

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).

Comment [HP1]: The writing format is not correct

The abstract must have the following information:
Abstract
background information - Yes
statement of the problem - not clear
Objective research - nil
Research and/or analytical methods / Methodology - yes but methodology should be summarized
Main findings, results, or arguments - nil
The significance or implications of your findings or arguments. - nil

Comment [HP2]: Unclear Introduction, the introduction needs to have complete information such as the following information:

Introduction
General background information - yes
Specific background information - yes
A description of the gap in our knowledge that the study was designed to fill - should add more
A statement of study objective, - should include and (optionally) a brief summary of study

Comment [HP3]: the use of the word 'may be' is inappropriate

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 (Kopeck, 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)

Comment [HP4]: This citation is not in the reference list

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.

Comment [HP5]: Should have citation here

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



Milk Heating



Cooling



Inoculation



Mixing



Fermentation

Comment [HP6]: Research methodology should be specific procedure (with citation). In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability



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).

Comment [HP7]: methodology writing needs to be more creative

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 T₂ scoring the highest at 8.30 and T₆ is scoring the lowest at 7.65.

Comment [HP8]: Should add introduction

The colour scores fall between 7.64 and 8.57. The colour grade for treatment T₅ is the highest. T₂ and T₆ are just behind. The lowest colour rating is T₇. The scores for texture vary from 7.66 to 7.97. The texture ratings of treatments T₂ and T₄ are the highest, and treatment T₇ is the lowest.. From 7.65 to 8.36 are the flavour ratings. T₇ is rated as having the least taste, while T₂ has the top score.

Aroma ratings range from 7.53 to 7.92. T₇ has the lowest aroma rating, while T₃ has the highest rating. The overall evaluation ratings range from 7.65 to 8.20. T₇ has the lowest overall rating, while T₂ 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

Comment [HP9]: enter the result (table or figure), then make a discussion about the result

Comment [HP10]: enter a creative figure to make this result more interesting

The highest titratable acidity is observed in T₇ with a value of 1.25±0.02%, indicating a stronger acidic nature compared to other treatments. The lowest titratable acidity is found in T₁, measuring at 0.72±0.05%, suggesting a milder acidity. Mid-range values for titratable acidity

include T₂ (0.90±0.02%), T₃ (0.97±0.01%), T₄ (0.76±0.01%), T₅ (1.15±0.02%), and T₆ (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 T₁ at 4.60±0.40, suggesting it is the least acidic. Conversely, T₄ has the lowest pH value of 4.27±0.24, indicating the highest acidity. Other treatments fall within the mid-range, including T₂ (4.44±0.03), T₃ (4.34±0.03), T₅ (4.56±0.02), T₆ (4.28±0.01), and T₇ (4.62±0.01). The range difference between the highest and lowest pH is 0.33.

The highest total phenolic content is found in T₅, with a value of 1.91±0.02%, indicating a rich presence of phenolic compounds. The lowest value is observed in T₃ at 0.55±0.05%, indicating the least presence of phenolic compounds. Mid-range values include T₁ (1.36±0.16%), T₂ (1.80±0.01%), T₄ (1.33±0.03%), T₆ (1.70±0.04%), and T₇ (0.51±0.01%). The difference between the highest and lowest values is 1.36%.

The highest total flavonoid content is recorded in T₇ at 8.98±0.08%, indicating a substantial presence of flavonoids. The lowest content is found in T₂ at 7.03±0.02%, suggesting the least presence of flavonoids. Mid-range values include T₁ (9.80±0.01%), T₃ (8.92±0.05%), T₄ (7.83±0.01%), T₅ (9.23±0.48%), and T₆ (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 T₂ at 1.36%, indicating a higher concentration of dissolved solids. The lowest value is found in T₄ at 0.45%, suggesting a lower concentration of dissolved solids. Other treatments fall within the mid-range, including T₁ (0.69%), T₃ (0.73%), T₅ (0.56%), T₆ (0.48%), and T₇ (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 T₁ to T₇. Treatment T₂ 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 T₅ and T₁ received scores of 8.00±0.13 and 7.94±0.17, respectively, showcasing their favorable qualities. On the other hand, treatments T₃, T₄, and T₇ received similar scores of 7.85±0.14, 7.86±0.21, and 7.86±0.20,

Comment [HP11]: Conclusion should show overall findings. The author needs to provide a synthesis of key points and highlight the important takeaways from the study.

suggesting that these yoghurts were also well-accepted but did not stand out as much as T₂. Interestingly, treatment T₆ 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 T₂ and T₅ emerging as the top choice.

References

Amerine, M. A., Roessler, E. B., & Ough, C. S. (1965). Acids and the acid taste. I. The effect of pH and titratable acidity. *American Journal of Enology and viticulture*, 16(1), 29-37.

Bakry, I. A., & Farag, M. A. Plain set and stirred yogurt with different additives: implementation of food safety system as quality checkpoints.

Comment [HP12]: There is no citation for this reference

Dan, T., Hu, H., Tian, J., He, B., Tai, J., & He, Y. (2023). Influence of Different Ratios of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* on Fermentation Characteristics of Yogurt. *Molecules*, 28(5), 2123.

Gouda, A. S., Abdelruhman, F. G., Alenezi, H. S., & Mégarbane, B. (2021). Theoretical benefits of yogurt-derived bioactive peptides and probiotics in COVID-19 patients—A narrative review and hypotheses. *Saudi Journal of Biological Sciences*, 28(10), 5897-5905.

Markowiak-Kopeć, P., & Śliżewska, K. (2020). The effect of probiotics on the production of short-chain fatty acids by human intestinal microbiome. *Nutrients*, 12(4), 1107.

Comment [HP13]: There is no citation for this reference

Montemurro, M., Pontonio, E., Coda, R., & Rizzello, C. G. (2021). Plant-based alternatives to yogurt: State-of-the-art and perspectives of new biotechnological challenges. *Foods*, 10(2), 316.

Penna, A. L. B., Paula, A. T., Casarotti, S. N., DIAMANTINO, V., & SILVA, L. (2015). Overview of the functional lactic acid bacteria in the fermented milk products. *Beneficial microbes in fermented and functional foods*, 1, 100-154.

Rashwan, A. K., Osman, A. I., & Chen, W. (2023). Natural nutraceuticals for enhancing yogurt properties: a review. *Environmental Chemistry Letters*, 21(3), 1907-1931.

Tsafrakidou, P., Michaelidou, A. M., & G. Biliaderis, C. (2020). Fermented cereal-based products: Nutritional aspects, possible impact on gut microbiota and health implications. *Foods*, 9(6), 734.

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