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The Study of the Microbial Influence and Sensory Acceptability of Sourdough Baked Goods Among Young Adults in KwaDlangezwa, KwaZulu-Natal, South Africa

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Abstract

Sourdough, once a traditional bread-making method, has gained renewed popularity in contemporary culinary practices. This study explores the relationship between microbial characteristics, sensory appeal, and microbial content in sourdough-derived products, focusing on English muffins, sourdough bread buns, and blueberry muffins. A mixed-method approach combining microbiological analysis with sensory evaluation and consumer surveys. A quantitative approach was used whereby an effective test was done to assess preferences for taste, texture, aroma, and overall satisfaction among 60 participants from KwaDlangezwa. Sensory data were collected using a 9-point hedonic scale and analysed using descriptive statistical analysis, while microbial content was analysed using serial dilutions and plated samples on agar. Colonies were examined, isolating them via microscopy and additional cultivation. Results indicated favourable sensory acceptability for all products, with blueberry muffins showing a strong preference for taste and aroma , particularly for their sweetness and moistness. Microbial analysis revealed significant fungal presence in sourdough bread buns, with fungal counts associated with enhanced flavour and texture properties of the products. Even though this study did not identify the key species involved in the fermentation process, these findings highlight the role of microbial communities in shaping both the nutritional and sensory qualities of sourdough products. Future research should explore the specific microbial community of the sourdough and how it influences the desired characteristic tastes and flavours of the target product.

Keywords: Fermentation, wellness benefits, microbial composition, sensory acceptability, sourdough

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Introduction

KwaDlangezwa is a rural area in South Africa characterised by unique dietary habits and a youthful population, making it an intriguing setting for investigating sourdough consumption. The region's traditional food practices often emphasise community - and local ingredients, thus sourdough, with its artisanal roots and digestive benefits, aligns well with the dietary preferences and values of its residents (Tincho & Kammal, 2021). Furthermore, the youthful demographic presents a significant opportunity to explore changing dietary trends as younger generations increasingly seek nutritious-oriented food options (Ntyintyane, 2022). Given these local factors, the examination of sourdough not only serves to fill a research gap but also reflects the potential for sustainable dietary practices within KwaDlangezwa's socio-economic landscape. Sourdough, a traditional form of bread-making, has been practiced for centuries and is gaining renewed interest due to its distinct sensory qualities and possible digestive advantages. Sourdough originated in ancient civilisations that used natural fermentation with wild yeast and lactic acid bacteria (LAB) (Suchintita Das et al., 2023). Fermentation is not only responsible for the leavening of the bread, but it also imparts distinctive flavours and textures. Therefore, it is a popular choice among artisanal bakers and wellness focused consumers (Suchintita Das et al., 2023). The sensory appeal of sourdough is greatly influenced by the microbial factors during fermentation. For example, the relationship between yeast and LAB contributes to the characteristic sour flavour and chewy texture of sourdough bread. Lactic acid bacteria, such as *Lactobacillus* and *Leuconostoc*, play a vital role in producing organic acids (Zahra et al., 2022). These organic acids help reduce the pH, which not only improves the flavor of the bread but also helps prevent the growth of spoilage microorganisms (Moro et al, 2022). Additionally, yeast is essential in bread-making as it produces carbon dioxide during fermentation, leavening the bread and improving its texture. The conditions of fermentation and microbial strains involved can significantly affect the final taste, aroma, and overall sensory qualities (Moro et al, 2022). The sensory appeal of sourdough is central to its consumer acceptance. This includes the sour taste, chewy texture, and aroma are key factors that influence the preference of sourdough over other types of bread. Recent innovations in sourdough bread-making have been observed, which aim to enhance sensory characteristics and make sourdough more appealing to a broader audience (Zahra et al., 2022). These include exploring the use of different ingredients and manipulating the fermentation times.

To do this, understanding the microbial characteristics that impact these sensory properties is essential for improving sourdough production and meeting consumer expectations.

Despite the recent interest in sourdough, there is a gap in understanding how microbial composition affects its sensory acceptability, particularly in rural areas like KwaDlangezwa. While various studies have identified the general role of lactic acid bacteria (LAB) and yeast in fermentation, a few studies have explored how their microbial composition influences key sensory attributes like taste, texture, and aroma, which are critical for consumer preferences (Jebo & Urga 2024). In addition, factors such as the duration of fermentation, the environmental conditions, and ingredient formulations have not been sufficiently linked to microbial content and sensory characteristics. Addressing this gap is crucial for optimising sourdough production and meeting consumer demands for products that are flavourful, wellness-focused, and sustainable. This study focuses on evaluating the acceptance of sourdough baked goods among young adults in KwaDlangezwa. It aims to explore how the sensory qualities of these products, along with their microbial composition, affect consumer preferences. Furthermore, the research investigates the relationship between the microbial content of sourdough products and their sensory characteristics such as taste, texture, and overall appeal. By analysing how microbial factors influence sensory experience and nutritional benefits, the study seeks to highlight the crucial role these elements play in determining the overall acceptability of sourdough baked goods. The study also recognises its limitations, emphasising the need for further, more detailed research in this area.

Literature review

The resurgence of sourdough bread signifies an increasing fascination with artisanal and wellness-focused foods, particularly among younger consumers. This phenomenon can be linked to the unique flavours and textures that sourdough provides, along with its potential digestive benefits (Cappelle et al., 2023). As young adults represent a significant demographic in consumer behaviour, it is crucial to understand their preferences and perceptions regarding sourdough baked goods (Patel, 2023). Aspects such as flavour consistency and perceived digestive benefits play a vital role in shaping consumer acceptance (Baker et al., 2022). Young adults often weigh well-being considerations against convenience and culinary exploration, suggesting that their views on sourdough products may differ from those of older generations (Finley, 2024). Additionally, the diverse cultural landscape of South Africa necessitates a nuanced understanding of regional variations in taste preferences and eating habits, especially concerning sourdough (García-Barón et al., 2025). From a microbiological standpoint, sourdough is characterised by the presence of wild yeasts and lactic acid bacteria, which have been essential to its production since ancient times. The roots of sourdough can be traced back roughly 6,000 years to Ancient Egypt, where the first instances of leavened bread appeared (Ozdal & Abu-Khalil, 2025). Historical documents indicate that the ancient Greeks and Romans also utilised sourdough methods, underscoring its cultural importance in communal diets and the dissemination of baking knowledge (Ray et al., 2024).In spite of the historical and cultural significance of sourdough, there exists a gap in knowledge regarding its microbial influences and how these may impact sensory acceptability among modern consumers, particularly young adults in areas such as KwaDlangezwa, KwaZulu-Natal. This study aims to investigate the microbial characteristics of sourdough, assess its sensory relevance to young adults, and address this existing knowledge gap by evaluating their preferences.

The microbial properties of sourdough

Sourdough bread is produced through a natural fermentation process involving a symbiotic culture of lactic acid bacteria (LAB) and wild yeast, which not only leavens the dough but also enhances its flavour and texture (Pérez-Alvarado, 2022). The microbial composition of sourdough varies depending on factors such as geographical region, flour type, and fermentation conditions, with LAB and yeast being the primary microbial groups (Hernández-Parada et al., 2022). LAB species such as *Lactobacillus brevis*, *Lactobacillus sanfranciscensis*, and *Lactobacillus plantarum* play a crucial role by producing lactic, organic, and acetic acids that impart the characteristic tangy flavour and extend the bread's shelf life (Sevgili et al., 2023; Warburton et al., 2022). These bacteria also generate antimicrobial compounds that inhibit spoilage organisms, contributing to the bread's safety and quality (Islam & Islam, 2024). Furthermore, LAB influences the dough's viscosity, strength, and extensibility by modifying the starch and protein matrix, thereby improving crumb structure (Katina et al., 2023). Meanwhile, yeast fermentation produces carbon dioxide, which causes the dough to rise, creating the light and airy texture typical of sourdough bread, and adds complexity to its flavour through the production of alcohols, esters, and other volatile compounds (Warburton et al., 2022; Zheng et al.). The interplay between LAB and yeast not only shapes the sensory qualities of sourdough, such as sourness and aroma, but also affects consumer acceptance and preferences. Research highlights that the microbial consortium is responsible for the distinct flavour profiles that are highly valued by consumers, with key LAB species enhancing flavour complexity through organic acid and aromatic compound production (Islam & Islam, 2024). Studies focusing on young adults reveal that cultural backgrounds influence taste preferences, with the balance between sourness from LAB and sweetness from yeast playing a significant role in perceptions of freshness and quality (Škrobot et al., 2025). Understanding these preferences is vital for tailoring sourdough products that align with local culinary traditions and consumer expectations. Additionally, the functional benefits of sourdough fermentation, such as improved nutrient bioavailability and reduced anti-nutritional factors, contribute to better digestibility and enhanced nutritional value, appealing particularly to wellness-focused consumers who prioritise both taste and wellness benefits in their dietary choices (Sevgili et al., 2023). Thus, the microbial properties of sourdough are central not only to its unique sensory attributes but also to its growing popularity among diverse consumer groups.

Sensory attributes of sourdough products
Sensory acceptability plays a vital role in the acceptability of sourdough products, influencing consumer preferences and purchasing decisions. Sourdough products have a unique sensory profile, with their characteristic sour taste resulting from organic acids produced during fermentation. This sourness is affected by factors such as flour type, fermentation duration, and the composition of bacteria and yeasts in the starter (Sevgili et al.,2023). Texture is another key factor in sensory acceptability. A denser and chewier texture generally characterises sourdough bread compared to other varieties, which can be attributed to its reduced water content and elevated acidity levels Temkov et al. (2024), While certain consumers favour a lighter texture, this can be accomplished by enhancing the hydration levels of the dough (Prieto-Vázquez del Mercado et al., 2022). Furthermore, the structure of the crumb plays a significant role in the sensory experience, as consumers typically exhibit a preference for an open crumb, which is regarded as more tender and easier to chew (Steyn, 2022). Consumer perceptions significantly influence sensory acceptability of food. A considerable number of individuals link sourdough with traditional and artisanal methods of production, which enhances its attractiveness (Maurice et al., 2022). Those who are familiar with sourdough typically anticipate a pronounced sour flavour and aroma; however, individuals who lack familiarity with sourdough may not resonate with its distinctive sensory characteristics, potentially affecting their level of acceptance (Mutlu, 2023)

Benefits of sourdough
Sourdough fermentation significantly improves the digestibility and nutrient bioavailability of cereal-based products, especially for individuals with gluten sensitivity. Moro et al. (2015) notes that the enzymatic processes facilitated by lactic acid bacteria (LAB) during fermentation lead to the breakdown of complex carbohydrates, proteins, and phytates, thereby diminishing anti-nutritional components and enhancing the uptake of vital minerals such as calcium, iron, and zinc. In comparison to conventional breads, sourdough exhibits superior digestibility, attributed to the action of LAB and wild yeast in degrading gluten and other components, which may alleviate negative reactions in those with gluten sensitivity (Islam & Islam, 2024). Furthermore, the organic acids generated during fermentation contribute to the degradation of phytic acid, an antinutrient that hampers mineral absorption (Ma et al., 2024). In addition, the LAB in sourdough, including *Lactobacillus sanfranciscensis* and *Lactobacillus plantarum*, have probiotic properties that contribute to improved gut health, enhance immune responses, and reduce inflammation (Barkiene et al., 2022). These strains also exhibit antioxidants and antimicrobial properties, which increase their benefits (Rizzello et al., 2019). Incorporating LAB-rich sourdough starters into food production can create functional foods with potential probiotic advantages, though further research is needed to optimise fermentation for maximum benefits.

Consumer trends
Gomez et al. (2016) highlight that consumer perceptions of bread's shelf life and freshness significantly affect preferences and sensory acceptability. The need for healthier baked goods is rising due to concerns, such as gluten intolerance, and a shift towards healthier eating. Additionally, rising prices have led consumers to seek economic alternatives, creating a trend for baked products that combine wellness-focused ingredients with traditional enjoyment (Upadhay, 2023). Despite the growing interest in baked goods such as sourdough, there remains a significant research gap concerning the microbial characteristics and sensory acceptability of these products among rural youth populations in KwaDlangezwa, KwaZulu-Natal. Most existing studies focus on urban consumers or commercial sourdough production, overlooking the unique dietary habits, cultural preferences, and microbial environments present in rural South African settings. Furthermore, limited data exists on how young adults in these areas perceive the taste, texture, and overall appeal of sourdough baked goods, which is crucial for successful adoption and sustained consumption. Addressing this gap is vital, as young adults in rural communities are not only potential consumers but also key agents in disseminating nutritional knowledge and influencing family dietary practices.

Methodology
This research employed a comparative quantitative methodology involving a sensory evaluation using a structured 9-point hedonic scale to assess the acceptability of sourdough bread samples to analyse sensory qualities such as appearance, taste, aroma, and texture. Regarding microbial influence, quantitative data were collected through microbiological assays, such as plate counts to determine the colony-forming units (CFU) of specific sourdough microorganisms and correlate these findings with sensory data. According to Dehalwar & Sharma (2024) this technique provides generalizable data suitable for statistical analysis and hypothesis testing, and the identification of patterns and relationships between variables. The sourdough starter was prepared through a systematic fermentation process to cultivate wild yeast and lactic acid bacteria. A mixture of 100 grams of all-purpose flour and 100 millilitres of filtered water was combined in a glass container and left at room temperature (around 23°C) for 5 to 7 days, with daily feedings of equal parts flour and water to encourage microbial growth (Cato et al., 2020). During fermentation, the starter was observed for bubbles and growth, indicating active fermentation, and the pH was monitored using pH strips, aiming for a range of 3.5 to 4.5 (Terrazas-Avila et al., 2024). The resulting starter was used in baking trials to assess consumer acceptability of sourdough products. The methodology involved formulating and evaluating three sourdough-based food products: English muffins, sourdough buns, and blueberry sourdough muffins. The English muffins were baked with 60% sourdough starter, 30% all-purpose flour, 10% milk, salt, and baking soda. The sourdough buns incorporated 50% sourdough starter, 40% bread flour, 10% butter, eggs, sugar, and salt for a richer flavour. Blueberry sourdough muffins consisted of 50% sourdough starter, 30% all-purpose flour, 10% milk, 10% fresh blueberries, sugar, and baking powder. Each product was baked using standardised procedures to ensure uniformity. Conventional (non-

sourdough) versions of each product were also prepared, keeping identical ingredient proportions but omitting the sourdough starter, allowing for a controlled comparison of consumer acceptability. Participants in this study were selected through convenience sampling and were aged between 18 and 27 years. Recruitment was done via university notice boards and social media, with the inclusion criteria specifying that participants should be English speakers without allergies to any of the sourdough ingredients. A total of 60 participants and this number being a recommended size for sensory acceptability testing (Blaak et al., 2018). Ethical clearance for the study was obtained under UZREC171110 030Dept 2021/1. Informed consent was collected from all participants before testing.

Each sample underwent pre-filtration through a 0.45 µm membrane filter to eliminate larger particles, ensuring only microbial-sized entities were examined. Phosphate-buffered saline was utilised to create serial dilutions from 10^{-1} to 10^{-5}, based on preliminary tests to maintain optimal plate counts for accurate enumeration (Danaski et al. 2022).The diluted samples were inoculated onto Sabouraud Dextrose Agar (SDA) for fungal isolation and Nutrient Agar for bacterial isolation, with each prepared in duplicate. SDA was chosen for its ability to enhance fungal growth while inhibiting bacteria, as highlighted by Aernan et al. (2023). The plates were incubated at 37°C for 7 to 10 days, with daily observations to track growth patterns. Yeast colonies were examined under a light microscope, utilising Gram staining to enhance the visibility of their morphological traits. The analysis concentrated on the shape, size, and arrangement of the cells, which are crucial for initial identification (Dabban et al., 2024). Sensory testing was conducted in the Department of Consumer Science at the University of Zululand, where the facility was equipped with individual booths to ensure privacy and minimise distractions. The controlled environment was designed to reduce biases and improve the reliability of the results, as noted by Gruenig (2023). These booths provided panellists with privacy and minimised external distractions, creating a controlled environment essential for obtaining unbiased and reliable data. According to Gruenig (2023), such controlled settings are crucial in sensory evaluation to reduce potential biases that may arise from environmental factors or panellist interactions. In this study, the panellists were untrained, reflecting typical consumer responses rather than expert evaluations, which aligns with the research aim of assessing general acceptability among young adults. Sensory evaluations were conducted without confirming microbiological safety post-baking. Although baking temperatures above 180°C generally inactivate viable pathogens and probiotic organisms. Sensory evaluation involved data being subjected to statistical analysis using an Excel statistical package (XLSTAT) to generate frequencies. For the microbial data analysis, colony counts were expressed as colony-forming units per millilitre (CFU/mL). Using Excel, 95% binomial confidence intervals were calculated based on the method described by Bai (2023). To explore how microbial characteristics affect the sensory appeal of sourdough products, a comparison was made between microbial data and sensory attributes to determine any potential relationships between these two factors.

Results and discussion

Demographic characteristics of participants

The current study involved a participant pool that was predominantly young and female. Specifically, female participants comprised 86.6% of the sample, while males accounted for only 13.3%. Additionally, the age distribution was heavily skewed towards younger adults, with 75% of respondents aged between 18 and 22 years, and the remaining 25% between 23 and 27 years. Notably, there were no participants from older age groups, which underscores a concentrated focus on younger consumers within this research. This demographic concentration presents a notable limitation in terms of the generalizability of the findings. Sensory preferences and perceptions of sourdough baked goods may vary significantly across different age groups and between genders, influenced by diverse cultural, physiological, and experiential factors. Therefore, the predominance of young females in the sample restricts the extent to which these results can be extrapolated to a broader population that includes older adults and a more balanced gender distribution. To address this limitation, future research should aim to recruit a more diverse and representative sample. Including participants from a wider age range, encompassing middle-aged and older adults, as well as striving for gender parity, would enhance the robustness and applicability of the findings. Such diversity would allow for a more comprehensive understanding of sensory preferences and microbial influences across different demographic segments, ultimately contributing to more inclusive and generalizable conclusions within the context of sourdough baked goods acceptability.

Microbial properties results

The microbial assessment of the sourdough sample demonstrated significant variability in colony-forming units per millilitre (CFU/mL) on Sabouraud dextrose agar (SDA), particularly across different dilution levels. The 10^{-1} dilution yielded a result too numerous to count (TNTC), indicating a highly dense microbial population. Conversely, the 10^{-2} dilution resulted in 2.5×10^{4} CFU/mL, while the 10^{-3} dilution recorded an unexpected increase to 1.9×10^{5} CFU/mL, which may suggest potential inconsistencies either in the dilution or plating procedures. This variability underscores the importance of not presenting CFU counts for each dilution individually; rather, it is more accurate to report the estimated mean microbial concentration (CFU/g) derived from plates yielding counts within the standard range of 30 to 300 colonies. This approach enhances accuracy and reliability in comparing microbial loads across different samples. Sabouraud dextrose agar primarily targets fungal growth, but may also support certain bacterial populations, and therefore the total CFU counts in this study likely represent a mixed microbial community. For a more effective characterisation of the fungal component, antibiotic supplemented SDA or additional selective media tailored to distinguish fungi from bacteria is recommended. The data underscores the complex microbial ecology typical of fermented products like sourdough, where diverse microorganisms—including lactic acid bacteria, yeasts, and molds—interact to influence product quality. This microbial interplay drives the production of organic acids, alcohols, and other metabolites that are critical for flavour, aroma, texture, nutritional value, and shelf stability. Factors such as flour type, fermentation conditions, and local microbial flora significantly shape this diversity. The sourdough bun demonstrated moderate fungal growth on SDA, with no detectable fungal colonies at the 10^{-3} dilution and an absence of bacterial colonies on bacteriological agar, suggesting fungal predominance. In contrast, blueberry muffins showed extremely high bacterial loads, with TNTC counts at 10^{-1} and 10^{-2} dilutions and substantial counts at 10^{-3}, indicating significant bacterial contamination. Similarly, the English muffin exhibited no fungal growth but very high bacterial counts analogous to the blueberry muffin. The estimated bacterial concentration in blueberry muffins reached 2.5×10^5 CFU/g, emphasizing the potential for extensive microbial colonization in such products. This may be influenced by factors including ingredient composition, moisture content, and storage conditions, consistent with previous studies highlighting the importance of strict hygiene practices to mitigate foodborne risks (Chinecherem, 2024; Gunduz et al., 2022; Vermelho et al., 2024).

The microbial profiles observed reflect the interplay of intrinsic factors (such as moisture and sugar content) and extrinsic factors (including post-baking handling and storage). The elevated bacterial levels in blueberry and English muffins suggest possible lapses in post-baking hygiene since baking typically eliminates viable microorganisms. Conversely, the fungal predominance in the sourdough bun aligns with its unique fermentation process, which fosters the growth of lactic acid bacteria and yeasts. The relationship between temperature and microbial viability during baking processes, particularly in relation to probiotics and pathogens, raises significant safety and ethical considerations. While temperatures exceeding 180°C are generally effective in deactivating viable microorganisms, the presence of these organisms prior to baking cannot be overlooked. In most instances, the harsh conditions of baking are unlikely to allow probiotics to survive, leading researchers to explore alternative benefits derived from metabolic byproducts known as postbiotics. Compounds such as lactic acid, ethanol, esters, and bacteriocins, produced during fermentation, can remain present in baked products and may contribute powerfully to both flavour and health benefits. According to Żółkiewicz et al. (2020), these metabolites not only enhance the sensory appeal of fermented foods but also carry the potential to support gut health, even when viable probiotics are no longer detectable. Despite the promising nature of postbiotics, existing literature lacks a thorough investigation into the identification and quantification of these metabolites in baked goods. This gap presents an opportunity for future research to focus on elucidating the role of postbiotic compounds in such products. By examining how different sourdough fermentation methodologies influence the formation of these metabolites, researchers could gain insights into the microbial and chemical transformations that occur during the baking process. Such comprehensive studies are essential for enhancing our understanding of the complex relationships between microbial activity, product quality, and consumer sensory experiences. Ultimately, advancing this field of study could lead to innovative baking practices that optimise both the nutritional and sensory qualities of baked goods, aligning with contemporary health trends and consumer preferences. This study sought to investigate the relationship between the microbial content with sensory characteristics of sourdough-derived products. However, the validity of such correlations remains preliminary due to methodological constraints.

Sensory evaluation results

Table 1 summarises the results of the sensory evaluation, revealing a higher acceptability score for blueberry muffins across all sensory attributes compared to the traditional sourdough bread and English muffins.

Table 1: Sensory evaluation of the three baked products

The sensory evaluation of the products revealed notable preferences in various sensory attributes**.** Appearance was a key factor, The blueberry muffin scored the highest in appearance (8.4), indicating it is visually the most appealing among the three products. This could be attributed to the colourful blueberries and the appealing golden-brown crust typical of muffins. Sourdough bread (8.1) also scores well, likely due to its rustic crust and artisanal look. The English muffin, while still positively rated (7.8), ranks slightly lower, suggesting a more modest visual appeal. The aroma was another important factor in consumer perception, with the blueberry muffin again leading with a score of 7.8, reflecting the pleasant, sweet, and fruity scent that enhances its desirability. The English muffin (7.0) and sourdough bread (6.7) follow, with sourdough having the lowest aroma score, possibly due to its characteristic tangy smell which may not be universally preferred. This finding aligns with several studies highlighting the significant influence of flavour profiles on consumer acceptance of baked goods. For instance, Nakitto et al. (2024) demonstrated that appealing aroma and taste, particularly those associated with sweetness, are crucial drivers of consumer preference. Taste**,** as the most influential factor in product acceptance, showed a clear preference for sweeter flavours, with the blueberry muffin ranking highest (8.5). Furthermore, the same product was preferred for appearance, scoring 8.4 agreeing with Guiné (2022) that the initial influence on consumers is primarily driven by colour, visual appeal, flavour, taste, and texture. Nevertheless, it is the taste and texture that ultimately influence whether a consumer chooses to repurchase the product. These findings align with past studies on sourdough sensory evaluation, which suggest that sweeter flavours tend to be more popular among younger demographics (Stefani et al., 2019). Sourdough bread (7) and English muffins (6.5) were less favoured, reflecting a cultural preference for sweetness, particularly among young adults. Sourdough bread excels in texture with the highest score of 8.1, reflecting its chewy, crusty exterior and soft interior, which are hallmark qualities appreciated by consumers. The blueberry muffin (7.4) and English muffin (7.1) have lower texture scores, indicating that while they are acceptable, they may not provide the same level of textural satisfaction as sourdough. Finally**,** mouthfeel scores are relatively close among all three products, with sourdough bread at 7.3, blueberry muffin at 7.9, and English muffin at 7.0. The blueberry muffin again ranks highest, suggesting a pleasant and satisfying sensation in the mouth, likely due to its moist crumb and juicy blueberries. The sourdough's slightly lower mouthfeel score could be linked to its denser texture. with some participants appreciating the airy, chewy qualities unique to fermented sourdough bread. This suggests a preference for textures beyond the standard soft crumb. This aligns with findings showing diverse textural preferences exist across different demographics (Olakanmi et al., 2023). This highlights the importance of considering individual preferences when evaluating sensory attributes. Moreover, a study by Temkov et al. (2024) found that texture plays a significant role in consumer acceptance of sourdough products, which is consistent with our findings.

Food action rating scale

Further analysis of consumption frequency offers valuable insights into consumer preferences, as shown in Table 2. The Food Action Rating Scale revealed a diverse range of responses across the products evaluated. For example, the English muffin demonstrated variability in consumption patterns, with a small group of respondents (4 individuals) indicating they would consume it "every opportunity that I had," while a larger group (16 individuals) noted they would eat it "very often." This suggests that while the English muffin is positively received, it does not possess the same level of universal appeal as the blueberry muffin or sourdough bread, which garnered more consistent preferences across participants.

Table 2: Frequency rating of sourdough products

Response	English Muffin (N)	English muffin (%)	Blueberry Muffin (N)	Blueberry muffin (%)	Sourdough Bread (N)	Sourdough Bread (%)
"I would eat this every opportunity"	4	7.3	29	52.7	15	27.3
"I would eat this very often"	16	29.1	4	7.3	15	27.3
"I like this and would eat it now and then"	22	40.0	16	29.1	12	21.8
"I would eat this if available"	15	27.3	4	7.3	14	25.5
"I don't like this but would eat it occasionally"	1	1.8	0	0	3	5.5
"I would hardly eat this"	1	1.8	0	0	1	1.8
"I would eat this only if forced to"	1	1.8	0	0	0	0
"Unrated"	0	0	7	12.7	0	0

The blueberry muffins lead in ratings, where 29 respondents claimed they would eat it "every opportunity that I had," indicating not only higher sensory acceptability but also favourable consumer sentiment in comparison to the other baked goods. This result aligns with existing literature indicating that fruit-flavoured products are typically preferred by younger demographics, resonating well with flavours associated with enjoyment (Stefani et al., 2019). Furthermore, Guiné (2022), confirms that taste and texture have a bearing on a consumer's decision to buy the product again.

Influence of microbial properties and quality on sensory acceptability

The microbial properties inherent in sourdough fermentation significantly contribute to the unique flavour and texture profiles of sourdough-baked goods. The lactic acid bacteria and wild yeast involved in the fermentation process not only enhance the sensory attributes but also impart digestive benefits, such as improved digestibility and potential probiotic effects (Pérez-Alvarado et al., 2022). The composition of microbes in sourdough products plays a significant role in their sensory characteristics. For example, Sourdough bread, which is high in fungi and minimal in bacteria, received high scores for texture (8.1) and appearance (8.1), indicating that fungi contributed positively to these qualities. In contrast, the blueberry muffin, which contains fewer fungi but a considerable number of bacteria, achieved the highest sensory ratings, especially for taste (8.5) and aroma (7.8). This suggests that bacteria, particularly lactic acid bacteria, may enhance the flavour and fragrance of certain baked goods. The English muffin, characterised by low fungal content and a notable presence of bacteria, scored lower than the blueberry muffin in all sensory categories. This implies that the specific types and quantities of bacteria can influence sensory appeal. Although no correlation tests were performed, the findings indicate that the balance of fungi and bacteria in sourdough products affects their sensory properties. A higher concentration of fungi, as seen in sourdough bread, may be preferred for texture and appearance, while a greater bacterial presence, like that in the blueberry muffin, may improve flavor and aroma. Even though the study uncovered important insights and implications, it is essential to critically evaluate the limitations of the methodology applied in this study, particularly concerning the examination of the third objective. One of the primary concerns is the absence of a correlational analysis to explore the connection between microbial composition and sensory characteristics effectively.

Conclusion and recommendation

This study emphasises the importance of microbial properties in the sensory acceptability and quality of sourdough products. Beneficial microbes enhance flavour and texture. As demand for artisanal, wellness focused foods increases, further research on optimising sourdough fermentation will benefit both academia and the food industry. Understanding the link between microbial properties and sensory characteristics is crubacteriacial for improving sourdough products and consumer satisfaction. The link between fungi and improved sensory qualities indicates a need for further research to pinpoint specific fungal species that enhance desirable traits, thus enhancing our understanding of their effects on product characteristics. Additionally, managing fungal populations during sourdough production could yield more consistent product quality, aligning with consumer expectations and food safety standards. This focused strategy may enhance the quality and marketability of local sourdough products. For a deeper insight into the Sourdough products in this research, subsequent studies should include a descriptive analysis of the products. This approach would yield important information regarding consumer preferences and their overall satisfaction. Additionally, utilizing correlation tests would provide a quantitative examination of the relationship between microbial traits and the outcomes of sensory acceptability assessments. By associating specific microbial profiles with sensory characteristics, researchers could pinpoint essential microorganisms that either enhance or detract from product acceptability.

This integrated methodology would provide a more thorough and detailed understanding of the elements influencing consumer perception and preference.

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