# Overview of modern approaches to the development and optimization of probiotic yogurt technology

**Imangaliyeva Zhadyra Kenzhegazyevna**
Kazakhstan

**Statement of the Problem**: This paper examines modern methods of processing dairy products involving innovative technological solutions (high-intensity ultrasound treatment, ohmic heating, and high-pressure processing) and their impact on preserving bioactive compounds, improving sensory characteristics, and extending shelf life. It is shown that the introduction of these methods contributes to faster fermentation (HIU), reduced loss of vitamins and proteins (OH), and increased survival of probiotic cultures (HPP). In addition, the importance of integrating functional ingredients (probiotics, prebiotics, and antioxidants) is emphasized to enhance the nutritional value and improve the consumer properties of dairy products. The results obtained open up prospects for creating a new generation of products that meet the current requirements of functional nutrition.Relevance of the Problem. The modern dairy industry faces a number of challenges, including changing consumer food preferences, the need for innovative raw material processing technologies, and the necessity to increase the functionality of products. According to the study by Savaiano and Hutkins (2021), a balanced diet that includes dairy products plays an important role in preventing non-communicable diseases; however, contemporary dairy products must not only contain the necessary nutrients but also have proven health benefits. Special attention is paid to products containing functional ingredients such as probiotics, prebiotics, antioxidants, dietary fibers, and protein structures.

**Methodology**: The main research methods used included content analysis of publications in the ScienceDirect and Google Scholar databases over the period from 2016 to 2025, aiming to identify current trends in the production of functional dairy products.Research Results High-Intensity Ultrasound (HIU) for Improving the Texture of Dairy Products.One of the most promising methods of milk processing is high-intensity ultrasound treatment (HIU). According to the study by Wang et al. (2025), using HIU in the fermentation process of dairy products accelerates the formation of the protein gel, reducing the total fermentation time by 20–30%.Furthermore, the findings of Akdeniz & Akalın (2019) confirmed that ultrasound treatment reduces the size of protein aggregates, thereby increasing the homogeneity of the final product's texture. This effect also decreases the likelihood of syneresis (whey separation), which improves the consumer perception of the product. Therefore, using HIU not only speeds up the yogurt production process but also helps achieve a denser, creamier structure with improved organoleptic characteristics.Ohmic Heating (OH) as a Method for Preserving Bioactive Compounds.Ohmic heating (OH) is regarded as an alternative to traditional pasteurization, ensuring uniform heating of milk by passing an electric current through it. According to Silva et al. (2021), using this technology can reduce vitamin loss by up to 40% compared to traditional thermal treatment, due to gentler and more uniform temperature distribution.Moreover, the findings of Barros et al. (2021) showed that OH

helps preserve proteins in their native state, minimizing denaturation and improving the functional properties of the final product. Applying OH also increases the stability of probiotic cultures, which is confirmed by the study of Cappato et al. (2018), noting that ohmic heating helps maintain probiotic viability throughout the product's shelf life.High-Pressure Processing (HPP) – A Method for Increasing the Shelf Life of Dairy Products. Processing milk and dairy products with high pressure (HPP) is one of the most effective methods of extending shelf life without adversely affecting organoleptic properties. The study by Patrignani et al. (2017) showed that applying pressure in the range of 400–600 MPa makes it possible to preserve up to 85% of probiotic cultures, whereas with traditional pasteurization this figure does not exceed 50%.In addition,

**Conclusions and Significance of the Research** : This study demonstrated that the implementation of modern technologies for processing dairy products—such as high-intensity ultrasound (HIU), ohmic heating (OH), and high-pressure processing (HPP)—contributes to preserving bioactive compounds, improving sensory characteristics, and increasing shelf life.The use of ultrasound accelerates fermentation and enhances product texture, making them more uniform and creamy (Wang et al., 2025). Ohmic heating reduces losses of vitamins and proteins and also boosts probiotic survival, as confirmed by Silva et al. (2021). High-pressure processing extends the shelf life of dairy products without thermal impact, allowing up to 85% of probiotics to be preserved (Patrignani et al., 2017).Moreover, integrating functional ingredients such as probiotics, prebiotics, and antioxidants opens up new possibilities for creating products with proven health benefits.Hence, the further development of these technologies and their introduction into industrial production will allow for the creation of a new generation of dairy products that meet the requirements of functional nutrition while providing maximum health benefits to consumers.This research was funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP25794645).

## Biography

Zhadra Imangaliyeva received her PhD at the age of 28 from Kemerovo Technological University, specializing in Food Technology. She is currently engaged in research aimed at enhancing methods of food production and processing. She has published over 25 articles in high-impact international journals and serves on the editorial boards of several professional publications.

**Received**: March 20, 2025; **Accepted**: March 21, 2025; **Published**: May 20, 2025