce Non-Dairy Functional Beverage Products Supporting Gut Microbiota. *Foods*, 11(18), 2760. https://doi.org/10.3390/foods11182760

Dahiya, D., & Nigam, P. S. (2022). Probiotics, prebiotics, synbiotics, and fermented foods as potential biotics in nutrition improving health via microbiome-gut-brain axis. *Fermentation*, 8(7), 303. https://doi.org/10.3390/fermentation8070303/

Damián, M. R., Cortes-Perez, N. G., Quintana, E. T., Ortiz-Moreno, A., Garfias Noguez, C., Cruceño-Casarrubias, C. E., Sánchez Pardo, M. E., & Bermúdez-Humarán, L. G. (2022). Functional Foods, Nutraceuticals and Probiotics: A Focus on Human Health. *Microorganisms*, 10(5), 1065. https://doi.org/10.3390/microorganisms10051065

Dikeocha, I. J., Al-Kabsi, A. M., Ahmeda, A. F., Mathai, M., & Alshawsh, M. A. (2023). Investigation into the Potential Role of *Propionibacterium freudenreichii* in Prevention of Colorectal Cancer and Its Effects on the Diversity of Gut Microbiota in Rats. *International journal of molecular sciences*, 24(9), 8080. https://doi.org/10.3390/ijms24098080

Dulka, O. S., Prybylskyi, V. L., Fedosov, O. L., Olijnyk, S. I., Kuts, A. M., Sharan, L. O., Koretska, I. L., & Tiurikova, I. S. (2024). Innovative water preparation technology for production of kombucha fermented beverage. J*ournal of Chemistry and Technologies*, 8(1), 82-91. http://chemistry.dnu.dp.ua

Garcia-Gonzalez, N., Battista, N., Prete, R., & Corsetti, A. (2021). Health-Promoting Role of *Lactiplantibacillus plantarum* Isolated from Fermented Foods. *Microorganisms*, 9(2), 349. https://doi.org/10.3390/microorganisms9020349

Huh, E., Lim, S., Kim, H. G., Ha, S. K., Park, H. Y., Huh, Y., & Oh, M. S., (2018). Ginger fermented with *Schizosaccharomyces pombe* alleviates memory impairment via protecting hippocampal neuronal cells in amyloid beta1-42 plaque injected mice. *Food & function*, 9(1), 171–178. https://doi.org/10.1039/c7fo01149k

Kumar, M. R., Azizi, N. F., Yeap, S. K., Abdullah, J. O., Khalid, M., Omar, 10. A. R., Osman, M. A., Leow, A. T. C., Mortadza, S. A. S., & Alitheen, N. B. (2022). Clinical and Preclinical Studies of Fermented Foods and Their Effects on Alzheimer's Disease. *Antioxidants* (Basel, Switzerland), 11(5), 883. https://doi.org/10.3390/antiox11050883

Lasso García, C., German Bermúdez, F. A., Vanden Berghe, W., Zurita-Benavides, M. G., & Orellana-Manzano, A. (2024). Fermented beverages among indigenous Latin American societies. *Frontiers in Sustainable Food Systems*, 8. https://doi.org/10.3389/fsufs.2024.1390162

Manoj, P. M., Mohan, J. R., Khasherao, B. Y., Shams, R., & Dash, K. K. (2023). Fruit-based probiotic functional beverages: A review. *Journal of Agriculture and Food Research*, 14, 100729. https://doi.org/10.1016/j.jafr.2023.100729

Minnesota Department of Health. Ukrainian Culture and Foods (2023, 12, 11) Retrieved https://www.health.state.mn.us/docs/people/wic/localagency/culture/ukrainian.pdf

Mokoena, M. P., Mutanda, T., & Olaniran, A. O. (2016). Perspectives on the probiotic potential of lactic acid bacteria from African traditional fermented foods and beverages. *Food & Nutrition Research*, 60, 29630. https://doi.org/10.3402/fnr.v60.29630

Patel, P., Butani, K., Kumar, A., Singh, S., & Prajapati, B. G. (2023). Effects of Fermented Food Consumption on Non-Communicable Diseases. *Foods*, 12(4), 687. https://doi.org/10.3390/foods12040687

Salmerón I. (2017). Fermented cereal beverages: from probiotic, prebiotic and synbiotic towards Nanoscience designed healthy drinks. *Letters in applied microbiology*, 65(2), 114–124. https://doi.org/10.1111/lam.12740

Siesto G, Pietrafesa R, Infantino V, Thanh C, Pappalardo I, Romano P, Capece A. (2022). In Vitro Study of Probiotic, Antioxidant and Anti-Inflammatory Activities among Indigenous *Saccharomyces cerevisiae* Strains. *Foods*.11(9):1342. https://doi.org/10.3390/foods11091342.

Sørensen, AB, Harholt, J., & Arneborg, N. (2023). Application of *Yarrowia lipolytica* in fermented beverages. *Front. Food. Sci. Technol*. 3. https://doi.org/10.3389/frfst.2023.1190063.

Todorov, S. D., Dioso, C. M., Liong, M. T., Nero, L. A., Khosravi-Darani, K., & Ivanova, I. V. (2022). Beneficial features of *Pediococcus*: from starter cultures and inhibitory activities to probiotic benefits. *World journal of microbiology & biotechnology*, 39(1), 4. https://doi.org/10.1007/s11274-022-03419-w

Tomičić, Z., Šarić, L., & Tomičić, R. (2024). Novel Insights in the Application of Probiotic Yeast *Saccharomyces boulardii* in Dairy Products and Health Promotion. *Foods*, 13(18), 2866. https://doi.org/10.3390/foods13182866

Valero-Cases, E., Cerdá-Bernad, D., Pastor, J.-J., & Frutos, M.-J. (2020). Non-dairy fermented beverages as potential carriers to ensure probiotics, prebiotics, and bioactive compounds arrival to the gut and their health benefits. *Nutrients*, 12. https://doi.org/10.3390//nu120616

Wang, H., Zhou, C., Huang, J., Kuai, X., & Shao, X. (2020). The potential therapeutic role of *Lactobacillus reuteri* for treatment of inflammatory bowel disease. *American journal of translational research*, 12(5), 1569–1583. https://pmc.ncbi.nlm.nih.gov/articles/PMC7270012/