

Sourdough bread: Consumer perceptions and attitudes

Pão de fermentação natural: Percepções e atitudes dos consumidores

Pan de masa madre: Percepciones y actitudes de los consumidores

Received: 05/12/2025 | Revised: 05/20/2025 | Accepted: 05/20/2025 | Published: 05/24/2025

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Abstract

Faced with new market trends and consumer desires for healthier and more natural products, the bakery sector has sought innovative alternatives to remain attractive to the public. This project aimed to study the beliefs and attitudes of consumers about their consumption and nutritional aspects of sourdough bread (SB). An online survey was conducted to assess consumer knowledge about the product using Google Forms. The questionnaire evaluated issues related to consumer knowledge about the characterization of SB, purchase intention, and the influence of bread labeling on consumer perceptions and attitudes. It also assessed the profile of SB consumers and their consumption frequency, as well as the sociodemographic characteristics of the respondents (gender, age, education level, and state). The data were analyzed by the IBM SPSS Statistics software version 22. The results indicated that the consumption and purchase of natural fermentation bread were in several aspects, such as sensory and healthiness more natural products. It should be noted that consumers' knowledge of the production process is recurrent, 85.86% of participants know about the subject, and 53.6% identify its specific characteristics. This study will contribute to the development and commercialization of products made through sourdough fermentation, as well as help raise consumer awareness about the benefits and healthiness of the product.

Keywords: Natural fermentation; Nutritional aspects; Bread making; Consumer behavior; Sourdough.

Resumo

Diante das novas tendências de mercado e do crescente desejo dos consumidores por produtos mais saudáveis e naturais, o setor de panificação tem buscado alternativas inovadoras para manter-se atrativo ao público. Este estudo teve como objetivo investigar as crenças e atitudes dos consumidores em relação ao consumo e aos aspectos nutricionais do pão de fermentação natural (PFN). Foi realizada uma pesquisa online, por meio do Google Forms, com o intuito de avaliar o conhecimento dos consumidores sobre o produto. O questionário abordou questões relacionadas à caracterização do PFN, intenção de compra e influência da rotulagem do pão nas percepções e atitudes dos consumidores. Também foram avaliados o perfil dos consumidores de PFN e sua frequência de consumo, bem como as características sociodemográficas dos participantes (gênero, idade, escolaridade e estado). Os dados foram analisados com o software IBM SPSS Statistics, versão 22. Os resultados indicaram que o consumo e a compra do pão de fermentação natural estão associados, em diversos aspectos, à busca por produtos mais naturais, saudáveis e com melhores atributos sensoriais. Ressalta-se que o conhecimento dos consumidores sobre o processo de produção é expressivo: 85,86% dos participantes demonstraram familiaridade com o tema, e 53,6% identificaram características específicas do produto. Este estudo contribui para o desenvolvimento e a comercialização de produtos elaborados com

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fermentação natural, além de favorecer a conscientização dos consumidores quanto aos benefícios e à saudabilidade do PFN.

Palavras-chave: Fermentação natural; Aspectos nutricionais; Panificação; Comportamento do consumidor; Pão de fermentação natural.

Resumen

Ante las nuevas tendencias del mercado y el creciente interés de los consumidores por productos más saludables y naturales, el sector de la panificación ha buscado alternativas innovadoras para mantenerse atractivo al público. Este estudio tuvo como objetivo investigar las creencias y actitudes de los consumidores con respecto al consumo y a los aspectos nutricionales del pan de fermentación natural (PFN). Se realizó una encuesta en línea a través de Google Forms para evaluar el conocimiento de los consumidores sobre el producto. El cuestionario abordó temas relacionados con la caracterización del PFN, la intención de compra y la influencia del etiquetado del pan en las percepciones y actitudes de los consumidores. También se evaluaron el perfil de los consumidores de PFN y su frecuencia de consumo, así como las características sociodemográficas de los participantes (género, edad, nivel educativo y estado). Los datos fueron analizados mediante el software IBM SPSS Statistics versión 22. Los resultados indicaron que el consumo y la compra del pan de fermentación natural están asociados, en diversos aspectos, con la búsqueda de productos más naturales, saludables y con mejores atributos sensoriales. Cabe destacar que el conocimiento de los consumidores sobre el proceso de producción es significativo: el 85,86% de los participantes manifestó familiaridad con el tema y el 53,6% identificó características específicas del producto. Este estudio contribuye al desarrollo y comercialización de productos elaborados mediante fermentación natural, además de fomentar la concienciación de los consumidores sobre los beneficios y la salubridad del PFN.

Palabras clave: Fermentación natural; Aspectos nutricionales; Panificación; Comportamiento del consumidor; Pan de fermentación natural.

1. Introduction

Bread is a product obtained from wheat flour and/or other flours, added with liquid, resulting from the fermentation process or not, and cooking, and may contain other ingredients, as long as they do not detract from the product (Brasil, 2005). The fermentation process was a technique developed by the Egyptians around 4.000 B.C, (Martens, 2021; Vianna et al., 2018).

The first bakeries were founded by Portuguese immigrants in the 19th century in Brazil (Vianna et al., 2018) and since then the bakery market has not stopped growing. The Brazilian Association of the Bakery and Confectionery Industry found that the segment earned around BRL 91.94 billion (ABIP, 2020). Bread is characterized as a staple food, making up part of the diet. The nutritional characteristics of bread are composed of cereals, coming from wheat-based products, providing significant sources of proteins, complex carbohydrates, fibers, vitamins and minerals (Cauvain & Young, 2009).

Faced with new market trends and consumer desires for healthier and more natural products, the bakery sector has sought innovative alternatives to remain attractive to the public. Among these, the growth of artisan bakeries and those that work with the natural fermentation process stands out (Amante et al., 2020; Chiacchio, 2020; Kuiavski et al., 2020; Neves et al., 2020).

Sourdough bread (SB) uses the joint action of lactic acid bacteria and yeast, which acts as fermentation agents, contributing to the creation of bread with nutritional characteristics different from traditional bread, such as reduction of the glycemic index of the food (Demirkesen-Bicak et al., 2021).

The SB is process brings benefits such as reducing the content of fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAP) (Loponen & Gänzle, 2018); better digestibility of proteins from the wheat flour used, as well as promoting the release of bioactive peptides in the medium (Rizzello et al., 2019); reduced gluten content (Wang et al., 2014) and increased bioavailability of minerals and degradation of anti-nutritional compounds, such as phytic acid (Rodríguez-Ramiro et al., 2017).

Concomitantly with the use of sourdough fermentation, the use of natural ingredients provides several nutritional advantages: if fiber is added, bread made with whole grains is better source of vitamins B and E, in addition to many minerals that are not present in common bread (Canella-Rawls, 2012).

However, the understanding of the variables that influence the behavior and perceptions of consumers, consumption and purchase habits, and the influence of nutritional aspects are still little studied (Oliveira, 2008; Solomon, 2016).

Therefore, this project aimed to study consumers' perceptions and attitudes about the consumption of SB and its nutritional aspects.

2. Methodology

The study was submitted and approved by the Ethics Committee of the Federal University of Lavras (CAEE: 54907321.7.0000.5148). The research participants attested their agreement by filling out the informed consent form (ICF) containing all aspects and objectives of the research.

A social survey was carried out using a questionnaire applied to consumers (Pereira et al., 2018). This research used simple descriptive statistics with data classes, absolute frequencies, and relative percentage frequencies (Shitsuka et al., 2014), as well as statistical analysis (Bussab & Morettin, 2002).

The number of questionnaire respondents was determined using a non-probabilistic sampling method, in which elements are selected based on convenience, either voluntarily or accidentally (Aaker et al., 2008). The respondents were stratified into groups of consumers and non-consumers of SB with different profiles, lifestyles, and habits, in order to assess the influence of these factors on the collected responses (Grunert et al., 2012).

To assess the clarity of the questionnaire, pilot tests were initially conducted with 20 consumers. The aim was to identify inconsistencies in the questions, omissions, and other difficulties experienced by the respondents (Mitchell et al., 2012).

After the adjustments made following the pilot test, the questionnaire was applied via the internet, disseminated on social networks and e-mail to different audiences. The research objectives were informed to the participants, who must attest to their agreement to participate in it by filling out the ICF. The questionnaire was applied for 30 days, being made available to the participant. The purpose of applying the questionnaire is to characterize the profile of SB consumers.

The Google Forms tool was used to prepare and apply the online questionnaire. As for its structure, it has been fragmented into five sections. The first section was devoted to the free and informed consent form (ICF). In the second section, consumers' knowledge was attributed, such as the characterization of SB, the difference between bread produced with natural yeast and bread produced with biological yeast, the SB process, the benefits of bread and their importance, the relationship between SB and its characterization, through the benefits, satiety and healthiness.

The third section evaluated the consumer's purchase intention and the influence of bread labeling on consumers' perceptions and attitudes. The section was made up of 15 labels, with the same physical characterization, all of which have the same trade name of the brand "SR BREAD", containing diversified information on their packaging, such as "Very light and soft", "Made with Levain – no artificial additives added", "SB", "SB – Better digestibility", "Made with Levain", "Made with Long Fermentation Yeast", "Made with Levain – very light and soft", "Made with Levain – better digestibility", "Made with SB – very light and soft", "Made with Long SB – no artificial additives added", "Made with Long SB", "SB – No artificial additives added", "No artificial additives added", one label without any identification, only showing the product brand "SR BREAD" and finally, "SB – Very light and soft".

The fourth section was composed by the consumer profile of SB and their frequency of consumption. The fourth section was composed by the consumer profile of SB and their frequency of consumption, the reasons that led them to consume SB. Finally, the last section was intended to characterize the sociodemographic profile of the respondent (gender; age group; education; state).

To meet the research objectives, the data analysis procedures involved descriptive tests, difference and correlation

using the IBM SPSS Statistics software version 22. In the descriptive stage, adherence tests with Chi-Square (χ^2) were used to compare frequencies observed in the categories (Field, 2020). Data normality was verified using the Shapiro-Wilk test (S-W), resulting in a non-normal distribution ($p < 0.05$) (Bussab & Morettin, 2002). Textual content (words cited by respondents) was treated by volume proportions based on the co-occurrence of key terms and presented through a semantic network formed in VOSviewer (Shah et al., 2020; van Eck & Waltman, 2023).

Difference analyzes were performed with two procedures: the non-parametric Mann-Whitney test in cases with two independent samples and the Kruskal-Wallis test when there were more than three independent samples, complemented by comparison between pairs with Dunn's method (Cooper & Schindler, 2016). Correlations were measured using the Spearman method, considered a non-parametric test (Field, 2020). In the end, the use of multiple regression made it possible to analyze the correlation and predictive power of certain items for a dependent variable, in the case of this research, purchase intention (Hair et al., 2009).

3. Results

3.1 Sociodemographic variables

In the research questionnaire, the Google Forms tool was used. At the end of the collection, 191 valid responses were returned. The sample was mostly characterized by female respondents 72.80%, with a concentrated distribution in relation to the age group between 26 and 45 years, with 31.40% among respondents aged 26 to 35 years, and 22, 50% are between the age of 36 up to 45 years.

With regard to family income, 29.80% of respondents earn between one and three minimum monthly wages (R\$1,212.00 to R\$3,636.00). Regarding education, 36.10% of respondents have completed higher education, 29.3% have completed postgraduate studies, 22.5% have incomplete/ongoing higher education, 11.5% have completed high school and 0.5% have completed elementary school.

Aiming to analyze food consumption habits, the existence of food restrictions, intolerances, physical activity and consumption of fruits and vegetables were evaluated. The sample profile detailed 11% of the respondents with some type of food restriction.

Most respondents (48.20%) consumed fruits and vegetables daily, with 17.8% consuming four to six times a week, 20.4% two to three times a week, 9.9% at least once a week and 3.7% rarely consumed fruits and vegetables, 30.40% of the participants stated that they practice physical activity two to three times a week, although 20.90% of the respondents indicated that they rarely practice any physical activity.

3.2 Knowledge About Sourdough Bread

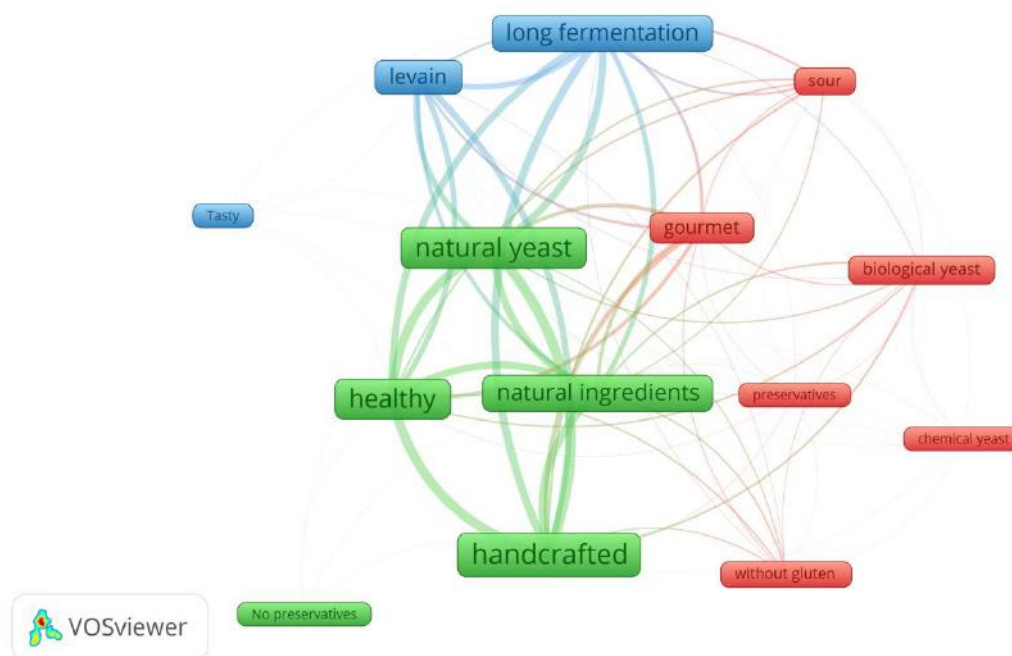
Regarding the participants' knowledge and perceptions about SB, 85.86% know about the subject, although only 53.6% identified the specific characteristics of the SB process.

If you analyze the means of communication in which the participants found out about or heard about SB 20.60% reported having found out about them on cooking channels, 16.40% through the website/blog/internet, 12.70% where they shop, 11.50% found out about it in a gastronomic course, 10.30% tried to produce the SB at home, 9.10% got to know them through relatives, and 6.70% got to know them through an influencer.

Regarding the SB process, statistically, significant differences were noted in the proportions of responses referring to the words that refer to the SB process ($p < 0.005$). Regarding the process, 82.72% referred to it as "handmade", 77.49% "SB", 72.77% "healthy", and 58.64% correlated with the "long fermentation" process, the participants relate the SB process to aspects related to healthiness and because they are handcrafted.

Based on the information in the questioning, on the words that refer to the SB, a graph with a systemic view was created using VOSviewer (Figure 1).

Figure 1 - Systemic view of the quoted words that refer to the process of making Natural Bread.



Source: VOSviewer (2022).

In order to obtain a more detailed understanding, the words mentioned by the respondents were listed in groups of colors, which refer to the SB process. The group highlighted in green pointed out that the words related to the SB process are related between SB, healthy, handmade, natural ingredients and without preservatives. The group highlighted in blue highlighted that the SB process is linked to “long fermentation”, “sourdough” and “tasty”. Analyzing the group highlighted in red and with less influence, there are terms related to the process, such as: “gourmet”, “biological yeast”, “gluten-free”, “chemical yeast” and “sour”. It is also possible to highlight a greater relevance for the group highlighted in green; “SB”, “natural ingredients”, “healthy” and “handmade”. Among the terms cited by the group, the one with the highest frequency among respondents was described as “SB”, in a complementary way.

In order to understand and evaluate the characteristics of those who already consume SB, the Mann-Whitney test was carried out in order to analyze whether the citation proportions are different between those who already consume or not. SB consumers listed “sourdough” as the most important term in the process, followed by “long fermentation”, “sour taste”, “natural ingredients” and the application of “biological yeast” having the lowest frequency (12%). This indicates a greater knowledge of the public about the process. While non-consumers cited the term “natural ingredients” as the most relevant, characterized, bread with the use of “long fermentation”, “biological yeast”, “sourdough” and a small portion (8%) related to the “sour” flavor.

3.3 Characteristics that Drive Consumption and Purchase of Sourdough Breads

Regarding the reasons that lead to the consumption of SB, 42.41% report not consuming SB, 56.54% of the sample have some level of consumption.

Continuing, the results related to the question of what would be the reasons that led to the consumption of SB, 62.96% of the respondents indicated that the sensorial aspects are important, 43.52% because they are healthier and 38.89% more natural.

In order to obtain a more detailed understanding of these motives, a differentiation test was carried out between profile characteristics and eating and health habits related to the motive for consumption. The results, using the Mann-Whitney test, demonstrated that people of different genders (Male and Female) have different proportions in the Reasons for Consumption ($U = 13,992,000$, $z = -2.723$, $p < 0.006$). Among the analyzed groups, both genders indicated “sensory aspects” as the main reason for SB consumption, with 59.76% being female and 72% being male. Although the “more natural” product is the second reason for consumption by males. When relating the reason for consumption to the female gender, women demonstrate prevalence in “sensory aspects”, followed by “healthier” and “more natural”. The aspect related to digestibility, the last item associated with consumption, with 32.93% for women and 28% for men.

The degrees of influence of the characteristics in the SB purchase decision indicated that the sensory characteristics of SB, such as taste (4.52), appearance (4.43), texture (4.40) and aroma (4.29) are important aspects. Factors linked to healthiness and naturalness were also highlighted as drivers of SB consumption. These factors are also directly related to the product development process.

With regard to the influence of education ($p < 0.001$), it was noted that the group of respondents with complete higher education associate the reason for consumption, mainly, with “sensory aspects”, (67.44%), while the group with completed high school, to the fact that they are “healthier” bread (55.56%).

In addition, people with higher consumption of fruits and vegetables and who practice physical activity two to three times a week, also pointed out the “sensory aspects” as the main reason for consumption - (63.79%; 68.57%), followed by “healthier” – (48.28%; 42.86%). This reinforces that even consumers with healthy lifestyles value the product beyond its nutritional benefits, with a focus on sensoriality.

Returning to the analysis of the complete set of respondents ($n=191$), the purchase intention values by a perception of the labels do not have a normal data distribution (K-S $p = 0.000$; S-W $p = 0.00$). Thus, the Kruskal-Wallis test was used to confirm the existence of statistically significant differences in the Purchase Intention values between the 15 labels presented ($H(15) = 512.314$, $p < 0.000$), as detailed in Table 1.

Table 1- Average Purchase Intention of Sourdough Bread by Characteristic Presented on the Label.

	No Subtitle	Very Light and Soft	No added artificial additives	Best digestibility
Untitled	2.10	3.20	3.50	2.70
Natural fermentation	4.00	3.80	4.30	3.90
Made with sourdough	3.30	3.60	4.00	3.60
Made with long natural fermentation	3.80	4.00	4.30	4.10

Source: Own authorship (2022).

It is noteworthy that the lowest purchase intention, with an average value of 2.10 between “definitely would not buy” and “maybe I would not buy” was observed for the label that did not have any information. The information contained on the label that demonstrate characteristics about how the product associated with not adding artificial additives were the claims with the highest means of purchase intention.

In addition to the sensory characteristics, the inherent health benefits of consuming the product should be explored in the product labeling, since this parameter also showed great influence.

A multiple linear regression analysis (forward method) was carried out to investigate to what extent the information added to the label impacted the Purchase Intention of the SB. The results showed that there was a significant influence of 6 of the 8 information checked ($F(6, 3049) = 109.998$, $p < 0.000$; adjusted $R^2 = 0.176$). The results showed that there was a significant influence of six of the eight pieces of information checked.

The information on the labels that most strongly impact purchase intention were “made with long SB (main title)” and “without the addition of preservatives and artificial additives (subtitle)”.

If you analyze the information contained on the labels, as well as the influence of purchase intention, respondents indicated a greater intention to purchase products whose packaging had information associated with the term “SB” or “made with long SB”.

It was noted that the higher cost of SB does not limit its consumption. The respondents evaluated that they would pay a higher amount to consume the product, and that the sensory qualities and digestibility. On the other hand, the low offer of bread in bakeries is a limiting factor.

It was observed that the analyzes carried out found that the characteristics contained in the packaging influenced the purchase decision of consumers, with the appropriate packaging consisting of the title “made with long SB” and the subtitle “without the addition of artificial additives”. However, the majority claimed that they consume SB for the sensory aspects (62.96%). Considering that 43.52% are concerned with healthiness, followed by 38.89% because the product is more natural.

4. Discussion

According to the most recent study released by the IBGE, the percentage of families headed by women between 2000 and 2010 increased from 37.3% to 38.7% (IBGE, 2014). A survey by the NIELSEN household panel, a global consumer analysis company, explored the behavior of Brazilian women in the last quarter of 2018 and showed that women are responsible for the consumption of 96% of households, even though they are in charge of only 37% (ABRAS, 2019). This fact may justify the female majority of respondents in this survey.

In terms of family income, the results showed that a relevant percentage of respondents have monthly incomes of more than 10 minimum wages. According to the last census applied to the Brazilian population, per capita household income for the year 2020 was estimated at R\$1,380.00 (IBGE, 2021). Thus, it is possible to verify that the people who answered the questionnaire have monthly incomes higher than the Brazilian average.

Awareness and the importance of food quality and nutritional aspects for consumers have been notable topics recently, emphasizing the implications of sourdough on the technological and nutritional attributes of bread (Canesin & Cazarin, 2021).

During the Covid-19 pandemic, there was an increase in information about SB that spread through social networks, apps and podcast formats. According to some authors (Oliveira, 2022; Thomas, 2024) the search for information about SB on the internet has grown by 300% in the last year by consumers. This fact justifies the high percentage of respondents knowing the product. However, the results indicate that most people still do not know in depth the concept and benefits of these products.

In the present study, a graph of key words with regard to SB was created using VOSviewer software. The image must be interpreted considering the larger the term size, the greater the citation occurrence; the more centralized the term, the greater its relationship with the other terms; the thicker the connecting line, the more times the terms are cited together. Finally, the colors represent the content cluster, indicating a set of terms that are usually cited together (Shah et al., 2020; van Eck &

Waltman, 2023). The terms mentioned can influence the consumer's purchase decision, when present in marketing actions and product labeling.

These results showed that consumers already relate the product to more natural and healthier products, associating them with the artisanal process.

It is important to understand and evaluate the characteristics of individuals who already consume SB and those who do not yet consume it in relation to the manufacturing process. The use of SB and the long fermentation process promotes the production of organic acids that slow down the absorption of sugars from white flour by the body, resulting in bread that has a lower glycemic index compared to bread produced with biological or chemical yeast (Silva & Fríscio, 2021). In addition, the long SB contributes to the peculiar sensory characteristics of the product such as a slightly acidic and/or sour taste and to greater conservation and resistance to microbial deterioration (Gazeta, 2022; Gobbetti et al., 2014).

This study assessed the reasons that determine the consumption of SB, and it was clear from the participants that the differentiated sensory aspects of the product are a determining factor in driving the purchase of the product.

Regarding the influence of education on product consumption, the results obtained demonstrate that consumers with different levels of education adhere to health trends, whereas adherence to sensorially, pleasure, and gourmet trends seems to be more valued by respondents with higher education.

The information contained on a product's label is extremely important when it comes to consumers deciding whether or not to buy a product. In Brazil, Bauducco has SB products, of which the packaging is highlighted with information that the product is manufactured with SB (Bauducco, 2020). In addition to this information, it would be interesting to address the preferred terms determined in this study: “made with long SB” and “without the addition of chemical additives”.

The SB demonstrate a trend in the bakery area (ABIP, 2021). The preparation of organic and natural flours associated with long fermentation and the search for healthiness in bakery products are a growing demand among consumers.

Although in Brazil there are already some products with the description that they are manufactured with the SB process, the options offered in the market for consumers are still limited. As several studies indicate, Brazilian consumers have difficulties in reading and understanding the labels, although 39% read the labels and check the validity of the products at the time of purchase, 38% of consumers claim not to understand the technical terms and meanings described on the packages. Among the main problems are complex language and small print, with labels being the axis of communication between consumer and product (Braz, 2019). The label is an important ally for raising consumer awareness of differences and information on product formulation.

Marketing data from the Bauducco company showed a significant growth of 70% in revenue after the launch of its SB line in 2021 (Neves et al., 2020; Oliveira, 2022). This result reinforces the market potential. However, it is extremely challenging for the food industry to find ways to satisfy the new market niche, through processes and products that use or eliminate chemical additives, and that, at the same time, have nutritional characteristics. In view of this, training and knowledge regarding the long SB process are essential.

This study presented an overview of SB consumers' knowledge and perceptions. It was observed that such knowledge about the SB production process is recurrent, 85.86% of the participants know about the subject, and 53.6% identify its specific characteristics. Among the reasons that drive consumption, “sensory aspects” were highlighted, followed by factors related to healthiness, such as “more natural products” and “healthier”.

The information contained on the labels influenced the decision to purchase the product, and the label with the highest purchase intention was the one that contained the claims in the main title such as “made with fermentation” and “made with long sourdough fermentation”, related to the subtitle “without the addition of preservatives and other artificial additives”. SB packages should be better explored, in order to communicate with the consumer information about the healthiness and

digestibility of bread and their nutritional properties. In addition, the low supply of the product was reported as a limiting factor in its daily consumption.

5. Conclusion

The results obtained in this study will contribute to the development and commercialization of products developed through sourdough fermentation, in addition to helping to raise consumer awareness about the benefits and healthiness of the product. These findings will also contribute to the development of effective strategies that will help increase the competitiveness of the SB market.

Acknowledgments

The authors would like to thank the financial support provided by the Coordination for the Improvement of Higher Education Personnel (CAPES) (process number 88887.966974/2024-00), the National Council for Scientific and Technological Development (CNPq), and a Research Supporting Foundation of Minas Gerais State (FAPEMIG).

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