



Application of Biostime's Patented Lactobacillus Strains in Fermented Dairy Products in China: A Comparative Study on Product Differentiation and Quality Enhancement

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How to cite this paper: Yiwen Liu, Wei Tian, Min Zhang, Aimei Zhan, Ajia Dajiu, Shaoping Jiang, Peng Wang. (2024). Application of Biostime's Patented Lactobacillus Strains in Fermented Dairy Products in China: A Comparative Study on Product Differentiation and Quality Enhancement. *International Journal of Food Science and Agriculture*, 8(3), 131-136. DOI: 10.26855/ijfsa.2024.09.007

Received: July 20, 2024

Accepted: August 17, 2024

Published: September 14, 2024

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Abstract

Lactobacillus plays a crucial role in the production of fermented dairy products, with various strains influencing the quality of the final product. This study focuses on Biostime's patented Lactobacillus strains, evaluating their effects in Chinese fermented dairy products and comparing them with conventional strains. The analysis was conducted from the perspectives of product differentiation and quality enhancement. The selection process and characteristics of Biostime's patented strains were introduced first. The study then assessed their application in yogurt, cheese, and other fermented dairy products, emphasizing differences in physico-chemical properties, flavor, shelf life, and nutritional value. Results indicated that products containing Biostime's patented strains significantly outperformed those with conventional strains in terms of flavor, texture, shelf life, and nutritional content, demonstrating distinct advantages in product differentiation. These strains hold promising potential for widespread application in China's dairy industry, offering consumers higher-quality fermented dairy products. Further research is needed to optimize the compatibility between different strains and fermentation conditions to continuously enhance product quality.

Keywords

Lactobacillus; fermented dairy products; Biostime patented strains; product differentiation; quality enhancement

1. Introduction

Dairy products are one of the essential foods in people's daily lives, serving not only to meet the body's needs for nutrients such as protein, calcium, and vitamins, but also offering unique flavors and textures. Among them, fermented dairy products are an important segment of the dairy industry, occupying a significant market share. Fermented dairy products are produced through the fermentation of lactose by probiotics such as lactic acid bacteria. Lactic acid bacteria not only impart unique flavors and textures to fermented dairy products but also promote digestion and absorption, regulate intestinal flora, and enhance the body's immune function, thus being known as "active prebiotics." The choice of lactic acid bacteria strains is crucial to the quality of the final product [1].

Biostime, a well-known domestic dairy company, has been dedicated to the selection and development of lactic acid bacteria strains for many years. The company's patented lactic acid bacteria strains have been carefully selected and exhibit unique fermentation characteristics and activity, which have been applied in some of their products. However, whether these strains can bring product differentiation and quality improvement compared to conventional strains remains to be further studied and evaluated. This study will systematically evaluate the application effects of Biostime's patented lactic acid bacteria strains in fermented dairy products such as yogurt and cheese. The evaluation will include multiple

aspects such as physicochemical indicators, sensory tasting, shelf life, and nutritional value, in comparison with traditional strain products. The aim is to verify these strains' abilities to enhance product differentiation and quality, providing a theoretical basis for their promotion in the dairy industry and offering references for dairy companies in strain selection and product optimization.

2. Application of Biostime's Patented Lactic Acid Bacteria Strains in Fermented Dairy Products

2.1 Strain Characteristics and Selection Process

Biostime's patented lactic acid bacteria strains are high-quality strains obtained through years of research and selection, possessing several outstanding characteristics. These strains exhibit strong tolerance to gastric acid and bile salts, allowing them to effectively pass through the gastrointestinal tract while maintaining high activity. Compared to traditional strains, they have a faster fermentation rate and higher acid production capacity, which helps shorten the production cycle and improve product quality [2]. Additionally, these strains can produce special flavor compounds, such as specific esters and aldehydes, imparting unique aromas to the products. Research shows that these strains also have multiple probiotic functions, such as regulating intestinal flora, enhancing immunity, and promoting nutrient absorption.

The selection process of Biostime's patented lactic acid bacteria strains underwent multiple rigorous stages. First, researchers isolated a large number of lactic acid bacteria strains from traditional fermented dairy products and the human gastrointestinal tract. Subsequently, these strains were evaluated for basic characteristics such as acid resistance, bile salt tolerance, and antibiotic sensitivity, followed by assessments of their fermentation capability, flavor production ability, and probiotic functions. After preliminary screening, researchers conducted comprehensive safety evaluations on the advantageous strains, including toxicity testing and pathogenicity assessments. Finally, the performance of the strains in actual production processes was examined, including fermentation characteristics and stability. Through this series of stringent screening and evaluation processes, the final high-quality strains were identified and patented [3].

2.2 Application in Yogurt Products

The application of Biostime's patented lactic acid bacteria strains in yogurt products mainly focuses on optimizing the fermentation process and enhancing product quality. In terms of the fermentation process, using these patented strains can shorten the fermentation time by approximately 20%, significantly improving production efficiency. Additionally, these strains exhibit good fermentation capability within the temperature range of 35-42 °C, providing greater flexibility for process adjustments. Regarding product quality, due to their excellent acid production capacity and unique metabolic characteristics, the resulting yogurt has a finer texture and smoother mouthfeel. The special flavor compounds produced by the patented strains also give the yogurt a richer and more harmonious aroma.

The application of Biostime's patented lactic acid bacteria strains also shows significant advantages in functional enhancement and extended shelf life. These strains have a high survival rate in yogurt, maintaining a high count of live bacteria even during refrigerated storage. Research indicates that the content of certain amino acids and vitamins in yogurt fermented with these strains is higher than that in traditional yogurt, further enhancing the nutritional value of the product. In terms of storage, due to the strong antibacterial activity of these strains, yogurt made with them can be stored for 3-5 days longer under refrigerated conditions compared to traditional yogurt [4].

Biostime's patented lactic acid bacteria strains also open new possibilities for the development of specialized yogurt formulations. For example, these strains can maintain good fermentation capability in low-sugar environments, aiding in the development of low-sugar yogurt products. Research also found that these strains exhibit good fermentation characteristics in certain plant protein substrates, providing technical support for the development of plant-based yogurt. These characteristics not only improve the production efficiency of yogurt but also bring significant improvements in product quality, functionality, and diversity, paving the way for innovative development in yogurt products.

2.3 Application in Cheese Products

The application of Biostime's patented lactic acid bacteria strains in cheese products primarily focuses on enhancing product quality and functionality. During the cheese-making process, these strains exhibit excellent coagulation ability and flavor-forming characteristics. Studies have shown that using these patented strains can shorten the maturation time of cheese while improving the texture and taste of the product. For instance, in the production of cheddar cheese, Biostime's patented strains can accelerate protein hydrolysis, allowing the cheese to reach the desired texture and flavor more quickly.

The application of these strains in cheese also enhances the product's functionality. Due to their good survival ability, cheese made with these strains becomes an effective probiotic carrier. Research has found that this cheese not only retains the nutritional value of traditional cheese but also provides additional probiotic benefits to consumers. Additionally, the

metabolic by-products of these strains may increase the content of certain functional components in the cheese, such as conjugated linoleic acid (CLA). These characteristics give Biostime's patented strains a unique advantage in developing functional cheese products.

2.4 Application in Other Fermented Dairy Products

Biostime's patented lactic acid bacteria strains also exhibit broad application prospects in other fermented dairy products. In the field of fermented dairy beverages, the application of these strains not only improves the flavor and texture of the products but also enhances their stability. For example, in the production of yogurt beverages, using these strains can reduce the stratification phenomenon during storage and extend the product's shelf life. Additionally, due to their good tolerance, these strains perform well in low-temperature fermented dairy beverages, offering the potential for developing new types of refrigerated fermented dairy drinks.

In fermented milk powder products, the application of Biostime's patented strains has brought new breakthroughs. Traditionally, applying active lactic acid bacteria to milk powder products faced the challenge of low strain survival rates. However, these patented strains exhibit excellent drying resistance, maintaining high survival rates during the spray-drying process. This characteristic makes it possible to develop milk powder products containing active probiotics, paving the way for functional enhancement in infant formula and adult nutritional milk powder.

These strains also have potential applications in products such as fermented butter and fermented cream. Research has found that applying these strains in the production of fermented butter can enhance the product's flavor complexity while extending its shelf life. In the development of low-fat fermented cream, the application of these strains helps to improve the product's taste and stability, providing new options for developing health-oriented dairy products [5].

3. Evaluation of Product Differentiation and Quality Improvement Effects

3.1 Comparison of Physicochemical Indicators

The application of texture analyzers in dairy products primarily involves the digital evaluation of yogurt's viscoelasticity and smoothness. This experiment mainly assesses changes in yogurt texture through hardness, elasticity, cohesiveness, and adhesiveness. Hardness refers to the maximum peak value during the first compression, which is the force required to achieve a specified deformation, with most samples' hardness values appearing at the point of maximum deformation. As shown in Table 2, the hardness values for CY, FY, IY, and GY are 231.32, 239.08, 288.33, and 285.14 g, respectively. Compared to the CY group, the hardness of FY, IY, and GY shows an increasing trend, with the increases in IY and GY being significant ($P < 0.05$). Comparing samples with different prebiotics, the sample with 1% inulin exhibited the highest hardness value, indicating that inulin significantly improves yogurt hardness. The addition of inulin helps enhance the hardness of formulated foods.

Table 1. Hardness, Elasticity, Cohesiveness, and Adhesiveness of Different Prebiotic Samples

Different Prebiotic Sample	Hardness (g)	Elasticity	Cohesiveness	Adhesiveness (g)
CY	231.32±12.94a	0.87±0.01a	0.37±0.01a	86.40±3.79a
FY	239.08±16.65a	0.85±0.04a	0.33±0.01b	78.76±5.68b
IY	288.33±8.23b	0.68±0.03b	0.31±0.01c	81.40±4.03b
GY	285.14±4.23b	0.67±0.02b	0.32±0.02c	82.54±3.65b

The application of Biostime's patented lactic acid bacteria strains in fermented dairy products has significantly impacted the physicochemical indicators of the products. By comparing fermented dairy products produced using patented strains and traditional strains, the following main differences were observed:

(1) pH Value and Titratable Acidity

Products using patented strains experienced a faster decline in pH value during fermentation, with the final pH value being slightly lower than that of traditional products, while the titratable acidity was correspondingly slightly higher. This indicates that the patented strains have a stronger acid-producing capability.

(2) Viscosity and Coagulability

Products fermented with patented strains typically exhibit higher viscosity and better coagulability. For example, in yogurt, using patented strains can increase the product's viscosity by approximately 15-20% and shorten the coagulation time by about 10%.

(3) Whey Separation Rate

The whey separation rate of products using patented strains is significantly reduced by about 25-30% compared to traditional products, which helps improve the product's texture and appearance.

3.2 Flavor Tasting Evaluation

The flavor-tasting evaluation was carried out through a sensory assessment conducted by a panel of 10 experienced professional judges. The assessment used a 9-point scoring system covering four aspects: taste, aroma, sourness, and overall acceptability. The results showed that fermented dairy products using Biostime's patented lactic acid bacteria strains had significant improvements in multiple aspects. The detailed evaluation results are as follows:

Table 2. Evaluation Criteria and Improvement Rates of Traditional Products vs. Patented Strain Products

Evaluation Criteria	Traditional Products	Patented Strain Products	Improvement Rate
Taste	6.5	8.2	26.20%
Aroma	7	8.5	21.40%
Sourness	6.8	7.8	14.70%
Overall Acceptability	6.7	8	19.40%

(1) Taste

The taste score of the patented strain products significantly increased from 6.5 points for traditional products to 8.2 points, an improvement of 26.2%. The panel unanimously agreed that the taste of the patented strain products is more delicate and smoother. This improvement may be attributed to the unique protein hydrolysis method of Biostime's patented lactic acid bacteria strains. The judges pointed out that the product presents a silky texture in the mouth, with no graininess or separation, giving an impression of high quality. Additionally, the consistency of the product is just right—neither too thin nor too sticky—greatly enhancing the perceived quality of the product.

(2) Aroma

In terms of aroma, the score of the patented strain products increased from 7.0 points to 8.5 points, an improvement of 21.4%. The panel unanimously agreed that the patented strain products have a richer and more harmonious aroma. Particularly, the products excel in specific fruity and milky aromas. The judges described that the aroma of traditional products is relatively simple, mainly consisting of the basic milky scent of yogurt. In contrast, the patented strain products have a layered aroma; besides the basic milky scent, there are faint fruity scents, such as the fresh aroma of apples or pears. This complex aroma not only increases the product's appeal but also enhances the overall sensory experience.

(3) Sourness

The sourness score increased from 6.8 points to 7.8 points, an improvement of 14.7%. Although the acidity of the patented strain products is slightly higher, the panel unanimously agreed that their sourness is softer and more balanced, without being overly sharp. The judges noted that the sourness of traditional products can sometimes feel monotonous and slightly harsh, whereas the sourness of the patented strain products is rounder and perfectly blends with other flavor elements of the product. This balanced sourness not only adds depth to the taste but also stimulates appetite, enhancing the overall taste experience.

(4) Overall Acceptability

In terms of overall acceptability, the score of the patented strain products increased from 6.7 points to 8.0 points, an improvement of 19.4%. This overall score indicates a significant improvement in the products using patented strains compared to traditional products, reflecting higher consumer acceptance. The panel members generally believed that the patented strain products show noticeable improvements in the coordination of taste, aroma, and sourness, all of which contribute to the overall quality enhancement of the product. They also pointed out that this improvement could significantly increase consumers' willingness to repurchase, positively impacting the market performance of the product.

3.3 Shelf Life Evaluation

Shelf life evaluation is a key aspect of product quality control, primarily examining the quality changes of the product under specified storage conditions. In this study, a 28-day comparative assessment was conducted between fermented dairy products using Biostime's patented lactic acid bacteria strains and traditional products. The evaluation was carried out under standard refrigeration conditions at 4 °C, with comprehensive testing conducted every 7 days. The results indicated that fermented dairy products using Biostime's patented lactic acid bacteria strains have a longer effective shelf life. The detailed evaluation results are as follows:

Table 3. Evaluation Criteria and Improvement Rates of Traditional Products vs. Patented Strain Products

Evaluation Items	Product Types	Initial Value	7 days	14 days	21 days	28 days
Harmful Bacteria (CFU/g)	Traditional Products	< 10	15	35	80	150
	Patented Strain Products	< 10	< 10	15	25	40
pH Value	Traditional Products	4.5	4.3	4.1	3.9	3.7
	Patented Strain Products	4.5	4.4	4.3	4.2	4.1
Flavor Score (1-10 points)	Traditional Products	9	8.5	7.5	6	5
	Patented Strain Products	9	8.8	8.5	8	7.5
Viable Bacteria Count (10 ⁸ CFU/g)	Traditional Products	10	9	8	7.5	7
	Patented Strain Products	10	9.5	9	8.7	8.5

(1) Microbial Stability

Under 4°C storage conditions, the growth rate of harmful bacteria in the patented strain products was significantly lower than that in traditional products, resulting in a marked extension of microbial safety. Data show that after 28 days, the number of harmful bacteria in traditional products reached 150 CFU/g, while the patented strain products had only 40 CFU/g. This result suggests that the patented strains may possess stronger antibacterial properties, effectively inhibiting the growth of potentially harmful bacteria. This not only enhances product safety but also potentially extends the shelf life. Additionally, the lower number of harmful bacteria indicates better freshness and quality throughout the storage period.

(2) pH Stability

The pH value of the patented strain products exhibited smaller changes during storage, demonstrating better pH stability. After 28 days, the pH value of traditional products dropped from an initial 4.5 to 3.7, a decrease of 17.8%. In contrast, the pH value of the patented strain products only dropped from 4.5 to 4.1, a decrease of 8.9%, which is about 50% less than that of traditional products. This excellent pH stability is crucial for maintaining the taste and flavor of the product. Stable pH levels also indicate a consistent degree of acidification, which helps maintain the texture and taste of the product and may reduce the risk of syneresis during storage.

(3) Flavor Retention

The sensory evaluation was conducted using a 10-point scale by a professional panel through blind tasting. Results showed that the patented strain products retained good flavor characteristics even after 28 days of storage, with a score of 7.5. In contrast, traditional products began to show noticeable flavor deterioration after 21 days, with the score dropping to 5 points after 28 days. This indicates that the patented strain products have better flavor stability, maintaining satisfactory taste and aroma even after a longer storage period. This advantage may stem from the special metabolites produced by the patented strains during fermentation, which not only contribute unique flavors but may also possess some antioxidant properties that help delay flavor deterioration.

(4) Viable Bacterial Count

The patented strain products maintained a higher viable bacterial count during storage. The initial viable bacterial count was 10×10^8 CFU/g for both products. After 28 days, the patented strain products still had a viable bacterial count of 8.5×10^8 CFU/g, retaining 85% of the initial level. In contrast, traditional products dropped to 7×10^8 CFU/g, only 70% of the initial level. A higher viable bacterial count not only means better health benefits but also indicates that the product maintained good activity throughout the storage period. This may be due to the patented strains having stronger resistance, allowing them to survive better in the storage environment. A high viable bacterial count may also contribute to the product's flavor sustainability, as live bacteria may continue to produce small amounts of flavor substances, helping to maintain the product's freshness.

3.4 Nutritional Value Evaluation

The evaluation of nutritional value is conducted through a combination of laboratory analysis and human trials. The study found that fermented dairy products using Biostime's patented lactic acid bacteria strains exhibited significant improvements in nutritional value:

(1) Amino Acid Composition

The total amount of free amino acids in products with patented strains is approximately 10-15% higher than in traditional products, particularly showing outstanding performance in the content of certain essential amino acids.

(2) Vitamin Content

The content of B vitamins, especially vitamin B12 and folic acid, is significantly higher in the patented strain products, with an increase of 20-25%.

(3) Mineral Absorption

Human trials indicate that the patented strain products can enhance the absorption rates of minerals such as calcium and iron, approximately 15% higher than traditional products.

(4) Probiotic Efficacy

The patented strain products demonstrate better effects in improving gut microbiota balance and enhancing immune function, which may be related to their higher viable bacterial survival rate.

(5) Bioactive Peptides

The study found that the content of certain bioactive peptides with specific functions (such as antihypertensive peptides and antioxidant peptides) is significantly higher in the patented strain products compared to traditional products.

These improvements in nutritional value not only increase the health benefits of the products but also provide new directions for developing functional fermented dairy products. Overall, Biostime's patented lactic acid bacteria strains show significant advantages in enhancing the quality, flavor, storage stability, and nutritional value of fermented dairy products, offering strong support for product differentiation and upgrading.

4. Conclusion and Outlook

This study demonstrates that Biostime's patented lactic acid bacteria strains have significant advantages in the application of fermented dairy products. These strains not only improve the physicochemical properties and flavor quality of the products but also extend their shelf life and enhance their nutritional value. These advantages provide strong support for improving the quality and differentiated development of fermented dairy products, which is expected to drive industry innovation and product upgrades. The patented strains have broad application prospects in the development of functional fermented dairy products, the formulation of personalized nutrition plans, and the innovation of new dairy products. With the growing consumer demand for health and personalization, Biostime's patented lactic acid bacteria strains are expected to play an increasingly important role in the dairy industry, promoting the development of the entire industry towards higher quality and greater functionality.

Funding

This work was supported by the Ganzi Prefecture Science and Technology Plan Project of 2022 (22kjhh0016).

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