

EFFECTS OF COMMERCIAL SWEETPOTATO (*Ipomoea batatas*) POWDER ON PROBIOTIC VIABILITY, PHYSICOCHEMICAL CHARACTERISTICS, AND SENSORY ATTRIBUTES OF YOGURT

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ABSTRACT

This study investigated sweetpotato powder (SPP) as a prebiotic additive in functional yogurt, assessing its impact on probiotic viability, physico-chemical properties, and sensory attributes. Yogurt samples were prepared with three SPP levels: 0% (control), 1% SPP, and 2% SPP, and stored at 4°C for 14 days. Probiotic viability was determined by enumerating *Lactobacillus delbrueckii* subsp. *bulgaricus* viable counts. Results showed no significant differences in probiotic populations on days 1 and 7, suggesting SPP did not influence early bacterial survival. However, by day 14, yogurt with 2% SPP exhibited significantly higher mean difference compared to the control. Physicochemical analyses of pH and titratable acidity indicated no significant differences across treatments or storage periods. Sensory evaluation using a 5-point Hedonic Scale revealed notable improvements in sourness, overall taste, and general acceptability with 1% SPP. These findings demonstrate the potential of sweet potato powder as a functional prebiotic ingredient for yogurt.

Keywords: Sweetpotato powder, functional yogurt, *Lactobacillus delbrueckii* subsp. *bulgaricus*, probiotic viability, sensory evaluation

INTRODUCTION

Globally, consumers are increasingly prioritizing health and wellness in their food choices, driven by a growing awareness of sustainable nutrition and holistic well-being. This shift leads consumers toward products that provide more than basic nutrition, reflecting the rise of functional foods enriched with vitamins, probiotics, minerals, fiber, and antioxidants, which are notable for improving mental and physical well-being (Baker *et al.*, 2022). Among these, yogurt is a well-known fermented dairy product recognized as an exemplary carrier of probiotics, live microorganisms that confer health benefits when ingested in adequate amounts (Abdi-Moghadam *et al.*, 2023; Granato *et al.*, 2010). Viable bacteria such as *L. delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* are essential for enhancing gut health metrics, including microbiota balance, immunity, and gastrointestinal function (Fernandez and Marette, 2017; Saleem *et al.*, 2024).

Yogurt is one of the most extensively consumed fermented dairy products worldwide, valued for its nutritive composition and health-promoting properties. In recent years, its popularity has surged due to its probiotic cultures. However, the properties of yogurt

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depend heavily on the survival and stability of these probiotic microorganisms throughout processing and storage. Maintaining sufficient probiotic viability remains a challenge due to factors such as acidity, temperature fluctuations, and storage duration (Shori, 2015; Tripathi and Giri, 2014).

To address this challenge, incorporating prebiotics into yogurt has emerged as a promising strategy to enhance probiotic survival. Prebiotics are non-digestible food components that selectively stimulate the growth and activity of beneficial gut bacteria (Gibson *et al.*, 2017). They serve as substrates for probiotics, improving their viability while contributing to gut health (Markowiak and Slizewska, 2017; Rosa *et al.*, 2021). Commonly used prebiotics in dairy products include inulin, fructooligosaccharides, and resistant starch (Rosa *et al.*, 2021), yet there is growing interest in identifying alternative, locally available prebiotic sources that are cost-effective, sustainable, and capable of enhancing both the nutritional and sensory qualities of yogurt (Olamiti, 2025).

Sweetpotato (*Ipomoea batatas*), an abundant and underutilized crop in the Philippines, offers significant potential. It is rich in macronutrients, micronutrients, bioactive compounds, dietary fiber, resistant starch, and natural sugars, making it a versatile 3-in-1 nutritional source with benefits similar to cereals, fruits, and vegetables (Amagloh *et al.*, 2021; Kiliç *et al.*, 2025; Ortiguero, 2014). These components can act as substrates for probiotic growth, potentially enhancing their survival in yogurt during storage (Afiati *et al.*, 2018). Additionally, sweet potato is rich in natural pigments such as carotenoids and anthocyanins, which may influence yogurt's color and nutritional value, while its mild sweetness and textural properties could improve sensory acceptability (Afiati *et al.*, 2018; Yuliana *et al.*, 2023). Although inulin remains the most widely used prebiotic, there is a growing need to explore locally available and sustainable alternatives. Despite sweet potato's promising attributes, limited research has explored its direct application as a prebiotic additive in yogurt production, particularly in the form of sweet potato powder (SPP). Utilizing SPP in yogurt formulation could provide dual advantages: enhancing probiotic viability and improving sensory characteristics. Since consumer acceptance is crucial for the success of functional foods, it is essential to evaluate not only probiotic viability and nutritional benefits but also sensory quality, including flavor, texture, color, and overall acceptability, which are directly influenced by the product's physicochemical properties (Yuliana *et al.*, 2023). Yellow-fleshed SPP acts as a natural stabiliser and prebiotic, enhancing yoghurt quality and storage stability (Lu *et al.*, 2026).

Given this background, the present study evaluated SPP as a prebiotic additive in yogurt. Specifically, it aimed to assess the effects of different SPP levels on the probiotic viability of *L. delbrueckii subsp. bulgaricus* during storage, physicochemical characteristics, and sensory attributes. This research provides a scientific basis for using locally available prebiotics, contributing insights to the development of functional dairy products and supporting value addition for sweet potato in the food industry.

MATERIALS AND METHODS

Experimental Site, Design, and Treatments

The study was conducted over two months (October–November 2025) at the Dairy Training and Research Institute (DTRI), UPLB. Yogurt was formulated with three treatment levels of sweet potato powder (SPP): Control (0%), 1% w/v SPP, and 2% w/v

SPP, and evaluated for probiotic viability, physicochemical, and sensory properties. A two-factor factorial experiment in a completely randomized design (CRD) was used, with SPP concentration and storage time (0, 7, and 14 days at 4°C) as factors. Three batches of yogurt were produced for all treatment combinations, and probiotic viability and physicochemical analyses were performed at each storage interval. Sensory evaluation was conducted on day 7 to determine the consumer acceptability of the yogurt samples.

Yogurt Preparation

Pasteurized cow's milk (3.75% fat, 8.5% SNF) from DTRI was standardized to 2% fat, 10% milk solids, and 7% sugar using skim milk powder and refined sugar. North Native commercial sweet potato powder (0%, 1%, or 2%) was incorporated as a single-ingredient, additive-free, gluten-free, zero-fat, and no-added-sugar product containing 8.5% protein. Milk was heated at 45°C, and dry ingredients such as skim milk, sugar, and SPP were added. The mixture was then pasteurized at 85–90°C for 10 minutes, then the mixture is cooled to 42°C and inoculated with probiotic cultures of *L. delbrueckii subsp. bulgaricus* and *Streptococcus thermophilus* (0.008 g/L, 1:1). Fermentation proceeded at 45°C for 4 hours. Yogurt was cooled to 10°C, stirred for uniformity, and stored at 4°C.

Microbial Enumeration

The determination of probiotic viability was carried out following standard microbiological procedures described in the Compendium of Methods for the Microbiological Examination of Foods published by the American Public Health Association. The viable count of *L. delbrueckii subsp. bulgaricus* was determined using de Man, Rogosa, and Sharpe (MRS) agar. MRS agar (67.15 g/L) was autoclaved at 15 psi for 15 minutes, cooled, and poured into sterile plates. Serial dilutions from 10⁻¹ to 10⁻⁸ were prepared, and dilutions 10⁻⁴ to 10⁻⁸ were plated using the spread plate method (100 µL per plate, in duplicate). Plates were incubated at 32°C for 24 hours, and colonies within 25–250 Colony-Forming Units (CFU)/mL were used to compute viable counts using the following formula:

$$\frac{CFU}{mL} = \frac{\sum C}{[(1 \times n_1) + (0.1 \times n_2)] \times d}$$

where:

$\sum C$	Sum of all colonies counted on all selected plates
n_1	Number of plates counted at the lower dilution
n_2	Number of plates counted at the higher dilution
d	Dilution factor corresponding to the lower dilution used

Physicochemical characteristics

The pH of the yogurt samples was measured using a calibrated digital pH meter. The instrument was standardized with pH 4.0 and 7.0 buffer solutions before each use, after which the electrode was immersed directly into the sample until a stable reading was obtained. Titratable acidity was determined following standard dairy industry procedures. A 10 mL aliquot of the yogurt sample was titrated with 0.1 N sodium hydroxide using phenolphthalein as the indicator, and the endpoint was identified by the appearance of a faint, persistent pink color. These measurements are routinely used to evaluate the quality,

freshness, and fermentation activity of dairy products. In this study, both pH and titratable acidity were monitored across storage days to assess changes in yogurt quality over time.

Sensory Evaluation

Twenty student panelists (18–24 years old) evaluated 30 mL samples coded with random three-digit numbers. A 5-point Hedonic scale was used to evaluate appearance, aroma, sweetness, sourness, texture, overall taste, and general acceptability. Samples were served in random order with water for palate cleansing.

Statistical Analysis

All data from the probiotic viability, physicochemical, and sensory evaluations were tabulated and prepared for statistical evaluation. Probiotic viability data were analyzed using analysis of variance (ANOVA) to assess the effects of SPP concentration and storage time on each parameter. Tukey’s Honest Significant Difference (HSD) test was used for post hoc pairwise comparison of treatment means. Physico-chemical characteristics data were analyzed using the Kruskal–Wallis test. Sensory evaluation data were analyzed using the Chi-square Test of Independence. Cochran–Mantel–Haenszel (CMH) test as a post hoc comparison method at a 5% level of significance ($p \leq 0.05$) was used. All statistical analyses were performed using SAS® Studio, and results were presented as mean $\pm$ standard deviation.

RESULTS AND DISCUSSION

Probiotic Viability of *Lactobacillus delbrueckii* subsp. *bulgaricus*

To determine the effect of sweetpotato powder (SPP) on the viability of *Lactobacillus delbrueckii* subsp. *bulgaricus*, viable cell counts were monitored during 14 days of refrigerated storage. Figure 1 illustrates the changes in bacterial counts for each treatment from Day 1 to Day 14. An increasing trend in viable counts was observed throughout the storage period across all treatments.

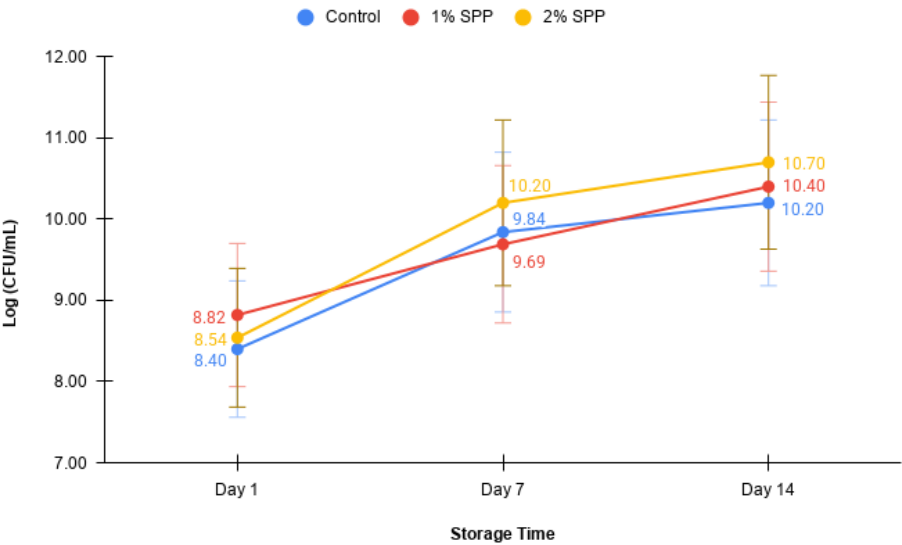


Figure 1. Probiotic viability (Log CFU/mL) of yogurt during storage.

For the control treatment, viable counts increased from 8.40 to 10.20 log CFU/mL. Similarly, the 1% SPP treatment exhibited an increase from 8.82 to 10.40 log CFU/mL, while the 2% SPP treatment showed the highest counts, increasing from 8.54 to 10.70 log CFU/mL. These findings indicate that the viability of *L. delbrueckii* subsp. *bulgaricus* was maintained and progressively increased during the 14-day refrigerated storage period. Moreover, the higher counts observed in SPP-containing treatments suggest that sweet potato powder may have provided fermentable substrates and prebiotic components that supported the growth and survival of the yogurt starter culture.

Table 1. Probiotic viability comparisons across treatments within each sampling day.

Day	Treatments	Mean $\pm$ SE	Comparison	Mean Difference $\pm$ SE	P-value
Day 1	Control	8.40 $\pm$ 0.315	Control vs 1% SPP	-0.421 $\pm$ 0.251	0.743
	1% SPP	8.82 $\pm$ 0.202	Control vs 2% SPP	-0.145 $\pm$ 0.066	0.503
	2% SPP	8.54 $\pm$ 0.202	1% SPP vs 2% SPP	0.276 $\pm$ 0.215	0.901
Day 7	Control	9.84 $\pm$ 0.450	Control vs 1% SPP	0.157 $\pm$ 0.156	0.968
	1% SPP	9.69 $\pm$ 0.409	Control vs 2% SPP	-0.317 $\pm$ 0.100	0.213
	2% SPP	10.20 $\pm$ 0.465	1% SPP vs 2% SPP	-0.474 $\pm$ 0.129	0.134
Day 14	Control	10.20 $\pm$ 0.181	Control vs 1% SPP	-0.205 $\pm$ 0.104	0.607
	1% SPP	10.40 $\pm$ 0.244	Control vs 2% SPP*	-0.516 $\pm$ 0.087	0.021
	2% SPP	10.70 $\pm$ 0.186	1% SPP vs 2% SPP	-0.311 $\pm$ 0.072	0.077

Data are presented as mean difference $\pm$ SE (n=6 per treatment per sampling day).

*Significantly different at $p < 0.05$.

Using the probiotic viability data presented in Table 1, no significant differences were observed among the Control, 1% SPP, and 2% SPP treatments during Day 1 and Day 7. This indicates that, at the early stages of storage, the incorporation of SPP did not significantly affect the initial viability of *Lactobacillus delbrueckii* subsp. *bulgaricus*. Since SPP is primarily composed of complex carbohydrates and dietary fiber, with only limited amounts of readily fermentable sugars (Alla *et al.*, 2025), its immediate effect on bacterial growth during the first week of storage is likely minimal. Consequently, all treatments exhibited comparable viable counts during these initial time points.

By Day 14, a significant increase in viable counts was observed in the 2% SPP treatment, which showed higher probiotic viability compared with the control ($p = 0.021$). These findings are consistent with literature identifying sweet potato as a functional prebiotic source rich in resistant starch, soluble dietary fiber, and polyphenolic compounds. These components are known to enhance the growth of lactic acid bacteria, improve buffering capacity, and support microbial tolerance under acidic conditions during extended storage (Kilinc *et al.*, 2025; Cao *et al.*, 2022). Similar dose-dependent improvements in probiotic viability have also been reported in yogurt fortified with purple yam (Felsimino *et al.*, 2020) and in camel milk yogurt enriched with sweet potato powder (Omar *et al.*, 2019), further supporting the potential prebiotic effect of plant-based carbohydrate sources in fermented dairy systems. The results suggest that sweetpotato powder does not significantly influence

starter culture viability during the early stages of storage but may exert a concentration-dependent prebiotic effect during prolonged refrigerated storage, as evidenced by improved microbial survival at higher inclusion levels. This highlights its potential role as a functional ingredient in enhancing the stability and performance of lactic acid bacteria in fermented dairy systems.

Previous studies have reported that *Lactobacillus delbrueckii* subsp. *bulgaricus* can maintain viability and, in some cases, exhibit continued growth during early refrigerated storage due to residual lactose metabolism and post-acidification processes. For instance, Tamime and Robinson (2007) and Hutkins (2018) describe that yogurt cultures may remain metabolically active during storage, contributing to changes in viable counts and acid development. In addition, Dave and Shah (1997) reported that probiotic and starter cultures in yogurt can maintain or increase viable counts during refrigerated storage depending on matrix composition and nutrient availability.

Table 2. Physicochemical characteristics comparison of yogurt treatments across days.

Treat- ment	pH Mean $\pm$ SE	TA Mean $\pm$ SE	Day Comparison	pH Mean Difference $\pm$ SE	p-value	TA Mean Difference $\pm$ SE	p-value
Control	Day 1 5.60 $\pm$ 0.265	Day 1 0.16 $\pm$ 0.009	Day 1 vs Day 7	0.133 $\pm$ 0.357	0.663	-0.010 $\pm$ 0.012	0.507
	Day 7 5.47 $\pm$ 0.240	Day 7 0.17 $\pm$ 0.008	Day 1 vs Day 14	0.167 $\pm$ 0.343	0.507	-0.013 $\pm$ 0.011	0.376
	Day 14 5.43 $\pm$ 0.219	Day 14 0.17 $\pm$ 0.007	Day 7 vs Day 14	0.033 $\pm$ 0.325	1.000	-0.003 $\pm$ 0.011	0.814
1% SPP	Day 1 5.47 $\pm$ 0.318	Day 1 0.16 $\pm$ 0.009	Day 1 vs Day 7	0.167 $\pm$ 0.441	0.507	-0.013 $\pm$ 0.019	0.653
	Day 7 5.30 $\pm$ 0.306	Day 7 0.18 $\pm$ 0.017	Day 1 vs Day 14	0.267 $\pm$ 0.376	0.376	-0.017 $\pm$ 0.011	0.261
	Day 14 5.20 $\pm$ 0.200	Day 14 0.18 $\pm$ 0.007	Day 7 vs Day 14	0.100 $\pm$ 0.365	1.000	-0.003 $\pm$ 0.019	1.000
2% SPP	Day 1 5.33 $\pm$ 0.437	Day 1 0.18 $\pm$ 0.020	Day 1 vs Day 7	0.067 $\pm$ 0.642	0.825	-0.007 $\pm$ 0.030	1.000
	Day 7 5.27 $\pm$ 0.470	Day 7 0.19 $\pm$ 0.023	Day 1 vs Day 14	0.200 $\pm$ 0.652	0.383	-0.010 $\pm$ 0.031	0.814
	Day 14 5.13 $\pm$ 0.484	Day 14 0.19 $\pm$ 0.022	Day 7 vs Day 14	0.133 $\pm$ 0.675	0.507	-0.003 $\pm$ 0.032	0.814

Data are presented as mean difference $\pm$ SE (n=3 per treatment per sampling day).

Physicochemical Characteristics

The pH and TA of the yogurt samples were monitored over 14 days to assess whether the inclusion of SPP influenced acidification during refrigerated storage. As presented in Table 2, none of the individual day-to-day comparisons within each treatment were statistically significant ($p > 0.05$).

The pH values of the yogurt samples did not follow the expected downward trend typically associated with continued acidification during refrigerated storage. Instead, the day-to-day comparisons within each treatment (Control, 1% SPP, and 2% SPP) showed inconsistent fluctuations, with all p-values exceeding 0.05. These random changes across Days 1, 7, and 14 suggest that no meaningful shift in acidity occurred over the storage period. This behavior contrasts with previous reports, such as Omar *et al.* (2019), where yogurts supplemented with sweet potato exhibited a steady decline in pH during storage. The lack of a clear progression in the present study may be attributed to the limited sample size and variability in individual readings, which reduced the statistical power to detect subtle changes in acidification.

Similarly, titratable acidity (TA) increased only slightly over time but not to a statistically significant degree. All TA comparisons across days yielded p-values above 0.05 for every treatment, indicating that the observed increments were minimal and inconsistent. This trend differs from earlier findings where prebiotic supplementation produced measurable increases in TA during storage (Felismino *et al.*, 2020). Overall, the results show that neither pH nor TA changed significantly across storage days or among treatments, suggesting that the addition of sweetpotato powder at the tested levels did not markedly influence post-fermentation acid development.

Sensory Evaluation

Responses reflect how formulation changes influence product characteristics, as ingredients like SPP can affect appearance, sweetness, sourness, and texture. Perceptions of evaluators are crucial because even if a formulation demonstrates improved probiotic viability, it must also meet consumer expectations for flavor and quality in order to be considered marketable. Through this assessment, the study was able to determine whether the addition of sweet potato powder enhanced or compromised the sensory attributes of yogurt. The sensory attribute means of Control, 1% SPP, and 2% SPP are presented in Table 3. The products significantly differed in overall taste, sourness, and general acceptability. The following section presents a detailed analysis of the sensory attributes, based on the panelists' ratings, highlighting the statistical significance of the differences between the three treatments. The influence of each attribute on general acceptability is illustrated in Figure 2.

Appearance. There was no significant difference in the samples' visual appeal, as indicated by mean scores between the treatments ($P = 0.3308$). The study's respondents did not provide extensive comments on the samples' appearance. This suggests that appearance was not a primary factor in their assessment. This result may also support the observation that consumers' approval of food products is often influenced by their appearance (Spence *et al.*, 2022). Similarly, Vermeir and Roose (2020) also found that a product's visual attributes significantly impact consumer acceptability and expectations. These studies emphasize the importance of visual appeal in shaping consumer perceptions, even if it is not always the most discussed attribute during sensory evaluations.

Aroma. The statistical analysis revealed no significant difference between the three

treatments, indicating that Control, 1% SPP, and 2% SPP were equally acceptable in terms of aroma despite the small differences. There was no clear preference for one treatment over the other among the panelists. According to some panelists, both treatments had a pleasing and distinctive yogurt scent, which is in line with results from prior research that indicate no appreciable variations in aroma between comparable yogurt formulas. This aligns with the aroma profile commonly associated with fresh yogurt and could explain the minimal difference in preference between the treatments (Zhao *et al.*, 2023; Karagül-Yüceer and Drake, 2013). These findings align with the results of Saint-Eve *et al.* (2006), who noted that while aroma affects product perception, it is less likely to differentiate yogurt products unless distinct additives are added.

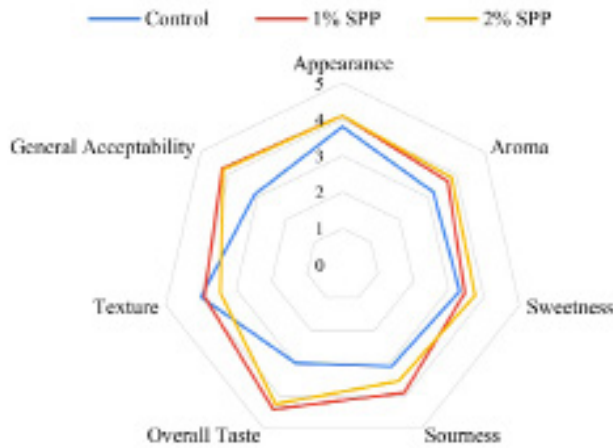


Figure 2. Sensory attributes of yogurt between treatments.

Table 3. Sensory Characteristics of yogurt formulated with different levels of inclusion of sweetpotato powder (SPP).

Attribute	Treatment			p-value
	Control	1% SPP	2% SPP	
Appearance	3.800 ± 0.768	4.100 ± 0.641	4.100 ± 0.788	0.3308
Aroma	3.200 ± 1.105	3.700 ± 0.733	3.850 ± 0.988	0.0893
Sweetness	3.300 ± 1.279	3.450 ± 1.276	3.750 ± 1.020	0.4473
Sourness	3.100 ± 1.021 ^a	3.900 ± 0.788 ^b	3.550 ± 0.759 ^b	0.0208
Overall Taste	3.000 ± 1.124 ^a	4.400 ± 0.681 ^b	4.250 ± 0.716 ^b	< 0.0001
Texture	4.000 ± 0.918	3.900 ± 0.852	3.450 ± 0.945	0.1329
General Acceptability	3.100 ± 1.021 ^a	4.250 ± 0.967 ^b	4.200 ± 0.894 ^b	0.0008

Data are presented as mean ± SE (n=20).

Hedonic Rating for Attributes: 1 – Dislike Extremely; 3 – Neutral; 5 – Like Extremely

^{a,b}Means within the same row with different superscript letters are significantly different ($p \leq 0.05$).

Sweetness. The difference in sweetness scores among all treatments was not statistically significant ($p>0.05$), suggesting no variation in sweetness preferences across the samples. This is likely because all samples were stored under similar conditions, resulting in comparable temperatures at the time of evaluation. Consequently, temperature-related effects on sweetness perception were minimized. This observation aligns with previous findings that colder products can influence sourness and sweetness perception, but when temperature is consistent across samples, perceived sweetness remains similar (Karagül-Yüceer and Drake, 2013).

Sourness. The significant difference ($p=0.0208$) in perceived sourness among all treatments indicates that panelists detected higher tartness in the sweet-potato-enhanced yogurts. 1% SPP and 2% SPP, which contained sweetpotato powder, were perceived as more tart than the control. This observation is consistent with previous studies showing that the incorporation of sweet potato powder can increase yogurt acidity, lowering pH level and increasing titratable acidity, which in turn enhances the sensory perception of sourness or tartness (Kilinç *et al.*, 2025). In this study, although no significant differences in pH were observed between the control and treatment groups, improvements in perceived sourness in the SPP-fortified samples may be attributed to matrix effects and interactions between taste-modulating components in sweetpotato powder and the milk system. Sweet potato powder contains sugars, organic acids, and phenolic compounds, which may influence flavor perception by enhancing or masking acidity and modifying overall taste balance. Additionally, even small, non-significant variations in titratable acidity or acid distribution within the gel matrix may be perceptible to sensory panelists, especially in fermented dairy systems where flavor sensitivity is high. Therefore, the discrepancy between instrumental pH values and sensory sourness scores may be explained by the combined effects of minor acidity differences, flavor-enhancing compounds in SPP, and complex sensory interactions that are not fully captured by pH measurement alone.

Overall Taste. The test demonstrated a p-value of <0.0001 , indicating a strong preference for the taste of 1% SPP and 2% SPP. This preference may be attributed to the creamier, smoother texture and enhanced sweetness of 1% SPP and 2% SPP, which are characteristics that generally appeal to consumers in yogurt products. Karagül-Yüceer and Drake (2013) highlighted that most consumers favor a balance of mild sourness and heightened sweetness in yogurt products, which could explain the higher acceptability of the yogurts.

Texture. The analysis showed no significant differences in texture among all treatments ($p<0.1329$), suggesting that panelists perceived the mouthfeel of all yogurt samples similarly. While 2% SPP was occasionally described as slightly grainy due to the higher level of sweet potato powder, and 1% SPP was noted as smoother, these variations were not statistically significant. This aligns with previous studies indicating that texture can influence consumer preference in fermented dairy products, with smoother and creamier textures generally being preferred (Gupta *et al.*, 2022). However, in this study, the different levels of sweetpotato powder did not significantly alter the overall sensory perception of texture since some evaluators perceived grittiness as a positive trait for yogurt.

General Acceptability. The higher score for 1% SPP indicates a stronger preference for the overall experience of the yogurt ($P=0.0008$). Panelists highlighted that 1% SPP offered a more balanced sweetness, sourness, and overall flavor profile, making it more appealing to a broader range of consumers. Many respondents noted that the tartness, smoothness, and

soft texture of 1% SPP were key factors in their preference, especially when compared to the grainy texture of 2% SPP. As most panelists mentioned, the sourness stood out as the most influential attribute in their evaluation, aligning with previous studies that show how sourness contributes to the overall acceptability of fermented dairy-based products (Kilinc *et al.*, 2025).

CONCLUSION

This study demonstrated that the incorporation of sweetpotato powder (SPP) influenced the physicochemical, microbiological, and sensory properties of yogurt during 14 days of refrigerated storage. Viable counts of *Lactobacillus delbrueckii* subsp. *bulgaricus* were maintained and increased across all treatments, with the 2% SPP formulation showing significantly higher viability at Day 14 compared to the control ($p = 0.021$), suggesting a potential concentration-dependent prebiotic effect during extended storage. However, no significant differences in pH and titratable acidity were observed among treatments over time, indicating that SPP did not markedly alter post-fermentation acid development under the conditions tested. Sensory evaluation revealed that SPP addition significantly affected key attributes such as sourness, overall taste, and general acceptability, while appearance, aroma, sweetness, and texture were not significantly different among treatments. Overall, the 1% SPP formulation obtained the highest general acceptability score, indicating a more balanced sensory profile preferred by panelists. These findings suggest that while higher SPP levels may enhance microbial viability, moderate inclusion levels provide better consumer acceptability.

Future studies should include comprehensive physicochemical characterization of sweetpotato powder, particularly its resistant starch, dietary fiber, and phenolic content, to better establish its functional role in fermented dairy systems. It is also recommended to include a broader range of probiotic strains or defined probiotic cultures in future studies to better evaluate true probiotic functionality. Finally, extended storage studies and consumer-based sensory testing are suggested to further validate product stability, acceptability, and potential market application.

REFERENCES

- Abdi-Moghadam Z, Darroudi M, Mahmoudzadeh M, Mohtashami M, Jamal AM, Shamlou E, and Rezaei Z. 2023. Functional yogurt, enriched and probiotic: A focus on human health. *Clin Nutr ESPEN* 57:575–586.
- Afiati F, Priadi G, and Setiyoningrum F. 2018. The improvement of functional food in yogurt enriched with purple sweet potato (*Ipomoea batatas* var. *Ayamurasaki*). *J Indones Trop Anim Agric* 43(2):159–168.
- Alla RHG, Ayman SD, and Ginat ME. 2025. Several qualities of sweet potato-flavored yogurt. *Food Technol Res J*. 8(1):60–71.
- Amagloh FC, Yada B, Tumuhimbise GA, Amagloh FK, and Kaaya AN. 2021. The potential of sweetpotato as a functional food in sub-Saharan Africa and its implications for health: A Review. *Molecules* 26(10):2971.
- Baker MT, Lu P, Parrella JA, and Leggette HR. 2022. Consumer acceptance toward functional foods: a scoping review. *Int J Environ Res Public Health* 19(3): 3217.

- Cao Y, Tian B, Zhang Z, Yang K, Cai M, Hu W, Guo Y, Xia Q, and Wu W. 2022. Positive effects of dietary fiber from sweet potato [*Ipomoea batatas* (L.) Lam.] peels by different extraction methods on human fecal microbiota in vitro fermentation. *Front Nutr* 9: 986667.
- Dave RI and Shah NP. 1997. Viability of yoghurt and probiotic bacteria in yoghurts made from commercial starter cultures. *Int Dairy J* 7(1):s31–41.
- Felismino MM, Oliveros MCR, Bautista JAN, and Mopera LE. 2020. Best inclusion rate of purple yam “Kinampay” (*Dioscorea alata* L.) powder in yoghurt. *Philipp J Vet Anim Sci* 46(1):31–41.
- Fernandez MA and Marette A. 2017. Potential health benefits of combining yogurt and fruits based on their probiotic and prebiotic properties. *Adv Nutr* 8(1):155S–164S.
- Gibson GR, Hutkins R, Sanders ME, Prescott SL, Reimer RA, Salminen SJ, Scott K, Stanton C, Swanson KS, Cani PD, Verbeke K, and Reid G. 2017. Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. *Nat Rev Gastroenterol Hepatol* 14(8):491–502.
- Granato D, Branco GF, Nazzaro F, Cruz AG and Faria JAF. 2010. Functional foods and nondairy probiotic food development: Trends, concepts, and products. *Comp Rev Food Sci Food Saf* 9(3):292–302.
- Gupta MK, Torrico DD, Ong L, Gras SL, Dunshea FR, and Cottrell JJ. 2022. Plant and dairy-based yogurts: a comparison of consumer sensory acceptability linked to textural analysis. *Foods* 11(3):463.
- Hutkins RW. 2018 *Microbiology and Technology of Fermented Foods*. 2nd ed. New York: Wiley-Blackwell.
- Karagül-Yüceer Y and Drake MA. 2013. Sensory analysis of yogurt. In Chandan RC and Kilara A, eds. 2nd ed. *Manufacturing Yogurt and Fermented Milks*, United Kingdom: John Wiley & Sons, Inc., pp. 353–367.
- Kilinc M, Akarca G, and Denizkara J. 2025. Effect of lyophilised sweet potato on the quality and nutritional characteristics of set yogurt. *Food Sci Nutr* 13(3):e70111.
- Lu PH, Huang YY, Lai YC, Khoirunnida FL, and Lu YC. 2026. Effects of yellow-fleshed sweet potato powder on the quality and stability of yoghurt during storage. *J Dairy Res* 1–9.
- Markowiak P and Śliżewska K. 2017. Effects of probiotics, prebiotics, and synbiotics on human health. *Nutrients* 9(9):1021.
- Olamiti G. 2025. Functional food applications of root and tuber-based prebiotics in gut microbiota management: A review. *Curr Res Nutr Food Sci J* 13(Special Issue-July):34–52.
- Omar HH, El-Nimer AM, Ahamed MA, and Hassaan HM. 2019. Production of functional bio-yoghurt made from camel milk, skim milk retentate, and fortified with sweet potato powder. *Egypt J Agric Res* 97(2.1):441–458.
- Ortiguero MCG. 2014. Evaluation of prebiotic potential of sweet potato (*Ipomoea batatas* L.) through in vitro assay. *Undergraduate Thesis*. College of Agriculture and Food Science, University of the Philippines Los Baños.
- Rosa MC, Carmo MRS, Balthazar CF, Guimarães JT, Esmerino EA, Freitas MQ, Silva MC, Pimentel TC, and Cruz AG. 2021. Dairy products with prebiotics: An overview of the health benefits, technological and sensory properties. *Int Dairy J* 117:105009.

- Saint-Eve A, Lévy C, Martin N, and Souchon I. 2006. Influence of proteins on the perception of flavored stirred yogurts. *J Dairy Sci* 89(3):922–933.
- Saleem GN, Gu R, Qu H, Khaskheli GB, Rajput IR, Qasim M, and Chen, X. 2024. Therapeutic potential of popular fermented dairy products and its benefits on human health. *Front Nutr* 11:1328620.
- Shori AB. 2015. Influence of food matrix on the viability of probiotic bacteria: A review based on dairy and non-dairy beverages. *Food Biosci* 13:1–8.
- Spence C, Motoki K, and Petit O. 2022. Factors influencing the visual deliciousness / eye-appeal of food. *Food Qual Prefer* 102:104672.
- Tamime AY and Robinson RK. 2007. *Tamime and Robinson's Yoghurt: Science and Technology*. 3rd ed. Cambridge: Woodhead Publishing.
- Tripathi MK and Giri SK. 2014. Probiotic functional foods: Survival of probiotics during processing and storage. *J Funct Foods* 9(1):225–241.
- Vermeir I and Roose G. 2020. Visual design cues impacting food choice: A review and future research agenda. *Foods* 9(10):1495.
- Yuliana N, Zuidar AS and Arpani AP. 2023. The effect of fermented sweet potato flour supplementation on the characteristics of ambon banana yoghurt. *MOJ Food Process Technol* 11(2):106–109.
- Zhao M, Li H, Zhang D, Li J, Wen R, Ma H, Zou T, Hou Y, and Song H. 2023. Variation of aroma components of pasteurized yogurt with different process combination before and after aging by DHS/GC-O-MS. *Molecules* 28(4):1975.