Original Research Article

Enhancing Yogurt Functionality through Enrichment with Cow and Soy Milk: Production and Quality Evaluation

Abstract

Yoghurt is a fermented dairy product produced from cow's milk. Soybeans are abundant, reasonably priced, and high in protein, so there has been some work done to use them to make more pleasant and acceptable food products. In keeping in mind yogurt is made out of cow milk and soy milk. Cow milk is rich in protein, calcium, vitamin D, and Potassium. Soy milk is rich in vitamins A, B, and proteins. The yogurt made out of this may have various health benefits. The study involved blending cow milk and soy milk in various proportions to create different yogurt formulations. The treatments were as follows: T1: Soy milk (200ml) without cow milk, T2: Cow milk (200ml) without soy milk, T3: [Cow milk (100ml) + Soy milk (100ml)], T4: [Cow milk (120ml) + Soy milk (80ml)], T5: [Cow milk (80ml) + Soy milk (120ml)], T6: [Cow milk (160ml) + Soy milk (40ml)], and T7: [Cow milk (40ml) + Soy milk (160ml)]. These formulations were tested to achieve a high-quality blended yogurt that is both nutritious and flavorful.

Keywords: Yogurt, cow milk, soy milk, enhancing.

1. Introduction

Milk is fermented with microorganisms to create yogurt, a dairy product. Although other bacteria may be added for varied flavors and health advantages, the most often utilized strains of bacteria are Lactobacillus bulgaricus and Streptococcus thermophilus. Lactose, or milk sugar, is fermented by these bacteria to produce lactic acid, which gives yogurt its thick consistency and tart taste. Yogurt can be eaten plain or flavored, and it's frequently used as a dessert, snack, or component of other recipes. It's also high in probiotics, good bacteria that help support intestinal health, protein, and calcium consumed (Penna, et al.,2015).

Yogurt is a probiotic. Probiotics reduce cell proliferation, It appears crucial to utilize probiotic microorganisms to cure and prevent intestinal dysbiosis, which raises the number of SCFAs in the colon (Kopec,.p and Slizewska,.k.,2020). S. thermophilus and L. bulgaricus interaction is one of the main factors that decide the fermentation process at the end of yogurt quality. This interaction accelerates the acidification, aroma volatiles, and non-metabolic volatiles in yogurt for good quality or organoleptic quality of yogurt (Farag.M et al.,2021). Yogurt eating has been linked to health advantages including antihypertension, anti-inflammatory, anti-oxidant, and anti-cancer (Gouda et al., 2021)

The process of lactic acid fermentation serves as the foundation for creating yogurt and other fermented beverages. Changes in milk proteins during and after fermentation and process parameters (temperature, duration, mechanical factors, such as stirring, pumping, and aeration) all affect the final gels' physical and structural characteristics.

To meet the rising demand for products without animal byproducts, unique plant-based foods, and beverages have been created and put on the market recently. Milk and dairy products have long been thought of as a category of food that contains vital nutrients for human nutrition that are rarely, and in the same proportions, found in other foods. However, those who have health issues caused by a diet high in cholesterol, lactose intolerance or malabsorption, or an allergy to milk proteins, should consume alternate products (Montemurro.M et al.,2021). Because milk contains proteins, carbs, minerals, and vitamins, it is commonly regarded as a healthy diet. Yoghurt has a similar nutritional profile to milk, from which it is formed (Rashwan. A. et al., 2023).

Protein, polysaccharides, and lipids are all part of the complex gel system that makes up yogurt. It is made from milk through fermentation, one of the earliest processes used by humans to turn milk into goods with a long shelf life. Yogurt is a well-balanced diet that contains 0–3.5% fat, 5–6% protein, 4.6–5.2% lactose, and minerals such as calcium (Ca; 0.12–0.14%), phosphorus (P; 0.09–0.11%), sodium (Na), potassium (K), magnesium (Mg), iron (Fe), copper (Cu), and zinc (Zn). Additionally, this dish gives consumers a variety of vitamins, such as vitamins A, B6, B12, and C (Dan. T et al.,2023). Fermentation is a metabolic process that converts carbohydrates, such as sugars and starches, into alcohol or organic acids using microorganisms like bacteria, yeast, or fungi. In the case of probiotic fermentation, the microorganisms involved are typically beneficial bacteria that confer health benefits when consumed (Tsafrakidou et al., 2020).

2. Materials:

Cow milk: The complex biological fluid known as cow milk is highly nutritious. Its makeup changes somewhat based on breed, nutrition, and stage of lactation.

Soy milk: Soy milk, often referred to as soybean milk or soymilk, is a plant-based beverage made by pulverizing and soaking soybeans, then straining the resulting mixture to remove the liquid. For people who are allergic to dairy, lactose intolerant, or who live a vegan lifestyle, it is a well-liked substitute for dairy milk.

2.1 Method:

Raw cow milk and soy milk

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Milk Heating

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Cooling

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Inoculation

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Mixing

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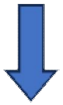
Fermentation



Cooling and Storage

2.2 Treatment details: Cow milk and soy milk were blended together with different formulations this process is done to achieve a high quality blended yogurth both in taste and in nutrition

Treatments	Cow milk	Soy milk
T1	-	200ml
T2	200ml	-
T3	100ml	100ml
T4	120ml	80ml
T5	80ml	120ml
T6	160ml	40ml
T7	40ml	160ml

Table 1: proportion of the cow milk and Soy milk

2.3 Sensory Analysis:

Sensory evaluation of samples of yogurt made from cow milk and soy milk was carried out by a panel of 20 semi-trained judges. The panelist was given samples and asked to evaluate the samples for colour, texture, taste, aroma, and overall acceptability by using a 9-point hedonic scale (Annexure I) for each attribute in each product (Amerine et al., 1965).

3. Result and Discussion

The table below presents data on the sensory assessment of yoghurt and demonstrates the noteworthy impact of various treatments on the sensory characteristics of yoghurt with varying concentrations. For each yoghurt, the average overall acceptability (OAA) score varied from 7.65 to 8.20, with T_2 scoring the highest at 8.30 and T_6 is scoring the lowest at 7.65.

The colour scores fall between 7.64 and 8.57. The colour grade for treatment T_5 is the highest. T_2 and T_6 are just behind. The lowest colour rating is T_7. The scores for texture vary from 7.66 to 7.97. The texture ratings of treatments T_2 and T_4 are the highest, and treatment T_7 is the lowest.. From 7.65 to 8.36 are the flavour ratings. T_7 is rated as having the least taste, while T_2 has the top score.

Aroma ratings range from 7.53 to 7.92. T_7 has the lowest aroma rating, while T_3 has the highest rating. The overall evaluation ratings range from 7.65 to 8.20. T_7 has the lowest overall rating, while T_2 has the highest rating

Table 2 :Effect of soy milk and cow milk addition on the sensory characteristics of yogurt

Treatment	Colour	Texture	Taste	Aroma	Overall Acceptability
T1	8.02±0.11 ^{a}	7.90±0.10^{ab}	7.90±0.10^{abc}	7.60±0.30 ^{a}	7.94±0.17 ^{b}
T2	8.18±0.13 ^{ab}	7.97±0.31 ^{b}	8.36±0.33 ^{c}	7.58±0.26^{a}	8.20±0.19 ^{a}
T3	7.93±0.30 ^{a}	7.73±0.34 ^{ab}	7.74±0.18 ^{ab}	7.92±0.13 ^{a}	7.85±0.14^{a}
T4	7.81±0.14^{ab}	7.92±0.13 ^{b}	7.73±0.20 ^{ab}	7.80±0.40 ^{a}	7.86±0.21 ^{b}
T5	8.57±0.10 ^{ab}	7.83±0.20 ^{ab}	8.22±0.32 ^{bc}	7.68±0.28 ^{b}	8.00±0.13 ^{b}
T6	8.31±0.30 ^{ab}	7.73±0.20 ^{ab}	7.98±0.22 ^{bc}	7.57±0.23 ^{b}	7.65±0.25 ^{a}
T7	7.64±0.13 ^{a}	7.66±0.21^{a}	7.65±0.20 ^{ab}	7.53±0.10 ^{a}	7.86±0.20 ^{a}

The highest titratable acidity is observed in T_7 with a value of 1.25±0.02%, indicating a stronger acidic nature compared to other treatments. The lowest titratable acidity is found in T_1, measuring at 0.72±0.05%, suggesting a milder acidity. Mid-range values for titratable acidity include T_2 (0.90±0.02%), T_3 (0.97±0.01%), T_4 (0.76±0.01%), T_5 (1.15±0.02%), and T_6 (1.18±0.02%). The difference between the highest and lowest values is 0.53%.

The pH values across the treatments indicate varying levels of acidity. The highest pH is recorded in T_1 at 4.60±0.40, suggesting it is the least acidic. Conversely, T_4 has the lowest pH value of 4.27±0.24, indicating the highest acidity. Other treatments fall within the mid-range, including T_2 (4.44±0.03), T_3 (4.34±0.03), T5 (4.56±0.02), T_6 (4.28±0.01), and T_7 (4.62±0.01). The range difference between the highest and lowest pH is 0.33.

The highest total phenolic content is found in T_5, with a value of 1.91±0.02%, indicating a rich presence of phenolic compounds. The lowest value is observed in T_3 at 0.55±0.05%, indicating the least presence of phenolic compounds. Mid-range values include T_1 (1.36±0.16%), T_2 (1.80±0.01%), T_4 (1.33±0.03%), T_6 (1.70±0.04%), and T_7 (0.51±0.01%). The difference between the highest and lowest values is 1.36%.

The highest total flavonoid content is recorded in T_7 at 8.98±0.08%, indicating a substantial presence of flavonoids. The lowest content is found in T_2 at 7.03±0.02%, suggesting the least presence of flavonoids. Mid-range values include T_1 (9.80±0.01%), T_3 (8.92±0.05%), T_4 (7.83±0.01%), T_5 (9.23±0.48%), and T_6 (7.86±0.21%). The range difference between the highest and lowest values is 1.95%.

The highest total soluble solids content is observed in T_2 at 1.36%, indicating a higher concentration of dissolved solids. The lowest value is found in T_4 at 0.45%, suggesting a lower concentration of dissolved solids. Other treatments fall within the mid-range, including T_1 (0.69%), T_3 (0.73%), T_5 (0.56%), T_6 (0.48%), and T_7 (0.78%). The difference between the highest and lowest values is 0.91%.

Treatments (T)	Titratable acidity (%)	pH	Total phenolic content (%)	Total Flavanoid content (%)	Total soluble Solids (%)
T_1	0.72 ± 0.05^{a}	4.60 ± 0.40^{a}	1.36 ± 0.16^{bA}	9.80 ± 0.01^{bc}	0.69
T_2	0.90 ± 0.02^{a}	4.44 ± 0.03^{a}	1.80 ± 0.01^{bB}	7.53 ± 0.02^{aA}	1.36
T_3	0.97 ± 0.01^{a}	4.34 ± 0.03^{a}	0.55 ± 0.05^{aA}	8.92 ± 0.05^{aB}	0.73
T_4	0.76 ± 0.01^{a}	4.27 ± 0.24^{a}	1.33 ± 0.03^{bA}	7.83 ± 0.01^{bA}	0.45
T_5	1.15 ± 0.02^{a}	4.56 ± 0.02^{a}	1.91 ± 0.02^{bc}	9.23 ± 0.48^{aB}	0.56
T_6	1.18 ± 0.02^{b}	4.28 ± 0.01^{b}	1.70 ± 0.04^{aB}	7.86 ± 0.21^{b}	0.48
T_7	1.25 ± 0.02^{b}	4.62 ± 0.01^{a}	0.51 ± 0.01^{aA}	8.98 ± 0.08^{aB}	0.78

Table 3 – Analysis of developed new product

4. Conclusion

Cow milk, a traditional ingredient in yoghurt, is rich in protein, calcium, vitamin D, and B vitamins, offering complete proteins and beneficial probiotics. However, it also contains cholesterol and saturated fats. With changing dietary preferences, soy milk has emerged as a popular alternative. This thesis will explore the differences and similarities between cow milk and soy milk yoghurt. While cow milk yoghurt is nutrient-dense and probiotic-rich, soy milk yoghurt provides its own health benefits, including being cholesterol-free. Future research should aim to optimize the fermentation process for soy milk yoghurt and examine its long-term health effects.

The overall acceptability of soy milk and cow milk yoghurt was evaluated through sensory tests, resulting in scores for treatments T_1 to T_7. Treatment T_2 stood out with the highest score of 8.20±0.19, indicating that it was the most preferred by the panelists due to its well-balanced flavor, texture, and aroma. Following closely, treatments T_5 and T_1 received scores of 8.00±0.13 and 7.94±0.17, respectively, showcasing their favorable qualities. On the other hand, treatments T_3, T_4, and T_7 received similar scores of 7.85±0.14, 7.86±0.21, and 7.86±0.20, suggesting that these yoghurts were also well-accepted but did not stand out as much as T_2. Interestingly, treatment T_6 received the lowest score of 7.65±0.25, indicating it was the least preferred among the samples, possibly due to some less favorable sensory attributes. These results highlight the varying degrees of consumer preference for different formulations of soy milk and cow milk yoghurt, with T_2 and T_5 emerging as the top choice.

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