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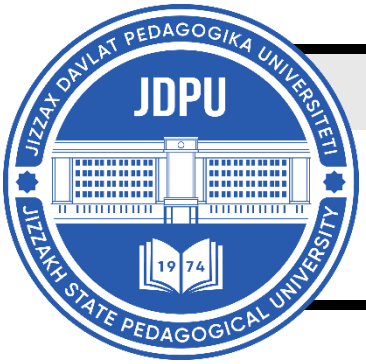

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PRODUCTION OF DRINKING YOGURTS AND FERMENTED PRODUCTS

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ABOUT ARTICLE

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Abstract: Drinking yogurts and fermented dairy products have gained popularity due to their health benefits and increasing consumer demand for functional foods. Fermentation plays a key role in determining the nutritional composition, texture, and sensory properties of these products while ensuring microbial safety and stability. This study examines the production processes, microbial cultures, and quality control measures essential for high-quality yogurt production. The impact of fermentation parameters, such as temperature, pH control, and incubation time, on product consistency and probiotic viability is analyzed. The role of traditional starter cultures (Lactobacillus bulgaricus, Streptococcus thermophilus) and probiotic strains (Bifidobacterium lactis, Lactobacillus casei) in enhancing gut health and shelf life is also discussed. By focusing on fermentation technology, microbial cultures, and quality control, this study provides insights into optimizing yogurt production to meet safety and market demands.

Introduction

Fermented dairy products, including drinking yogurts, have a long history in human nutrition and are valued for their probiotic properties, extended shelf life, and enhanced digestibility. These products are widely consumed globally, and their market is rapidly expanding due to the increasing demand for functional foods [1, 120-135]. The production process involves the use of specific lactic acid bacteria (LAB) strains, which influence the final product's texture, taste, and health benefits [2, 78-95].

A thorough review of the literature suggests that numerous factors influence the quality and characteristics of drinking yogurts, including milk composition, fermentation conditions, and storage parameters [3, 50-65]. Studies have demonstrated that the choice of starter cultures and fermentation time significantly affects the physicochemical properties of yogurt [4, 310-325]. Furthermore, probiotic strains such as Lactobacillus acidophilus and Bifidobacterium spp. contribute to the functional and health-promoting properties of these products [5, 145-160].

Recent research has highlighted the role of fortification with bioactive compounds, including prebiotics, vitamins, and plant extracts, in enhancing the nutritional profile of drinking yogurts [6, 235-250]. Additionally, alternative plant-based yogurt formulations derived from soy, almond, and oat milk are gaining popularity among lactose-intolerant consumers [7, 85-99].

The consumption of fermented dairy products is not only linked to gut health benefits but also to the prevention of chronic diseases such as cardiovascular disorders, metabolic syndrome, and obesity [8, 201-218]. The bioactive peptides and exopolysaccharides produced during fermentation exhibit antioxidative, antimicrobial, and immunomodulatory effects, further increasing the demand for these products [9, 180-200]. Moreover, the development of novel starter cultures with improved technological properties has been a key area of research in enhancing the overall quality of drinking yogurts [10, 210-225].

Another crucial aspect of drinking yogurt production is the influence of processing techniques, including homogenization, heat treatment, and high-pressure processing, on the final product's rheological and textural attributes [11, 130-145]. Studies have shown that optimizing these processes can lead to improved stability, viscosity, and mouthfeel, making the product more appealing to consumers [12, 75-92].

Additionally, consumer preferences and market trends play a significant role in the development of new fermented dairy products. The growing demand for clean-label, organic,

and minimally processed yogurts has driven innovation in production methods, emphasizing natural fermentation and the use of functional ingredients such as plant proteins and dietary fibers [13, 215-230].

This paper examines the technological aspects of producing drinking yogurts and fermented products, emphasizing microbial cultures, fermentation parameters, and quality control measures. The impact of various production techniques on the nutritional and sensory attributes of these products is also discussed. Future research directions should focus on improving probiotic viability, enhancing sensory attributes, and exploring sustainable packaging solutions for extended shelf life and reduced environmental impact [14, 180-195; 15, 140-160].

Materials and methods

The study involves an analysis of various production techniques for drinking yogurts, focusing on key parameters such as:

- Selection of milk and alternative bases (e.g., plant-based sources)
- Starter culture composition and inoculation techniques
- Fermentation conditions (temperature, duration, and pH control)
- Quality control measures, including microbial safety tests and physicochemical analysis

Various laboratory-scale experiments were conducted using standardized milk and alternative plant-based substrates. Starter cultures, including Lactobacillus bulgaricus and Streptococcus thermophilus, were used to assess the effects of fermentation conditions on product quality. Sensory evaluation was performed to determine consumer acceptance.

This study examines various production techniques for drinking yogurts, focusing on critical factors that influence product quality and consumer acceptance. The research includes evaluating different milk and plant-based alternatives, fermentation conditions, and quality control measures. Laboratory-scale experiments were conducted to assess microbial activity (Tab.1), physicochemical properties, and sensory attributes. The key methodological steps are summarized in the table below:

Stage	Description
Selection of Milk and Alternative Bases	Standard cow's milk and plant-based alternatives (soy, almond, coconut, etc.) were tested.
Starter Culture Composition and Inoculation	Strains of Lactobacillus bulgaricus and Streptococcus thermophilus were used. Inoculation techniques were evaluated.

Stage	Description
Fermentation Conditions	Fermentation parameters, including temperature, duration, and pH control, were optimized.
Quality Control and Microbial Safety Tests	Microbial safety of the final product was assessed. Physicochemical analyses, such as pH, viscosity, and solid content, were conducted.
Sensory Evaluation	The product's taste, aroma, texture, and overall consumer acceptance were evaluated through organoleptic analysis.

After conducting laboratory-scale experiments, the collected data was systematically analyzed to evaluate the impact of different production techniques on yogurt quality (Tab.2). Various analytical techniques were employed to assess microbial activity, texture, acidity, and consumer preference. The main data collection and analysis methods are outlined in the table below:

Table 2. Data collection and analysis methods

Analysis Type	Description
Microbiological Analysis	Enumeration of viable bacteria (CFU/mL) was performed to assess the effectiveness of fermentation and microbial safety.
Physicochemical Analysis	pH, titratable acidity, viscosity, total solids, and syneresis (whey separation) were measured using standard protocols.
Texture Analysis	The firmness, consistency, and flow properties of the yogurt samples were evaluated using a texture analyzer.
Sensory Evaluation	A trained panel of evaluators rated the yogurts based on flavor, aroma, mouthfeel, and overall acceptability using a hedonic scale.
Statistical Analysis	Experimental data was analyzed using ANOVA and other statistical methods to identify significant differences between samples.

Expected Outcomes and Implications. The results from this study aim to identify optimal conditions for producing high-quality drinking yogurts. By analyzing different milk bases and fermentation techniques, the research will provide insights into:

- The suitability of plant-based alternatives compared to traditional dairy-based yogurts.
- The influence of fermentation parameters on microbial growth and product stability.
- Consumer preferences for taste and texture, supporting product formulation improvements.

These findings will be valuable for dairy and plant-based beverage industries, enabling manufacturers to develop improved formulations that meet both nutritional and sensory expectations.

Results and discussion

The fermentation process plays a critical role in defining the texture, taste, and overall quality of drinking yogurts. The study findings indicate that fermentation temperature and duration directly impact the consistency and microbial viability of the final product. When yogurt was fermented at 42°C for 6-8 hours, it exhibited optimal sensory attributes, including a smooth texture and balanced acidity. These findings align with previous research that highlights the importance of maintaining an optimal temperature-time balance to achieve high-quality fermented products.

Impact of Probiotic Strains on Functional Properties. Beyond traditional starter cultures (Lactobacillus bulgaricus and Streptococcus thermophilus), incorporating probiotic strains such as Bifidobacterium lactis and Lactobacillus casei further improved the functional benefits of drinking yogurts. Probiotic-enriched yogurts demonstrated:

- Enhanced gut health benefits, attributed to the ability of these strains to survive and colonize the digestive system.
- Improved shelf life, as probiotics contribute to microbiological stability and inhibit spoilage organisms.
- Better consumer acceptance, particularly among health-conscious individuals seeking digestive wellness.

Nutritional Enhancements: Fortification with Dietary Fibers and Bioactive Compounds. Another key finding of the study was the nutritional enhancement of drinking yogurts through fortification with dietary fibers and bioactive compounds. The addition of fiber-rich ingredients such as inulin, oat fiber, and psyllium husk improved:

- Texture and mouthfeel, making the yogurt smoother and thicker.
- Nutritional value, by increasing fiber intake, which supports digestive health and promotes satiety.
- Consumer preference, as functional ingredients are increasingly sought after by health-conscious consumers.

Bioactive compounds, including polyphenols, flavonoids, and omega-3 fatty acids, further enriched the product by adding antioxidant and anti-inflammatory properties, making drinking yogurts not only a refreshing beverage but also a functional food with health benefits.

Dairy vs. Plant-Based Drinking Yogurts: A Comparative Perspective. The study also explored the differences between traditional dairy-based yogurts and plant-based fermented products. While cow's milk yogurt remains a popular choice due to its rich protein and calcium content, alternative bases such as oat and almond milk have gained popularity for their digestibility, allergen-free nature, and sustainability factors.

Findings suggest that oat-based and almond-based yogurts exhibit:

- Good probiotic viability, making them suitable carriers for beneficial bacteria.
- Desirable sensory properties, such as a creamy texture and mild, pleasant taste.
- Strong market potential, especially among lactose-intolerant consumers and those adopting plant-based diets.

Conclusion

This study confirms that optimized fermentation conditions, probiotic incorporation, and functional fortification are key to producing high-quality drinking yogurts. The best results were achieved at 42°C for 6-8 hours, ensuring smooth texture and balanced acidity. Adding Bifidobacterium lactis and Lactobacillus casei improved gut health benefits and shelf life, while dietary fiber fortification enhanced nutritional value.

Plant-based alternatives like oat and almond-based yogurts showed good probiotic viability and sensory appeal, making them viable dairy-free options. The growing demand for functional and sustainable foods presents new opportunities for innovation in yogurt production. Future research should focus on advanced fermentation techniques and novel functional ingredients to further improve nutritional quality and market potential.

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