

Project Management and Sensory Acceptance in Ready-To-Use Bakery Products: A Systematic Literature Review

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Abstract

Bakery nutritional products are limited in a global market considering the consumer preferences. Recent years have seen a surge in publications, especially in India and Latin America, reflecting nutritional and development of new products challenge, however, there are project management tools that could help in the development of new products because proactive approaches are necessary to navigate bakery product development complexities. Malnutrition and obesity pose global health challenges, elevating the importance of providing more nutritious bakery options. This systematic literature review explores the intersection of bakery product development with project management methodologies, emphasizing nutritional enhancement and consumer acceptance by the analysis of 69 articles from 2013 through 2024 from prestigious database such as Scopus and Redalyc to generate an overview for new future projects related to enhance the sector in Mexico. The study identifies multiple opportunities in bakery product research. The most researched products in this area are bread, cake, cookies and tortillas compared to pasta, pizza, pudding, waffles, etc. Additionally, only a quarter of articles explore new commercial prototypes, indicating significant potential for further development in this area.

Keywords: Project Management, Sensory acceptance, Ready to use, Bakery, Literature review, New products.

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1. INTRODUCTION

In 2020, approximately 149 million children under the age of five suffered from chronic malnutrition, representing 22% of the world's under-five years population (Global Nutrition Report, 2020). It is estimated that around 768 million people worldwide suffered from chronic malnutrition in the same year, accounting for approximately 9.9% of the global population (FAO, 2021). Another global nutrition problem is obesity, with 1.9 billion adults worldwide overweight in 2020, of which over 650 million are obese. This represented approximately 39% of the global adult population (Banco Mundial, 2021).

In 2019, annual production in the baking industry reached around 270 million tons, representing a market value of approximately 430 billion dollars (Euromonitor International, 2022). The annual wheat intake per capita on a global scale reaches 65.6 kg. Additionally, it is consumed in 173 nations, with

consumption rates surpassing 50 kg per capita per year in 102 of these countries (Reynolds & Braun, 2022).

On the other hand, advancements in bakery production technology have enhanced the texture, flavor, appearance, efficiency, shelf life, homemade, "ready-to-use" or instantly made of these products. However, despite these advancements in the baking industry, there have been very few interventions to improve the nutritional value since the beginning of bakery thousands of years ago. In this context, there is a growing demand for convenient and nutritionally enhanced offerings that align with modern consumer lifestyles with increasing emphasis on health and wellness. There exists a pressing need to innovate and introduce bakery products that not only meet consumers' convenience preferences but also provide enhanced nutritional value. This requires a shift towards the development of bakery items that offer quick and easy preparation while delivering superior nutritional profiles.

In the knowledge field of project management and according to (Project Management Institute, 2021), the 35% of projects experience scope creep or corruption, while 13% of projects failed, indicating that poor project management will lead to project failure. In general, the four most common causes of project failure are: loss of project relevance, changes in project scope, incorrect estimation of costs, activities, and timelines, as well as poor risk estimation. Therefore, proper project management from the conceptualization of the idea and the development of testing phases and feasibility analysis will help to minimize the probability of the project being launched without the expected success. In the field of bakery product development, the integration of solid project management methodologies becomes even more crucial due to the dynamic nature of demand and preferences, making it necessary to know success stories where good production practices are combined with good administration in the development of new baking products.

In the context of the global battle against malnutrition and the ongoing quest for solutions to improve public health, the baking industry emerges as a sector of significant interest. Faced with persistent challenges associated with chronic malnutrition and obesity, the contribution of baking to offering more nutritious and balanced food products becomes relevant. This systematic literature review aims to explore the current state of research in this field, focusing on the integration of sensory evaluations, project management methodologies, and enhancements in the nutritional composition of products. By addressing these key aspects, the goal is to comprehend the latest trends and advancements in the field, as well as identifying opportunities to optimize the proposals of quality and nutritional value of bakery new products.

2. METHOD AND CLASSIFICATION FRAMEWORK

In this section a methodology framework is described, with the main objective being the analysis of high-impact contributions to model their importance in understanding the system, supported by precise evidence to outline future research (Klug, 2013).

From a methodological point of view, this literature review addresses a systemic, explicit, and reproducible approach for the identification, evaluation, and interpretation of the existing information as a key tool for decision making (Al-Qatawneh & Hafeez, 2015).

In the present review it will be important to have a methodological structure to follow and which is presented below through sections A) Data collection, B) Data analysis and C) Synthesis and classification framework.

A. Data collection

The data collection used in this article review was organized according to specific characteristics providing a structured framework.

Step 1: Research question

The central questions of the research are:

1. What has been the evolution of instant baking on a commercial level?
2. What project management methodologies are used in baking projects?
3. How much acceptance is perceived of pre-made bread mixes?

Step 2: Search for contributions

The methodology is based on selecting articles by a high impact database that is available to the analyst and the context of the research (such as ScienceDirect®, Scopus®, Emerald Publishing®, Taylor & Francis Group®, IEEE®, among others).

For this exercise Redalyc® source was selected, it is considered an indexing system that integrates high-quality scientific and editorial journals in the Latin America region into its index; it now exclusively integrates those that share the non-profit publication to preserve the academic and open nature of scientific communication, from any region (Redalyc, 2023). In this way, Scopus® database also was selected as it is a database of summaries and citations of worldwide scientific literature, covering a wide variety of disciplines and subject areas, in addition to being updated regularly to include new articles and magazines, guaranteeing the most recent and relevant information (Codina, 2017).

In both databases search for specific words, considering bakery, pastry, cake or bread as keywords that address the line of research to be discussed; ready-to-use, pre-made, pre-mixed, and instantaneous since it is the prepared way of study; consumer acceptance and sensory evaluation as the point success and finally project, management, project management and methodology was determined since it is the methodology tools proposed as ideal for the conditions of the research. In addition, selection criteria, such as research type articles (research articles and literature review), language (English) and period time (2013 - 2024).

The articles were found through the institutional resources of the Advanced Technology Center, CIATEQ, entered the databases in February 2024 using the following standard search in title, abstract, or keywords:

TITLE-ABS-KEY (("bakery" OR "pastry" OR "cake" OR "bread") AND ("ready-to-use" OR "pre-made" OR "pre-mixed" OR "instantaneous") AND ("consumer acceptance" OR "sensory evaluation") AND ("project" OR "management" OR "project management" OR

"methodology")) AND PUBYEAR > 2012 AND PUBYEAR < 2025

Step 3: Classification and evaluation of selection criteria

The collection of articles was carefully reviewed to identify those contributions that did not meet either the research focus or the previously defined selection criteria.

The Figure 1 shows the process of article discrimination, in total 266 articles were selected (147 through Scopus and 119 through Redalyc) by reading the title, abstract, or conclusions. Among these, review articles, book chapters, conference papers, and books, as well as articles in languages other than English, were excluded (131). Also, articles that did not address bakery products (66) were excluded. Finally, a total of sixty-nine articles were chosen for this systematic literature review.

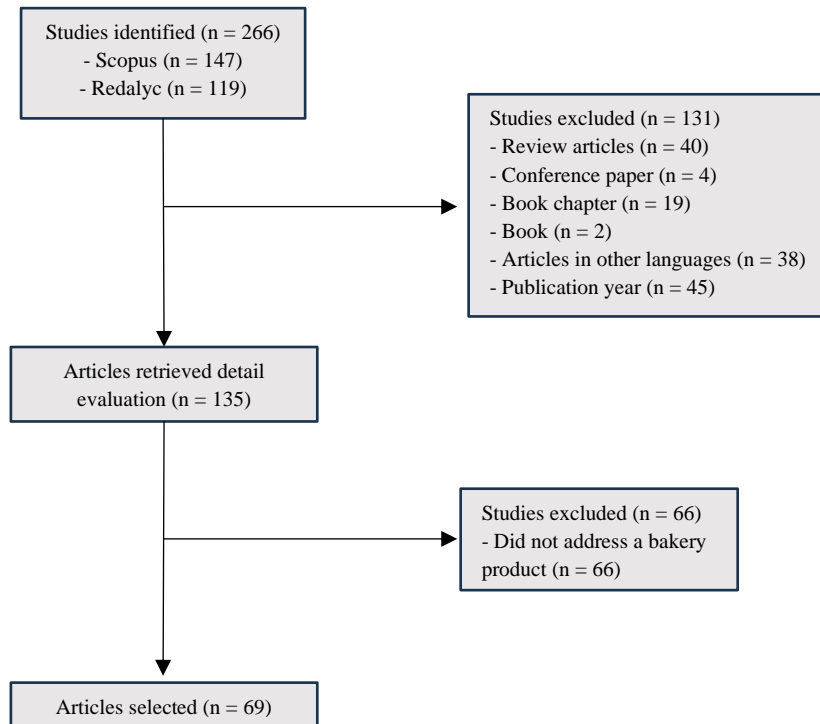


Figure 1: Flow chart of selection of articles for the present review

B. Data analysis

The sample articles were considered under the objective of analyzing and identifying patterns by country or region regarding the topics addressed and the publication Journals. These insights can serve as recommendations for researchers interested in the topic.

The analysis also included the author and year of publication, country where the study was conducted, the presentation or type of proposed bakery product, added value of the proposal, overall focus of the article, whether it presents a project management model or tool, and the level of implementation of these articles were explored.

This approach helps determine whether there are guiding lines in the technical specifications for developing new ready-to-use bakery products with added nutritional value. It also provides an overview of the success and acceptance of such products worldwide.

Under the concepts discussed above and the filters applied to the set of articles, a digital spreadsheet database was utilized as a means of classification and reference for the literature review. A specific taxonomy was designed to process the information and obtain relevant findings, considering the aspects described in Section C.

C. Synthesis and classification framework

The classification framework for this article is depicted below:

1) Publication year

To have a trend of evolution or growth of the topics of this literature review, the articles were reviewed identifying their year of official publication in the Journal.

2) Countries involved in development

It is crucial to identify the country involved in the development of each article, not only to compare the international interest levels regarding specific topics but

also to understand the context in which the research is conducted. This classification identifies areas of opportunity for countries to contribute to new developments in the baking industry, as well as explore information in those countries with greater development.

3) Source

Exploring the diversity of publication media allows us to know not only the level of trust that authors have in certain journals, but also outlines the recommended publication media for publishing more mature works.

4) Product type

This classification seeks to identify which products are most involved in the success cases presented to have an overview for the launch of new baking products, even those that have not been explored.

5) Approach

In each article, we look for the development approach of the baking products presented and evaluate whether there are commercial schemes, or they only remain as laboratory-level proposals.

6) Sensory acceptance

In each article, the relationship of taste of the baking products presented is sought, seeking to know if studies were carried out or aspects that the consumer does not like in order to avoid repeating failed situations in future proposals for new products.

7) Implementation level

The purpose is to know the degree of maturity of the products presented in each article to have an in-depth overview of the development of new commercial products.

8) Challenges

This classification is free to identify those challenges, both in product development and in the execution of methodologies or project management, that the authors were facing and that were explicit in the article.

3. CLASSIFICATION RESULTS

This section describes the result of the classification to provide relevant information to answer the research questions below.

1) Results by publication year

The Figure 2 presents the behavior of publications. The results of this classification carried out described a growth behavior starting in 2018 with one decline in 2022. In 2024 there is only one article because the search was at the beginning of February and no records were yet found. However, interest in related topics within the scientific community is on the rise.

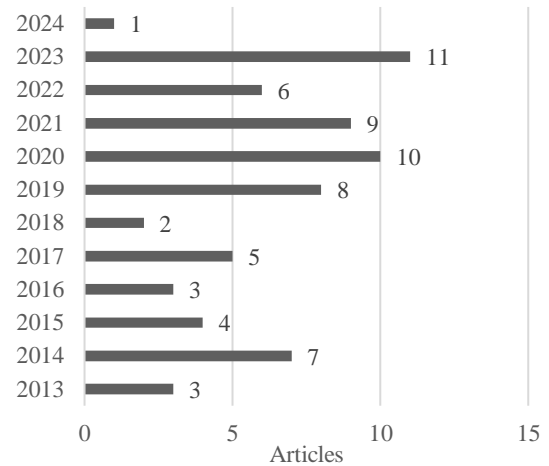


Figure 2: Results by publication year

There is an interesting trend since 2019 where the number of publications has practically doubled compared to the previous 6 years. In 2021 and 2022, a decrease in publications is observed, presumably due to the importance of focusing research on COVID-19.

2) Results by country

The classification results of the articles corresponding to countries involved in the development of each article are presented in Figure 3.

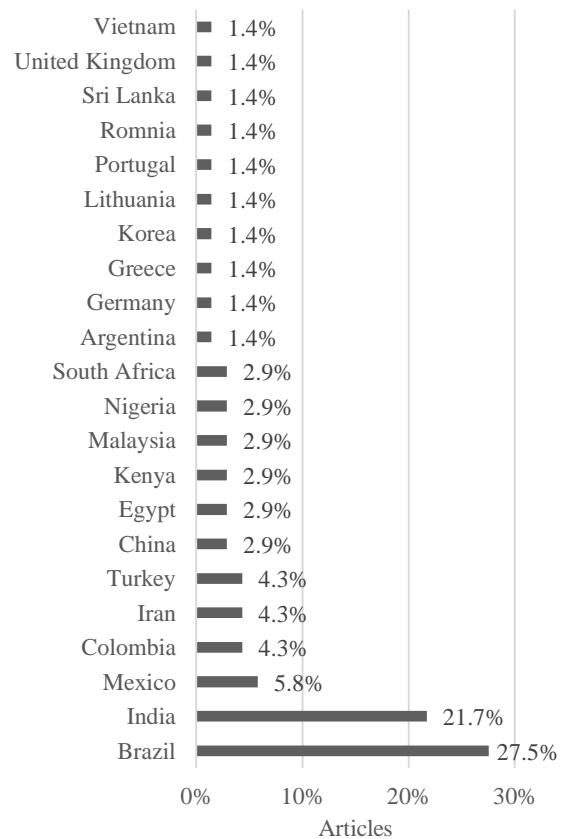


Figure 3: Results by country

It is observed that Brazil represents the first place of interest about bakery and nutritional products with the 27.5% of contributions, followed by India with 21.7%, and Mexico in third place with 5.8% of the publications.

In this context, Figure 4 shows the countries that published articles on this topic are observed, with a higher intensity of blue indicating a greater number of articles published.

From this Figure 4 and Table 1, it can be observed that Asia and America are the continents that

publish the most on the topics of this review, showing opportunities to develop projects related to bakery in other countries.

Table 1: Incidence by continent

Continent	Qty of articles	Percentage
Europe	6	8.7%
Asia	28	40.6%
America	27	39.1%
Oceania	0	0.0%
Africa	8	11.6%

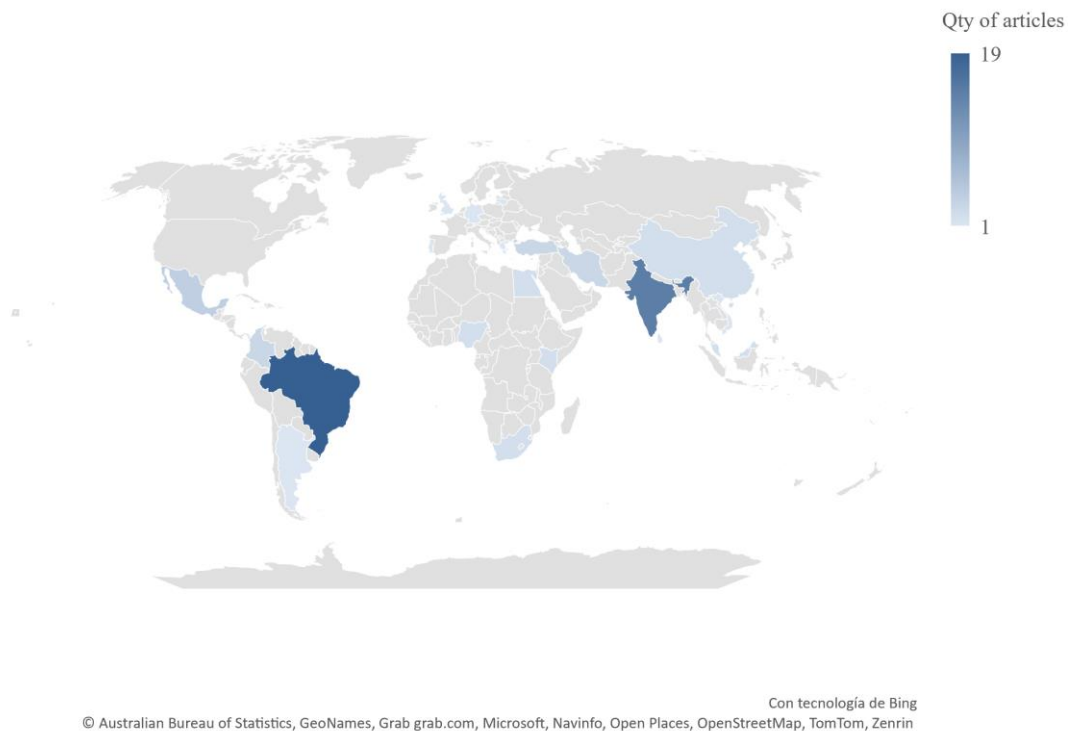


Figure 4: Incidence by country

3) Results by source

The greatest participation of journals according to the articles published, stands out directly in Scopus with a 70% of participation in the article reviewed as in the percentages shown in the Figure 5.

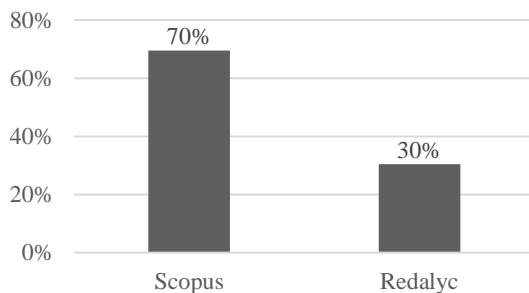


Figure 5: Databases involved

The Figure 6 presents a list of the main journals where research works were published as such as *Ciência e Tecnologia de Alimentos*, *Journal of Food Measurement and Characterization*, *Biotecnia*, *Nutrition and Food Science*, *Foods* and *Journal of Food Process Engineering* with more than one contribution.

In this context, there are Journals with just one contribution and with a high prestigious as such as *World Applied Sciences Journal*, *Journal of Food Quality*, *Journal of Applied and Natural Science*, *Journal of Agricultural and Food Chemistry*, *International Journal of Food Science and Technology*, *International Journal of Biological Macromolecules*, *Innovative Food Science and Emerging Technologies*, *Dyna*, among other Journals grouped in “others category”.

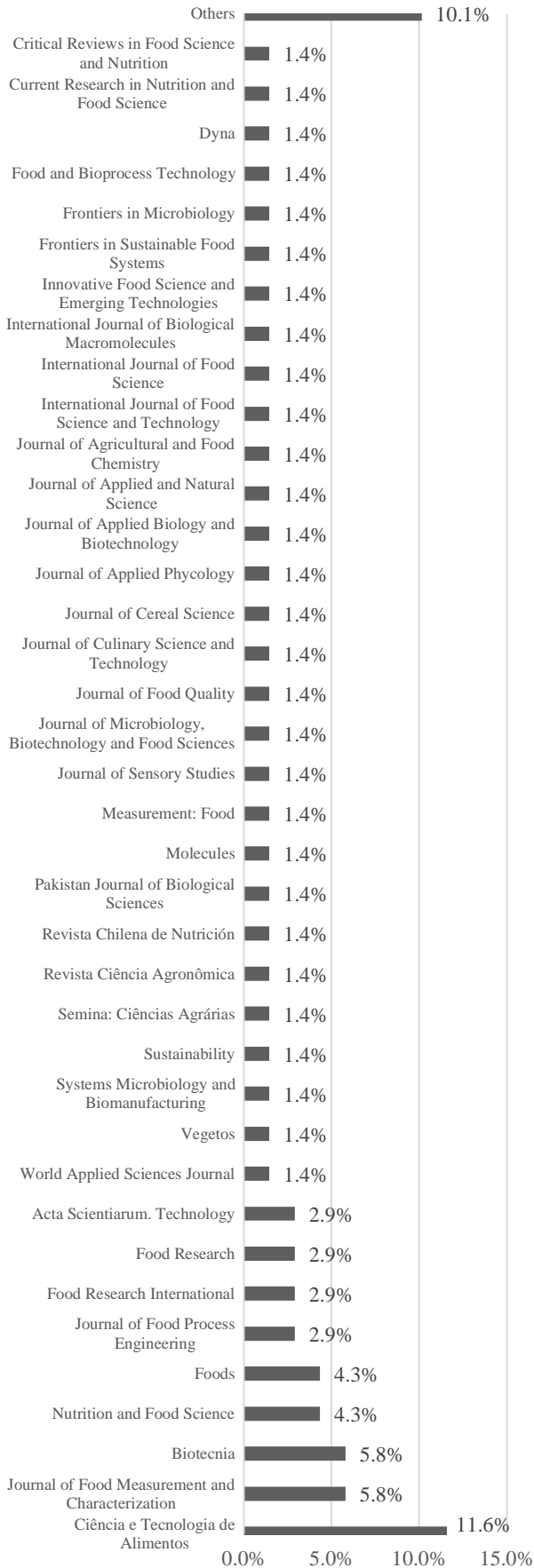


Figure 6: Results by source or Journal

4) Results by product type

Of the 69-articles collected, it is necessary to identify the kind of product of study, this is because in the Figure 7 depicted the available product where bread has the first place with 33% of participation (also called French bread).

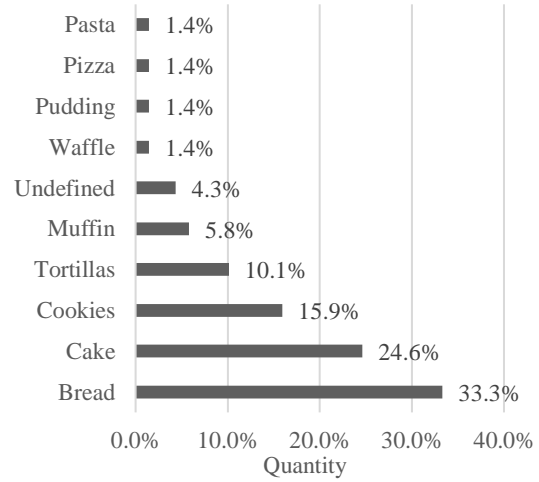


Figure 7: Results by product type

The second place is for cake products with more than 24% of contributions, finally the cookies product has the third position. There are other interesting products, such as waffles, pizza, pudding, and pasta, which present opportunities for the development of related products.

Between bread and cakes, 57.9% of the publications were centered. An interesting fact is that publications focusing on tortillas ranked fourth, just below bread, cakes, and cookies.

5) Results by approach

The following classification was made based on the overall focus of the article (see Figure 8), considering whether the proposed ideas can be commercialized or are solely intended for research purposes.

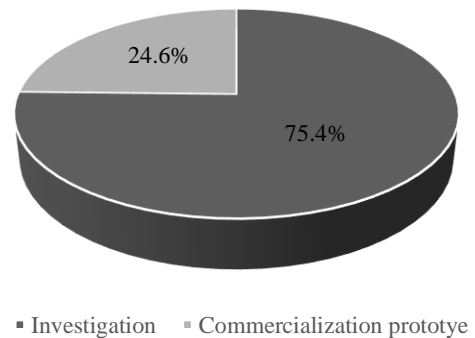


Figure 8: Results by approach

Three out of four articles focused on research, while only one out of four had a marketing focus. With this it can be concluded that in the scientific and technological field there is little evidence in relation to commercially successful products.

This classification is recommended to understand their operation and results in real life to generated new proposals with an overview business.

6) Results by sensory acceptance

An important aspect that was considered was the articles containing sensory acceptance. This provides an idea of what percentage of the population likes or dislikes a product.

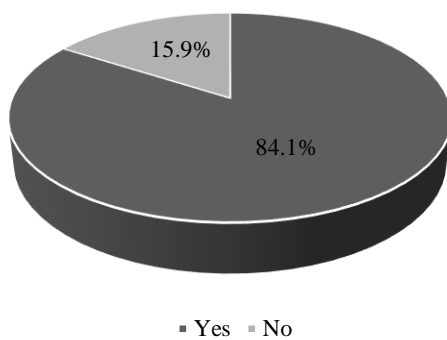


Figure 9: Results by sensory acceptance

For product launch purposes, this is a characteristic that must be considered. As seen in Figure 9, three out of every five articles considered the sensory acceptance of the proposal.

7) Results by implementation level

The articles were classified according to the level of implementation depending on the maturity level or progress of the project. It was considered to classify them into three categories: proposed, implemented, or unspecified, as seen in Figure 10.

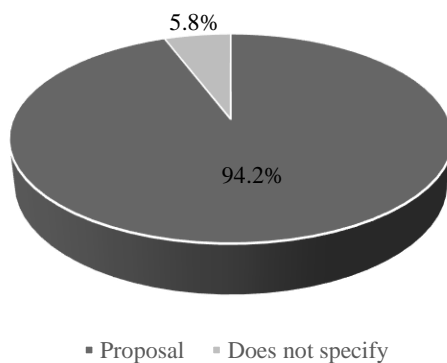


Figure 10: Results by implementation level

The proposed category refers to articles or publications that showcase a product but lack evidence of its commercialization; rather, they are tested at the laboratory level and can be evaluated with potential consumers. The implemented classification considers products that have been commercialized or for which there is information on the market or commercial stage of the product.

The last classification, which is unspecified, refers to articles discussing bread-making without mentioning a particular product, potentially being a compilation of information on various bread-making products.

8) Results by challenges

In the review process, challenges related to the incorporation of additions to the bakery product were explicitly detected, such as (Gunasekara *et al.*, 2021) which talks about the challenge of preparing a gluten-free muffin with yam flour and hydrocolloids. In this same sense, (Hussein *et al.*, 2019), talks about the incorporation of coffee byproduct in breads to increase the fiber content. And (Cho *et al.*, 2014) talks about the distinction of benefits over brown or white rice cake.

On the other hand, (de Albuquerque *et al.*, 2019) talks about the challenge of implementing the CATA model for sensory evaluation and (Wang *et al.*, 2017) talks about the need for information and the data collection process of the last 5 years of gluten-free bread developments to find new product proposals.

4. CONCLUSIONS

There is a recent trend in the number of publications meeting search criteria, with articles from the past four years and the current year accounting for 53.6% of the total, while the previous seven years represent only 46.4%.

The top three countries with the most publications are Brazil, India, and Mexico accounting for 27.5%, 21.7%, and 5.8%, respectively. Neither the United States nor Canada have published any articles meeting the search criteria. The continents with the most publications were Asia and America, accounting for 40.6% and 39.1%, respectively.

During this systematic literature review, 73.9% of the selected articles focus on bread, cakes, or cookies, but an important fact is that 10% of the articles are centered on tortillas, the same percentage as pasta, pizza, muffins, and waffles combined. But only one article refers to a quick bakery product. It is a chickpea-based pudding typical of India called Puran.

Only one out of every four articles consider commercial prototypes, indicating a need for further research and development to bring these developments

to market. In this context, sensory evaluation is a critical parameter for prototype development, as evidenced by five out of every six articles considering sensory acceptance in their publication.

No articles discussing any project management methodology or tool to finalize the project were found. Further investigation is required to analyze whether there is evidence of implementation of any project management tool/model or method to increase the project's likelihood of success, as a proactive approach to project management is fundamental for addressing the multifaceted challenges encountered in bakery product development. By embracing rigorous project management practices, stakeholders can maximize the likelihood of delivering nutritionally enhanced bakery products that meet consumer expectations while achieving commercial success in a competitive market landscape.

Research to increase the nutritional value of bakery products and evaluate their sensory acceptability has increased over time, but more research is still needed to substantially improve the nutritional value of bakery products.

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