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FOOD TECHNOLOGY

Fermented water-soluble yam extract: growth kinetics, technological characteristics and sensory evaluation

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ABSTRACT: The shifting behavior of the contemporary population regarding ethical animal welfare concerns has driven an increased demand for plant-based foods and beverages. Thus, this study developed a water-soluble fermented yam extract (FWYE) using commercial strains of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, and evaluated its fermentation kinetics, microbial viability, technological properties during storage and sensory attributes. Lactic acid bacteria (LAB) adapted to the mathematical model within the tested matrix. During the storage period, the pH of the FWYE decreased, with the most pronounced reduction observed on day 21 (3.99), which coincided with the lowest counts of *L. bulgaricus* (6.73 log CFU/mL) and *S. thermophilus* (6.68 log CFU/mL). After 28 days of refrigerated storage, FWYE maintained LAB counts above 8.4 log CFU/mL. The technological properties exhibited syneresis values exceeding 77.92% and water retention capacity below 9.38%. For the sensory evaluation, 70 panelists assessed FWYE alongside strawberry-flavored (FWYES) and chocolate-flavored (FWYEC) versions. The highest scores for sensory attributes, as well as the greatest acceptability index (83.8%) and purchase intention (3.97), were recorded for FWYES. The results show that despite technological limitations, the fermented yam beverage proved effective in maintaining the viability of LAB and sensorially promising for consumers with restrictions on dairy consumption.
Key words: lactic acid bacteria, plant based, fermentation, strawberry, veganism.

Extrato hidrossolúvel fermentado de inhame: cinética de crescimento, características tecnológicas e avaliação sensorial

RESUMO: A mudança de comportamento da população contemporânea com questões éticas relacionadas ao bem-estar animal trouxe uma maior procura por alimentos e bebidas à base de vegetais. Neste sentido, este estudo objetivou desenvolver um extrato hidrossolúvel de inhame fermentado (FWYE) com linhagens comerciais de *Lactobacillus bulgaricus* e *Streptococcus thermophilus*, determinando o perfil cinético da fermentação, a viabilidade microbiana, as propriedades tecnológicas durante o armazenamento e os atributos sensoriais. Para desenvolver esse extrato as bactérias láticas (BAL) se adaptaram ao modelo matemático na matriz testada. Durante o período de estocagem, ocorreu redução do pH do FWYE, com maior redução com 21 dias (3,99), mesmo período em que ocorreu a maior redução na contagem de *L. bulgaricus* (6,73 log UFC/mL) e *S. thermophilus* (6,68 log UFC/mL). Além disso, ao final dos 28 dias de armazenamento em refrigeração, FWYE apresentou contagens desses microrganismos superiores a 8,4 log UFC/mL. Já as propriedades tecnológicas mostraram uma sinérese superior a 77,92% e capacidade de retenção de água inferior a 9,38%. E para avaliação sensorial, 70 avaliadores provaram a FWYE, saborizada com morango (FWYES) e chocolate (FWYEC). As melhoras notas dos atributos sensoriais, assim como maior índice de aceitação (83,8%) e intenção de compra (3,97) foram atribuídas ao FWYES. Os resultados mostram que apesar das limitações tecnológicas, a bebida de inhame fermentado, mostrou-se eficaz na manutenção da viabilidade das BAL e sensorialmente promissora para consumidores com restrições ao consumo de laticínios.
Palavras-chave: bactérias ácido láticas, base de plantas, fermentação, morango, veganismo.

INTRODUCTION

The adoption of plant-based diets has been driven by ethical, health, and environmental concerns, contributing to the growing availability of plant-based beverages, despite their nutritional differences compared to those made from cow's milk (BUTOVSKAYA et al., 2025). Additionally, lactose

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intolerance, which affects approximately 70% of the global population, has further fueled the demand for milk alternatives, such as plant-based beverages (ANTUNES et al., 2025).

The global market for plant-based products has been increasing, and the plant-based fermented beverages market is projected to grow at a compound annual rate of 13.3%, increasing from US$4.5 billion in 2023 to US$10.9 billion by 2030 (PERSISTENCE MARKET RESEARCH, 2024). Thus, the development of plant-based fermented beverages is important to attend to consumers specific demands.

Yam (*Dioscorea* spp.) is a tropical root rich in carbohydrates, fiber, and starch and its global consumption is estimated at 18 million tons (OBIDIEGWU et al., 2020). This plant contains several bioactive compounds, including proteins, non-starch polysaccharides, steroidal saponins, allantoin, and phenolics, and has antioxidant, anti-inflammatory, gastrointestinal, and microbiota-modulating effects, as well as cardioprotective, hypoglycemic, antitumor, and estrogenic activities. These characteristics make yam a functional food with several potential applications (LI et al., 2023).

However, limited information is available regarding its use to produce beverages with functional functions. Therefore, this study developed a water-soluble yam extract fermented with commercial strains of lactic acid bacteria (LAB) evaluated its fermentation kinetics, microbial viability, technological properties during storage and the sensory attributes of this beverage.

MATERIALS AND METHODS

Development of water-soluble extract of fermented yam (FWYE)

Lactic acid bacteria (LAB)

The microbial lyophilized fermentum consisting of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* Y438A (Sacco®, La Chapelle-sur-Erdre, Pays de la Loire, France) was stored at -80 ºC and used in this study. For its activation, LAB were inoculated (2%, v/v) into 10 mL of MRS broth (MBiolog, Belo Horizonte, Minas Gerais, Brazil) and M17 broth (Difco, Becton Dickinson Co., Sparks, MD, USA) and incubated under aerobic conditions at 37 ºC for 48 hours (VON MOLLENDORFF et al., 2007).

Fermentation water-soluble yam extract

Yams were purchased from a local store, cleaned by washing, and sanitized with 10% sodium hypochlorite for 10 minutes. Subsequently, the yams were peeled and homogenized 34% with 100 mL of sterile water and 7.5% sucrose. The resulting water-soluble extract was heated (60 ºC for 30 minutes) using a Thermomix (Cloyes-sur-le-Loir, France); and subsequently cooled to 42 ºC in an ice-water bath. An inoculum of 4% (8.00 log CFU/mL) of Y438A was added. The water-soluble yam extract was dispensed into sterile 50 mL vials and fermented at 42 ºC. Following fermentation, the extract was cooled to 15 ºC and stored at 4 ºC for 28 days to assess LAB viability, syneresis and water-holding capacity.

Kinetic profile of LAB strains in water-soluble yam extract

Assessment of the LAB population

The samples were collected at 30-minute intervals until a pH of 4.6 was reached (the endpoint of fermentation) (COSTA et al., 2025). This pH value was adopted based on DA COSTA et al. (2018) that also studied yam-based fermented beverages. LAB were enumerated on MRS Agar for *L. bulgaricus* and on M17 agar for *S. thermophilus* both incubated aerobically at 37 ºC for 48 h. Viability was expressed as log CFU/mL of water-soluble yam extract.

Determination of pH during fermentation

The pH was measured using a previously calibrated pHmeter (Gehaka PG1800 digital pH meter, São Paulo, Brazil) at 30-min intervals until a pH of 4.6 was reached.

Estimation of LAB multiplication parameter during fermentation

To estimate the multiplication parameters, equations 1 and 2 proposed by BARANYI & ROBERTS (1994) were used. The latency time (λ, h), the multiplication rate (μ_{max}, h^{-1}) and the maximum population were estimated (log CFU/mL).

$$y(t) = y_0 + \mu_{max}A(t) - In\left(1 + \frac{exp\ (\mu_{max}A(t)) - 1}{exp\ (y_{max} - y_0)}\right) \quad (1)$$

$$A(t) = t + \frac{1}{\mu_{max}} \ln\left(\frac{e^{(-\mu_{\max} t)} + q_0}{1 + q_0}\right) \quad (2)$$

In this context, y(t) represents the cell concentration (log CFU/mL) at time t (days), while y_{max} (k) is the maximum cell concentration (log CFU/mL). The term y_0 refers to the initial cell concentration (log CFU/mL), and μ_{max} denotes the maximum specific growth rate (CFU/mL/day). q_0 measures the physiological state of the cells, and mm is a parameter that describes the curvature after the exponential growth phase. Furthermore, A(t) is a function that considers the physiological state of the cells, incorporating the effects of various factors on microbial metabolism.

The parameters were estimated using Microsoft Excel Dmfit version 3.5 (ComBase, Dresden, Germany, https://www.combase.cc/). The Baranyi model formula was used to produce the maximum growth rate (μ_{max}) and R^2 (overall measure of prediction accuracy).

Technological characteristics of fermented water-soluble yam extract

Determination of syneresis throughout shelf life

Syneresis was measured on the 1st, 14th, and 28th days following FWYE production. The estimation of syneresis followed the method outlined by KIESERLING et al. (2019). Approximately 15 g of FWYE samples were weighed and transferred to a 15 mL Falcon tube. The samples were then centrifuged at 512.2×g for 20 minutes, and the syneresis level was calculated using equation 3.

$$Syneresis\ (\%) = \frac{Weight\ of\ supernatant\ (g)}{Weight\ of\ fermented\ milk\ sample\ (g)} x\ 100 \quad (3)$$

Determination of water-holding capacity throughout shelf life

The water-holding capacity (WHC) of FWYE samples was assessed using the method described by HARTE et al. (2003) with slight modifications. Twenty grams of FWYE were weighed into a 50 mL test tube and centrifuged (Nüve-Bench Top Centrifuge, NF 1200R, Turkey) at 15,000×g for 15 minutes at 20 ºC. The percentage of WHC was calculated using equation 4.

$$WRC = \frac{1 - Serum\ weight\ after\ centrifugation}{Weight\ of\ fermented\ milk\ sample} x\ 100 \quad (4)$$

LAB viability throughout shelf life

The viability of LAB was assessed on days 1st, 14th, and 28th. *S. thermophilus* colonies were enumerated on M17 agar, while *L. bulgaricus* was enumerated on MRS agar. Both types of plates were incubated at 37 ºC under aerobic conditions for 48 hours. Viability was reported as log CFU/mL of water-soluble yam extract.

Sensory analysis of water-soluble extract of fermented yam

Casuistry

Participants included male and female students and untrained staff of the Universidade Federal de Minas Gerais (UFMG), aged between 18 and 65 years, were recruited. Individuals with any restrictions related to the ingredients of the plant-based beverage, intolerance to any component of the formulation, health problems, or ongoing medication use were excluded. Accordingly, the selection criteria for panelists included absence of aversion to the product, availability, motivation and interest in participating in the sensory evaluation.

All participants signed the Informed Consent Form (ICF) for Research with Human Subjects, as well as completed the identification questionnaire provided. The research was submitted and approved by the UFMG Research Ethics Committee (CEP/UFMG) 51595121.8.0000.5149, on April 12, 2024.

For the acceptance and purchase intention tests, the fermented water-soluble yam extract (FWYE) and two flavored variants were developed. One variant consisted of FWYE added with 10% strawberry-flavored dessert powder (FWYES) (Malavério®, São Paulo, Brazil), and the other contained 20% chocolate-flavored dessert powder (FWYEC) (Malavério®, São Paulo, Brazil). The flavor mixtures were added after the yam beverage had undergone fermentation. Each flavor (strawberry or chocolate) was incorporated separately into the fermented beverage, stirred until fully dissolved, and then refrigerated until testing.

For the sensory analysis tests, microbiological safety analyses were performed based on Brazilian legislation (BRAZIL, 2022). Molds and yeasts, and *Salmonella* spp. were investigated.

Acceptability test

The acceptability test involved 70 untrained panelists. Samples were coded with random three-digit numbers and served alongside a glass of mineral water to cleanse the palate between samples. The refrigerated samples were presented on a tray in plastic cups, each containing approximately 25 mL. The distribution followed a monadic, sequential, and randomized design in individual booths. Participants evaluated the samples using a nine-point hedonic scale, ranging from 1 (“disliked very much”) to 9 (“liked very much”), with 5 representing the neutral midpoint (“neither liked nor disliked”), assessing the attributes of color, aroma, flavor, texture and overall impression.

For a beverage to be considered sensorially acceptable, it must have an acceptability index greater than 70%. To calculate this index, value 5 was used as a cutoff point, as described by DUTCOSKY (1996), where **A** represents the average score obtained for the product, and **B** is the maximum possible score (Equation 5).

$$IA\,(\%) = \frac{A\,x\,100}{B} \tag{5}$$

Purchase intention test

The purchase intention test also involved 70 untrained panelists. Samples were coded, delivered, and portioned following the same methodology used in the acceptability test. Sample evaluation employed a 5-point hedonic scale, where 1 corresponded to "definitely would not buy" and 5 to "definitely would buy".

Statistical analyses

Statistical analysis was performed using InfoStat software, version 2020 (DI RIENZO et al., 2020). Results were subjected to one-way analysis of variance (ANOVA) and evaluated at a significance level of 95%, using the coefficient of variation to assess data variability. Duncan's test was applied for LAB counts, while Tukey's test was used for pH, syneresis, and water-holding capacity (WHC).

For sensory tests, statistical analysis was conducted using SensoMaker software (version 1.92). Results were analyzed by ANOVA, and mean values were compared using Tukey's test (95% significance level).

RESULTS

Kinetic profile of LAB strains in water-soluble yam extract

The initial bacterial concentrations differed in the microbial consortium used. At the beginning of fermentation, the pH was 5.43, with bacterial counts of 5.17 log CFU/mL for *L. bulgaricus* and 9.69 log CFU/mL for *S. thermophilus* (Figures 1A and 1B). After approximately 2 hours and 30 minutes, the final pH of 4.6 was reached with *L. bulgaricus* (5.98 log CFU/mL) maintaining lower count than *S. thermophilus* (10.56 log CFU/mL) (Figure 1A and Figure 1B).

The correlation coefficients (R^2) of the models ranged from 0.936 for *L. bulgaricus* to 0.986 for *S. thermophilus*. The growth rates (μ) obtained were 1.22 h^{-1} for *L. bulgaricus* and 0.82 h^{-1} for *S. thermophilus*. These results indicated good fit to the Baranyi model and confirmed its suitability for modeling.

Technological characteristics of fermented water-soluble yam extract

The technological parameters of the beverage were evaluated during 28 days under refrigeration. The highest acidity (pH 3.99) of the FWYE was observed on day 21 showing a significant difference ($P < 0.05$) compared to 1st day (4.39) (Table 1).

Syneresis of the water-soluble fermented yam extract decreased from 90.57% on day 1 to 77.92% on day 21. The WHC values showed an inverse trend and the lowest value (6.15%) occurred on day 28, a value 3.23% lower than the highest one recorded on day 7 (Table 1).

At the end of the 28-day period, *L. bulgaricus* and *S. thermophilus* exhibited count higher than 8.0 log CFU/mL (Table 2). There was a reduction of 1.95 log CFU/mL in the *L. bulgaricus*

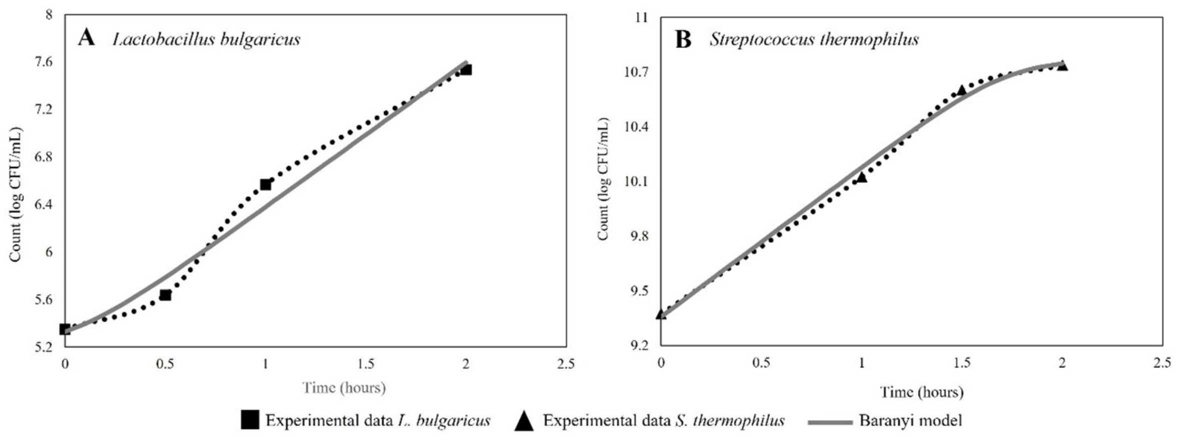

Figure 1 - Growth curves (log CFU/mL) of *Lactobacillus bulgaricus* and of *Streptococcus thermophillus*, in water-soluble fermented yam extract.

Table 1 - Technological characteristics of the water-soluble extract of fermented yam microbial consortium of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* Y438A.

Parameters	----------1st----------	----------7th----------	---------14th---------	---------21th---------	---------28th---------
pH	4.39 ± 0.06[a]	4.27 ± 0.03[ab]	4.19 ± 0.09[ab]	3.99 ± 0.10[b]	4.16 ± 0.12[ab]
Syneresis (%)	90.57 ± 1.17[a]	88.65 ± 2.61[a]	78.02 ± 6.44[a]	77.92 ± 6.76[a]	87.34 ± 3.55[a]
WHC (%)	7.77 ± 0.75[a]	9.38 ± 0.37[ab]	7.22 ± 0.60[ab]	8.78 ± 0.83[ab]	6.15 ± 0.70[b]

Different lowercase letters in the same row indicate significant differences ($P < 0.05$) between the evaluated time points. Results are expressed as mean ± standard error (n = 9).

count ($P > 0.05$) from the 1st to the 21st day of storage. *S. thermophilus* also showed lower counts on the 21st day (6.68 log CFU/mL).

Sensory analysis of water-soluble extract of fermented yam

The fermented water-soluble yam extracts, flavored or not, showed an absence of *Salmonella* spp. and mold and yeast counts >1.0 log CFU/mL.

The FWYES beverage received the highest scores in the acceptance analysis (Table 3). The attributes of color (8.20), flavor (7.52), and overall acceptance (7.55) differed from those of FWYE and FWYEC ($P < 0.05$). Texture scores were similar among FWYE (5.98), FWYES (6.68) and FWYEC (6.27).

FWYES was the unique formulation with an acceptability index above 70%, allowing it to be considered sensorially acceptable. In the purchase intention test, FWYEC also stood out obtaining an average score of 3.97 on the 5-point hedonic scale and indicating a preference between "possibly would buy" and "definitely would buy" (Figure 2). FWYE and FWYEC presented purchase intention scores of 2.54 and 2.85, respectively.

DISCUSSION

In contrast to traditional lactic acid fermentation, in which lactose constitutes the primary carbohydrate substrate, LAB in plant-based matrices utilize enzymes such as α-galactosidase and other glycosidases to hydrolyze complex oligosaccharides (LAVELLE et al., 2025). Yam possesses a nutritional composition favorable for fermentation, containing high levels of total carbohydrates (77.4-83.1%), starch (44.7-67.8 g/100 g), reducing sugars (3.7-7.1 g/100 g), fiber (3.5-14.1%), and protein (5.0-8.8%). This composition provides a matrix rich in substrates and nutrients essential for microbial growth and activity (SAHOO et al., 2023).

The combination of *L. bulgaricus* and *S. thermophilus* was effective in fermenting FWYE. A reduced fermentation time is advantageous for industrial applications, as shorter production cycles significantly enhance process efficiency and reduce operating costs (BAI et al., 2024). The increase in titratable acidity and pH decreases observed during the fermentation reflect the usual metabolic activity of LAB that converts the available carbohydrates into organic acids. This behavior can be attributed to the strains' adaptability to these substrates, as evidenced by microbial count data demonstrating growth throughout the fermentation process (ACÍN-ALBIAC et al., 2021). These findings are consistent with those of CUI et al. (2023), who reported that compounds present in yam stimulate microbial growth and promote medium acidification via microbial metabolism.

LAB viability is a critical determinant of the shelf life of fermented beverages. In yogurt, a fermented dairy product for which the presence

Table 2 - Viability (log CFU/mL) of LAB in water-soluble extract of fermented yam, throughout shelf life and refrigerated storage.

Strain	----------1st----------	----------7th----------	---------14th---------	---------21th---------	---------28th---------
L. bulgaricus	8.68 ± 0.36[ab]	7.10 ± 0.85[ab]	8.03 ± 0.15[ab]	6.73 ± 0.82[b]	9.13 ± 0.53[a]
S. thermophilus	9.28 ± 0.24[a]	8.42 ± 0.47[ab]	7.30 ± 0.71[bc]	6.68 ± 0.73[c]	8.44 ± 0.22[ab]

Different lowercase letters in the same row indicate significant differences ($P < 0.05$) between the evaluated time points. Results are expressed as mean ± standard error (n = 9).

Table 3 - Acceptance results for color, aroma, texture, flavor, overall impression, and purchase intention of water-soluble yam extract fermented with *Lactobacillus bulgaricus* and *Streptococcus thermophiles*.

Sample	-----Color-----	----Aroma----	----Flavor----	---Texture---	Overall Acceptance	Acceptability index (%)
FWYE	6.17[c]	5.32[b]	5.24[b]	5.98[a]	5.47[b]	60.7
FWYES	8.20[a]	8.00[a]	7.52[a]	6.68[a]	7.55[a]	83.8
FWYEC	7.28[b]	7.90[a]	5.28[b]	6.27[a]	6.01[b]	66.7

Equal letters in the same row do not differ statistically from each other by Tukey's test (P < 0.05). Fermented water-soluble yam extract (FWYE); fermented water-soluble yam extract with strawberry flavor (FWYES); and fermented water-soluble yam extract with chocolate flavor (FWYES).

of *L. bulgaricus* and *S. thermophilus* is mandatory, Brazilian regulations stipulate a minimum LAB count of 7.0 log CFU/mL (BRAZIL, 2007). In FWYE, LAB counts remained above this threshold even after 28 days of refrigerated storage (Table 2). After 21 days of storage, the lowest counts were recorded for both strains: 6.73 log CFU/mL for *L. bulgaricus* and 6.68 log CFU/mL for *S. thermophilus*. During fermentation, LAB are subjected to various environmental stresses (BAIG et al., 2022), including acid stress, which was particularly evident at 21 days of storage, when the pH reached 3.99 (Table 1). Elevated acid concentrations can negatively impact LAB multiplication (CEDILLOS et al., 2024).

In response to stress, LAB employ intrinsic self-regulatory mechanisms such as activation of the stress response system to enhance their tolerance to environmental challenges (HE et al., 2025). They can protect themselves from damage by inducing stress response pathways, including: (i) carbohydrate metabolism; (ii) amino acid metabolism; (iii) energy metabolism; (iv) DNA protection and repair; and (v) regulation of cell wall and membrane synthesis (HE et al., 2025). These protective mechanisms may have contributed to the LAB's ability to withstand acid stress, resulting in an increase in strain counts of approximately 2.0 log CFU/mL after 28 days of storage (Table 2).

In addition to monitoring LAB viability and pH during FWYE storage, evaluating the product's technological properties is essential. Water-holding capacity (WHC) and syneresis directly influence the stability, texture, and sensory attributes of fermented beverages (ARAB et al., 2023). These parameters are

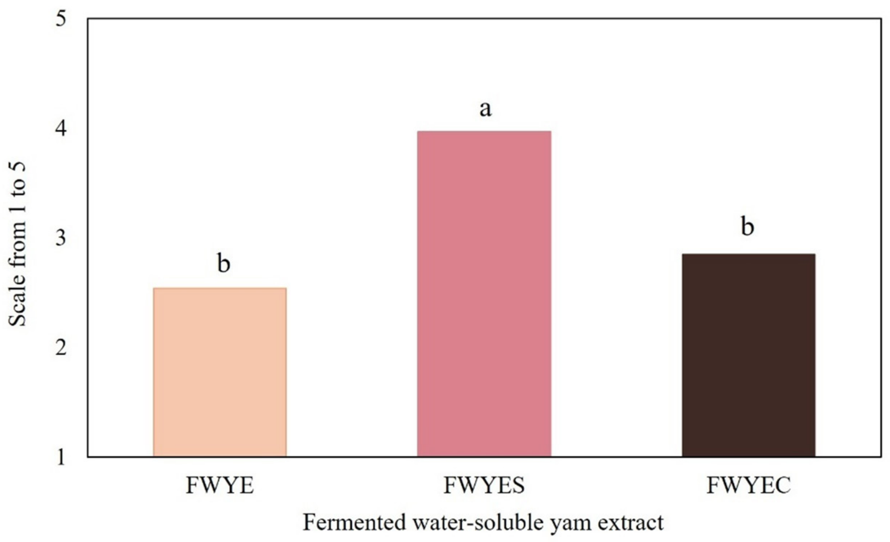

Figure 2 - Purchase intention results for fermented water-soluble yam extract (FWYE), fermented water-soluble yam extract with strawberry flavor (FWYES), and fermented water-soluble yam extract with chocolate flavor (FWYEC).

inversely correlated, such that higher WHC values correspond to lower syneresis levels (WU et al., 2023).

Syneresis is the expulsion of liquid from the gel network. In fermented beverages, it is considered as a quality defect that can negatively influence consumer perception (YAPA et al., 2023). In dairy-based products, the hydrophilic properties of casein are known to promote effective water retention and contribute to the formation of a rigid gel (ARAB et al., 2023); however, this effect is not observed in plant-based products. To reduce liquid expulsion, stabilizers or hydrocolloids, such as gelatin, vegetable gums, and pectin, are commonly used (PÉREZ et al., 2021). The addition of powdered yam has been reported to exert positive effects on the texture, stability, and consistency of yogurts (OLUFEMI & JOHN, 2016) and may serve as an alternative for controlling syneresis in the water-soluble extract prepared in this study.

COSTA et al. (2025) evaluated WHC and syneresis in milk fermented with *S. thermophilus* STI-12 and *Lacticaseibacillus paracasei* GV17, reporting values of 42.32% and 34.62%, respectively, after 28 days of storage. In FWYE, as expected, these parameters were inversely related (Table 1), with WHC at 6.15% and syneresis at 87.34%. Syneresis values above 77.92% were maintained throughout the beverage's shelf life.

PÉREZ et al. (2021) evaluated the syneresis of yogurt with added yam starch and reported syneresis percentages ranging from 56% to 58.4%. The authors concluded that yam starch is more effective than pectin in controlling syneresis and that the resulting beverage was well accepted by the 50 tasters.

One of the main challenges associated with plant-based beverages is their texture. To achieve the texture and water-holding capacity typically found in fermented milk-based beverages, the use of additives is required (KAUR et al., 2026). During the thickening process of plant-based beverages, starch molecules form a disorganized entangled structure, when heated, gelation creates stable junction zones within a three-dimensional network (CHANG et al., 2025). Consequently, viscosity increases due to water penetration and swelling of the starch granules (SHI et al., 2024).

When evaluated by tasters without added flavoring, FWYE received the lowest scores, including the lowest acceptability index (60.7%) (Table 3). The fermented water-soluble extract with added strawberry (FWYES) was the most accepted. YANG & LEE (2019) reported that consumer familiarity with sensory attributes such as taste, aroma, color, and texture is a key determinant of food acceptance, suggesting that the more recognizable the sensory profile, the greater the likelihood of consumer approval. The strawberry flavor may also be preferred by evaluators, reflecting its widespread presence in the Brazilian market and its strong association with consumer preference (JANIASKI et al., 2016). Additionally, volatile compounds associated with the strawberry flavor, such as esters and medium-chain fatty acids, contribute to higher perceived sweetness, making it the most suitable choice for masking undesirable flavors (FAN et al., 2021).

In this context and considering the results reported by BRESSANI et al. (2024) and YANG et al. (2020), yam-based fermented vegetable beverages can be regarded as sensorially acceptable. When these findings are integrated with the purchase intention data from the present study, it becomes evident that the drink with the strawberry flavored formulation constitutes a promising alternative. However, despite the favorable initial structural formation and the positive outcomes observed in the sensory analysis, the tendency for phase separation during storage underscores limitations in the physical and structural stability of the beverage. To address this issue, strategies such as the incorporation of modified starches or the use of exopolysaccharide-producing strains have been shown to effectively improve texture and reduce syneresis in fermented products (RODRIGUEZ-RUIZ et al., 2024).

CONCLUSION

The plant-based food matrix developed from fermented water-soluble yam extract proved effective in maintaining the viability of the inoculated LAB strains, while exhibiting a reduced fermentation time suitable for industrial application. Further research is warranted to assess the product's technological performance, particularly considering the low water-holding capacity and high syneresis observed throughout the FWYE shelf life. Future formulations could incorporate structuring agents, such as modified starches, or employ exopolysaccharide-producing strains to enhance stability. Despite these limitations, microbiological and sensory data highlight the potential of yam as a viable substrate for the development of fermented plant-based beverages. Moreover, the strawberry-flavored version was well-received by the reviewers, indicating a promising option for consumers with restrictions on dairy consumption.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare that they have no know competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

AUTHORS' CONTRIBUTIONS

The authors contributed equally to the manuscript.

DATA AVAILABILITY STATEMENT

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

DECLARATION OF USE OF ARTIFICIAL INTELLIGENCE

The authors declare that no artificial intelligence (AI) tools were used in the preparation, writing, editing, or analysis of this manuscript.

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