Revista ARACÊ
ISSN: 2358-2472

A SUSTAINABLE APPROACH: FOOD WASTE IN YOGHURT FORMULATION

https://doi.org/10.56238/arev7n1-197

Submitted on: 12/24/2024 **Publication date:** 01/24/2025

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ABSTRACT

This article aims to analyze the feasibility and benefits of using food waste in the formulation of yogurts, aiming to promote sustainability in the food industry. Key findings reveal that incorporating food waste into yogurt production can add nutritional value, reduce food waste, and positively impact the environment. It is concluded that the use of food waste in the formulation of yogurts is a viable and promising practice, provided that challenges related to food safety and consumer acceptance are overcome. This study contributes to the sustainability of the food industry and offers recommendations for future research in this field.

Keywords: Food Sustainability. Food Waste. Yogurt Formulation.

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ISSN: 2358-2472

INTRODUCTION

The growing concern for sustainability and the reduction of food waste has generated significant momentum in the search for innovative and efficient practices within the dairy industry. This sector, which is essential for global food, faces considerable challenges related to resource efficiency and waste management (XIA et al., 2024). In response to these demands, the use of food waste in the production of yogurt has emerged as a promising strategy, which not only aims to minimize waste, but also enhances the nutritional quality of products (WANG et al., 2024).

Food waste is made up of any part of a food that is not consumed or used, resulting in an alarming amount of disposal (XIA et al., 2024). Among these residues, fruit peels, vegetable bagasse, and leftover grains stand out, which make up a significant fraction of the total discarded food (TAHMAZ et al., 2024). Not only do these materials represent an economic loss for producers and consumers, but they also have a negative environmental impact, contributing to the emission of greenhouse gases when decomposed in landfills (MANJUNATA et al., 2024).

Integrating food waste into yogurt formulation offers an innovative solution to these challenges (WANG et al., 2024). By repurposing these ingredients, the dairy industry can not only reduce the volume of waste but also create products that are more nutritious and tasty. For example, the inclusion of fruit peels in the production of yogurts can increase fiber content and vitamin concentration, as well as provide unique flavors and textures (TAHMAZ et al., 2024). The use of vegetable pomace not only enriches the nutritional profile but can also add color and visual appeal to the final product, making it more attractive to consumers (MANJUNATA et al., 2024).

In addition to improving the sensory and nutritional characteristics of yogurts, this approach is in line with the principles of the circular economy (XIA et al., 2024). In this model, waste is seen as a resource that can be reused, contributing to the sustainability of food production (TAHMAZ et al., 2024). This transformation not only helps to mitigate the environmental impact of the dairy industry but also promotes a change in consumers' perception of dairy products (HASSOUN et al., 2024). By offering yogurts that are enriched with ingredients normally considered disposable, the industry can encourage more conscious and responsible consumption, where nutritional value and sustainability are in the foreground (WANG et al., 2024).

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The incorporation of food waste into yogurt production can also stimulate innovation and research within the industry (XIA et al., 2024). There is a growing need for studies that explore best practices for the use of these wastes, from ingredient selection to formulation and processing (BAGLARY et al., 2024). Research can open doors for the development of new product lines that meet specific consumer demands, such as functional and nutrient-rich foods (WANG et al., 2024).

Thus, investigating the possibilities and benefits of using food waste in yogurts becomes essential to move towards a more sustainable and innovative dairy industry (TAHMAZ et al., 2024). Such research not only contributes to reducing waste and improving the nutritional quality of products, but also promotes a more integrated and responsible approach to food production (HASSOUN et al., 2024). By joining efforts to turn waste into resources, the dairy industry can play a significant role in building a more sustainable and balanced food system, benefiting both consumers and the environment (VERMA et al., 2024).

This article aims to review the literature on the use of food waste in the production of yogurts, evaluating the nutritional benefits and environmental impacts associated with this practice. In addition, it is intended to discuss the barriers to consumer acceptance and the technical and regulatory challenges faced in implementing this approach. The analysis seeks to identify opportunities to promote innovation and sustainability in the dairy industry, contributing to healthier and more responsible eating.

METHODOLOGY

This study consists of a comprehensive literature review of the last five years, carried out using the Science Direct and Scopus databases. Articles were selected that explore the development of yogurts plus by-products from the food industry. The search focused on studies that discuss the production of yogurt, its physicochemical properties and its applications in the food industry. The keywords used for the search include "yogurt", "product development", "food waste", "food by-products", "dairy products", "circular economy".

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RESULTS AND DISCUSSION

DAIRY INDUSTRY

The dairy industry plays a vital role in the global economy, contributing significantly to economic development and food security in many countries (ZHOU et al., 2024). In terms of production and consumption, dairy products such as milk, cheese, yogurt, and butter are fundamental to the diet of billions of people around the world. According to the Food and Agriculture Organization of the United Nations (FAO), global milk production reached over 950 million tons in 2023, with consistent growth projected for the coming years, driven by the growing demand for dairy products and the increase in the global population (LAI et al., 2024).

The growth of the dairy industry can be attributed to several factors, including urbanization, changing consumer preferences, and increased awareness of the nutritional benefits of dairy products (WANG et al., 2024). The rise of the middle class in emerging economies has also contributed to an increase in demand for higher-quality dairy products (ZHAI et al., 2024). In addition, technological innovation has played a crucial role in increasing efficiency in the production, preservation, and distribution of dairy products (ZHOU et al., 2024).

However, the dairy industry faces significant challenges, such as sustainability concerns, greenhouse gas emissions, and waste management (ZHAI et al., 2024). The pressure to adopt more sustainable production practices and minimize environmental impact is driving research and development of alternative methods, such as the use of food waste in the production of yogurts and other dairy products (ZHOU et al., 2024). These innovations can help the industry align with the expectations of increasingly sustainability- and health-conscious consumers (KRAH et al., 2024).

YOGURT

Yogurt is a fermented dairy product that has been consumed for millennia, being valued for its nutritious properties and health benefits (ZHAI et al., 2024). It is produced by milk fermentation, in which specific bacteria, known as probiotic cultures, convert lactose into lactic acid, giving yogurt its creamy texture and characteristic flavor (ZHOU et al., 2024). The most commonly used crops in yogurt production include *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, which are responsible for fermenting milk (ZHANG et al., 2024). The combination of these cultures not only promotes the acidification

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ISSN: 2358-2472

of milk but also contributes to the production of bioactive compounds that can benefit gut health (LAI et al., 2024).

The yogurt production process involves several steps (JANY et al., 2024). First, the milk is pasteurized to eliminate unwanted pathogens and bacteria. It is then cooled and inoculated with the fermentation cultures. The inoculated milk is kept at a controlled temperature to allow the bacteria to ferment the lactose, resulting in the formation of yogurt. This process can vary in duration and temperature, depending on the type of yogurt desired (ZHAI et al., 2024).

Yogurt is widely recognized for its nutritional benefits, being an excellent source of protein, calcium, vitamins, and probiotics (LAI et al., 2024). The probiotics present in yogurt have been linked to several health benefits, including improving gut health, strengthening the immune system, and reducing the risk of chronic diseases such as diabetes and cardiovascular disease (ZHANG et al., 2024; HASEGAWA et al., 2023). Due to these properties, yogurt has become increasingly popular among consumers seeking healthy and functional alternatives in their diet (ZHOU et al., 2024).

In recent years, the demand for value-added yogurts, such as those enriched with fiber or that use food waste, has grown (ZHAI et al., 2024). This trend not only reflects the search for more nutritious food, but also the growing awareness of sustainability and food waste (TAHMAZ et al., 2024; HASEGAWA et al., 2023). The inclusion of food waste in yogurt production not only increases nutritional value but also offers an innovative solution for waste management in the dairy industry, contributing to the sustainability of the sector (WANG et al., 2024).

DEFINITION OF FOOD WASTE

Food waste is defined as any part of a food that is not consumed or used in food, resulting in significant waste that has both economic and environmental implications (MANJUNATA et al., 2024). In a world where food safety is a growing concern, the issue of food waste becomes increasingly relevant (KUMAR, et al., 2024). This waste not only jeopardizes efforts to combat hunger but also contributes to environmental degradation, as decomposing food waste in landfills generates significant greenhouse gas emissions (XIA et al., 2024).

Food waste can be classified into several categories, each with its distinct characteristics and origins:

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- Processing Waste: This waste is generated during the industrial food processing stages. Examples include fruit and vegetable peels, seeds, pulps, and trimmings (TAHMAZ et al., 2024). These materials are often considered by-products of the food industry, but if properly managed, they can be repurposed for the production of new foods, ingredients, or even functional compounds that can enrich other food products (VERMA et al., 2024).
- Consumption Waste: These residues arise from prepared and consumed meals, such as leftovers from dishes, uneaten foods, or even foods that do not meet quality standards for sale, such as fruits and vegetables that do not look perfect (TAHMAZ et al., 2024). These scraps represent a significant part of food waste, as they are often discarded without being used (KRAH et al., 2024). Educating consumers about meal planning and proper food preservation can help reduce this type of waste (VERMA et al., 2024).
- Agricultural Waste: This category includes crop leftovers, leaves, inedible plant parts, and other materials that are not used in food production (KRAH et al., 2024). This often overlooked agricultural waste represents a significant opportunity for recycling and repurposing. For example, incorporating agricultural waste into the production of biofuels, fertilizers, or even animal feed can contribute to a more sustainable approach in agriculture (VERMA et al., 2024).

Proper food waste management is key to mitigating waste and promoting sustainability (KRAH et al., 2024). It is not just about discarding what is not consumed, but about rethinking and reusing these resources in a way that can be beneficial in other applications (XIA et al., 2024). The transformation of food waste into new food products, such as the use of fruit peels in the manufacture of yogurts or in smoothies, is an example of how effective this management can be (KRAH et al., 2024). In addition, food waste composting and recycling initiatives help to return nutrients to the soil, promoting a healthier production cycle (WANG et al., 2024).

In summary, the issue of food waste requires a comprehensive approach that involves all parts of the food chain, from production to consumption (KUMAR, et al., 2024). By recognizing the value of food waste and implementing strategies for its use, one can not only reduce waste but also contribute to a more sustainable and efficient food system (TAHMAZ et al., 2024).

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TYPES OF FOOD WASTE USED IN YOGURTS

In the dairy industry, especially in the production of yogurts, several types of food waste have been exploited as valuable ingredients (WANG et al., 2024). The following lists some of the main types of food waste that are being incorporated into yogurt formulation:

Fruit Peels

Fruit peels are an abundant source of nutrients and bioactive compounds, often underestimated and discarded (TAHMAZ et al., 2024). Fruits such as apples, oranges, bananas, and pears have skins rich in dietary fiber, vitamins, and antioxidants (KUMAR, et al., 2024). For example, apple peel contains quercetin, a flavonoid with anti-inflammatory and antioxidant properties, which can help fight chronic diseases (TAHMAZ et al., 2024). By incorporating fruit peels into yogurt production, manufacturers not only add an interesting texture and distinct flavor, but also improve the nutritional profile of the final product (KUMAR et al., 2024). In addition, this practice contributes to sustainability by taking advantage of parts of fruit that could otherwise be discarded (KRAH et al., 2024).

Grain Scraps

Leftover grains, such as corn pomace, oats, wheat, and barley are another example of food waste that can be used in the production of yogurts (JANY et al., 2024). These grains are often generated during food processing, such as the production of flours and cereals (TAHMAZ et al., 2024). Incorporating grain pomace into yogurts not only adds an interesting texture and a more robust mouthfeel, but also enriches the protein and fiber content of the product (KRAH et al., 2024). For example, oats are known for their beneficial properties for cardiovascular health and their role in regulating cholesterol. The use of these grains in yogurts can offer consumers a more nutritious and satisfying food, promoting a more balanced diet (TAHMAZ et al., 2024).

Vegetable Pomace

Vegetable waste, such as carrot, beet and pumpkin pomace, are also standing out in the formulation of yogurts (KUMAR et al., 2024). These ingredients not only contribute to increased nutritional value but also offer vibrant colors and distinct flavors to dairy products (TAHMAZ et al., 2024). Carrot pomace, for example, is rich in beta-carotene, an antioxidant that is converted into vitamin A in the body, essential for eye health and the immune system

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(KRAH et al., 2024). Similarly, beetroot pomace can add an attractive color and is known for its beneficial properties for cardiovascular health (KUMAR, et al., 2024). The inclusion of vegetable pomace in yogurts allows consumers to enjoy healthier products while helping to minimize food waste (KRAH et al., 2024).

These residues not only provide new flavors and textures to yogurts, but also contribute to a healthier and more sustainable diet (TAHMAZ et al., 2024).

NUTRITIONAL BENEFITS

The inclusion of food waste in the formulation of yogurts has been shown to be an innovative and effective strategy to enrich the nutritional composition of these products (KRAH et al., 2024). Using ingredients such as fruit peels, vegetable pomace, and leftover grains not only helps reduce waste but can also transform yogurt into a more nutritious and functional food option (JANY et al., 2024). This practice is in line with the growing consumer demand for products that not only satisfy the palate but also contribute to health and well-being (ZHANG et al., 2024).

Food waste, such as fruit peels and vegetable pomace, is often underestimated, but is actually rich sources of essential nutrients (KRAH et al., 2024). For example, the peels of fruits such as apples and oranges are known to contain high concentrations of fiber, vitamins, and antioxidant compounds (LAI et al., 2024). Dietary fiber is crucial for digestive health, as it helps regulate intestinal transit, prevents constipation, and contributes to the overall health of the gastrointestinal tract. Additionally, fiber has the potential to increase feelings of fullness, which can be beneficial for weight management, helping consumers feel fuller after meals (JANY et al., 2024).

Vitamins, such as vitamin C present in citrus peels, are critical for immune system function and skin health (HASEGAWA et al., 2023). When these residues are incorporated into yogurts, they not only increase the nutrient content but also provide a richer and more interesting sensory experience (LAI et al., 2024).

In addition to fiber and vitamins, food waste is a significant source of antioxidant compounds, which play a vital role in protecting the body against oxidative stress and inflammation (ZHANG et al., 2024). Antioxidants, such as the polyphenols found in apple peels and oranges, can help neutralize free radicals, reducing the risk of chronic diseases such as heart disease, type 2 diabetes, and certain cancers (JANY et al., 2024). By enriching yogurts with these compounds, manufacturers not only improve the nutritional

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value of the products but also promote health benefits that go beyond basic nutrition (LAI et al., 2024).

The addition of fiber from food waste can also have a positive impact on the regulation of blood glucose levels (ZHANG et al., 2024). Soluble fiber, in particular, has the ability to slow down the absorption of sugars, helping to stabilize glucose levels after meals (HASEGAWA et al., 2023). This is especially important for people looking to manage diabetes or prevent sudden fluctuations in blood glucose (JANY et al., 2024). In addition, dietary fiber promotes the growth of beneficial bacteria in the gut, which is essential for gut health. A balanced gut microbiota is associated with better digestion, nutrient absorption, and even a strengthened immune system (ZHANG et al., 2024).

Incorporating food waste into yogurts not only enriches the nutritional composition but also presents a unique opportunity to meet the growing demand for healthier and more functional food options (LAI et al., 2024). Consumers are increasingly aware of the nutritional benefits of the foods they choose and seek products that not only satisfy their dietary needs but also promote long-term health (KRAH et al., 2024). With the addition of nutrients from food waste, yogurts become a more attractive and informed alternative, offering not only taste but also health and well-being (GAVRIL et al., 2024).

RESEARCH CARRIED OUT ON THE SUBJECT

Based on the bibliographic survey carried out, some studies on the use of by-products in the incorporation of yogurts are discussed below, aiming to highlight the results obtained by the researchers.

The study by Nguyen et al. (2024) looked at the effect of fortifying probiotic yogurts with raw and enzymatically treated melon rind powder to increase soluble fiber content. It was observed that yogurt with raw melon rind powder (RCRP) had lower hardness, viscosity, elasticity, and stability compared to control yogurt, while the addition of enzyme-treated powder (ECRP) increased these characteristics. After 15 days of storage, yogurt with RCT showed three-fold lower syneresis and higher antioxidant activity, suggesting that the enzymatic treatment of melon rind powder is effective to improve the stability, texture, and antioxidant properties of yogurt.

The research of Mahomud et al. (2024) investigated the effect of adding green banana peel polyphenol extract (GBPPE) to yogurt, with the aim of improving the viability and functionality of probiotics and product quality. Concentrations of 0.5%, 1% and 2% of

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GBPPE were tested. Compared to control yogurt, GBPPE formulations showed increased antioxidant activity, higher phenolic and flavonoid content, and better water-binding capacity and viscosity. Sensorially, yogurt with 0.5% GBPPE obtained the best acceptance. These results indicate that the use of GBPPE contributes to the development of probiotic yogurts with enhanced functional and sensory qualities.

The study by Klojdova et al. (2024) proposed the use of apple pomace, a byproduct of juice and cider production, to improve the textural properties of yogurts. Enriched with 1, 2 and 4% of freeze-dried or air-dried apple pomace powder, the yogurts showed improvements in hardness and elasticity, especially in the samples with 4% bagasse dried in the oven, which also obtained the best sensory evaluation. Apple pomace, rich in polyphenols and bioactive compounds, can add nutritional value, contributing to a more sustainable food approach by reusing by-products from the industry.

The research by Zhang et al. (2024) investigated the fiber incorporation of kale stalks, evaluating its impact on the quality and functional characteristics of goat yogurt. The fiber was added in concentrations of 0.5, 1.0 and 1.5%. The results showed that the addition of fiber increased the particle size and improved the hardness and cohesion of the yogurt, with the best water retention and thermal stability observed at the 0.5% fiber concentration. Microscopic analyses confirmed the integration of the fiber into the yogurt gel structure, resulting in significant improvements in rheological properties, such as resistance to temperature variations and recovery of the gel structure. Kale fiber also increased protein bioavailability during in vitro digestion. Thus, the inclusion of fiber from kale stalks can enrich the nutritional value and functional properties if added in yogurt.

The study by Jany et al. (2024) looked at the bioactive phytochemicals in pomegranate peel and their effect on fortified functional yogurt. The phytochemicals in this by-product were extracted using ethanol, methanol, and acetone to assess total phenols, flavonoids, anthocyanins, and antioxidant activity, with the ethanolic extract exhibiting the highest levels of bioactive compounds. The ethanolic extract was then incorporated into the yogurt at concentrations of 0.25%, 0.5% and 0.75%. Fortification with pomegranate peel increased antioxidant activity and phenolic compounds, as well as improved water retention and reduced syneresis. The best formulation was 0.5%, due to the balance between nutritional, physicochemical and sensory qualities. The work highlighted the potential of adding yogurts with pomegranate peel to enhance their functional value.

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In the study by Muñoz-Tebar et al. (2024) investigated the effect of date co-product ingredients (paste and flour, in concentrations of 3% and 6%) on yogurt made with goat's milk, focusing on nutritional, technological, physicochemical, microbiological and sensory aspects over 21 days of cold storage. The addition of both ingredients favored the growth of probiotic cultures, enhancing the probiotic potential of yogurt. Date flour caused greater physicochemical changes, especially in texture, color, and syneresis, while date paste helped reduce syneresis, better preserving physical quality. Sensorially, consumers preferred yogurts with date paste (3% and 6%), due to the more pleasant color and texture compared to flour.

The study by Gavril et al. (2024) looked at the use of pumpkin by-products, specifically pumpkin peel powder (PPP), in the development of enriched yogurt. Pumpkin peel contains antioxidants such as phenolics, flavonoids, and carotenoids, which are highly bioactive. The incorporation of PPP increased the nutritional value of yogurt, improving the content of β-carotene and bioactive compounds and also the texture characteristics. Sensorially, yogurt with PPP maintained good acceptability and had greater acceptance when compared to control yogurt.

The study by Bajya et al. (2024) investigated the use of unripened papaya peel powder (UPPP) to enhance the functionality of Greek yogurt. By-products of the fruit industry, such as papaya peel, are rich in bioactive compounds, including polysaccharides and polyphenols, which have potential health benefits. Through LC-MS-based metabolite profile analysis, 36 functional metabolites were identified in UPPP-enriched yogurt, such as kaempferol and carpaine derivatives, which contribute prebiotic and bioactive properties to the final product. This work indicates that plant ingredients such as UPPP can improve the functional and symbiotic characteristics of Greek yogurt.

Thus, the incorporation of food by-products into yogurts is a highly relevant and advantageous practice. The aforementioned studies point out that these residues, which come from fruits and vegetables, are rich in bioactive compounds such as fiber, antioxidants, and polyphenols, which can improve the nutritional quality and functional properties of yogurts. In addition, the use of by-products promotes sustainability, reducing food waste and valuing components that would otherwise be discarded. Therefore, the use of by-products in yogurts is a viable approach that contributes to functional food innovation and sustainability in the food industry.

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ENVIRONMENTAL IMPACTS

The production of yogurts with the incorporation of food waste has a significant positive environmental impact, reflecting the industry's growing concern with sustainability and resource efficiency (XIA et al., 2024). As awareness of environmental issues intensifies, waste management becomes a priority not only for producers but also for consumers seeking more responsible alternatives (HASSOUN et al., 2024). The practice of using food waste in the manufacture of yogurts not only contributes to the reduction of waste, but also acts as an effective strategy in the fight against greenhouse gas emissions, which are one of the main causes of climate change (JANY et al., 2024).

Food waste is one of the most critical issues facing modern society, with millions of tons of food being discarded annually around the world (BAGLARY et al., 2024). According to the Food and Agriculture Organization of the United Nations (FAO), about one-third of all global food production is lost or wasted, which is equivalent to approximately 1.05 billion tons of food (FAO, 2023). This waste not only represents a substantial economic loss, but also results in significant greenhouse gas emissions, since decomposing food in landfills produces methane, a potent greenhouse gas (VERMA et al., 2024).

By incorporating food waste into yogurt production, the dairy industry can play a vital role in reducing this waste (GAVRIL et al., 2024). Instead of being discarded, these by-products can be reused as ingredients, transforming what would otherwise be waste into valuable nutritional components (BAGLARY et al., 2024). This practice not only decreases the amount of waste that goes to landfills, but also reduces the need for new resources for food production, promoting a more efficient and sustainable cycle (VERMA et al., 2024).

The practice of using food waste in the production of yoghurts is a clear example of a circular economy. In this model, waste is seen as valuable resources to be reused, rather than being considered waste (CERVANTES et al., 2024). The circular economy promotes the reuse of materials, minimizing waste and promoting innovation in production processes (LIU, 2024). In the dairy industry, this can include integrating technologies that help turn waste into new products, such as enriched yogurts, that not only meet consumers' nutritional demands but also contribute to a more sustainable food system (JANY et al., 2024).

The use of food waste in the production of yoghurt also helps to reduce the pressure on agricultural systems. The demand for food is increasing globally due to population growth and changing consumption patterns (BAGLARY et al., 2024). This pressure can

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lead to unsustainable agricultural practices, which degrade the environment and compromise the quality of natural resources. By using food waste, the industry can reduce the need to grow new raw materials, promoting a more responsible and sustainable approach to food production (JANY et al., 2024).

By integrating food waste into yogurt production, the industry not only addresses the problem of waste but also aligns with global sustainable development goals (VERMA et al., 2024). The practice helps to promote food security, the conservation of natural resources, and the mitigation of climate change, contributing to a more balanced and sustainable future (BAGLARY et al., 2024).

CHALLENGES AND LIMITATIONS

While the inclusion of food waste in yogurt production offers a range of nutritional and environmental benefits, this practice also presents significant challenges that need to be addressed to ensure its viability and market acceptance (BAGLARY et al., 2024). Two of the main obstacles are food safety and consumer acceptance, both of which are crucial to the success of this innovative approach (WANG et al., 2024).

Food safety is one of the most relevant concerns when considering the use of food waste in yogurt formulation (GAVRIL et al., 2024). Food quality and safety are a priority, and it is essential that the waste used is not only safe for human consumption, but also that it maintains the integrity and quality of the final product (VERMA et al., 2024).

The origin of food waste is a critical factor; it is necessary to ensure that they come from reliable sources and that they have been handled and stored properly to avoid contamination (BAGLARY et al., 2024). Waste that is not treated or processed correctly can introduce pathogens or chemical contaminants, posing risks to consumer health (GAVRIL et al., 2024). Therefore, the implementation of strict quality control and safety standards in the production chain is indispensable (VERMA et al., 2024). This may include conducting microbiological testing and analyzing potentially harmful compounds present in residues before their inclusion in yogurts (JANY et al., 2024).

In addition, the standardization of waste incorporation processes in yogurt production is essential (VERMA et al., 2024). Each type of waste can have distinct characteristics that affect the texture, flavor, and durability of the final product. Therefore, strict quality control is required during all stages of production, from the selection and

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treatment of waste to the production and packaging of yogurt, to ensure that the product meets food safety standards (VERMA et al., 2024).

Another significant challenge is consumer acceptance towards products containing food waste (WANG et al., 2024). Many consumers may have prejudices or fears about the idea of consuming products made from "waste", associating this terminology with lower quality food or even safety issues. This perception can be a major obstacle to the widespread adoption of yogurts that use ingredients considered by-products (JANY et al., 2024).

To overcome this barrier, it is essential for the industry to conduct market research to understand consumer concerns and expectations (HASEGAWA et al., 2023). Additionally, well-designed awareness campaigns can play a vital role in educating consumers about the nutritional and environmental benefits of including food waste in yogurt production (GAVRIL et al., 2024). Informing consumers about the added nutritional value and safety of products can help change the negative perception associated with the consumption of residues-enriched yogurts (WANG et al., 2024).

Marketing campaigns should also highlight the sustainability principles involved in this practice, emphasizing how the use of food by-products contributes to the reduction of waste and the promotion of a circular economy (VERMA et al., 2024). This transparent communication can increase consumer confidence and encourage them to opt for products that are not only tasty but also environmentally responsible (JANY et al., 2024).

To strengthen consumer acceptance, it is equally important for companies to conduct research on consumer preferences regarding flavors, textures, and other sensory aspects of yogurts that incorporate food waste (VERMA et al., 2024). This will allow manufacturers to adjust their formulations to better meet consumer expectations and, consequently, increase the acceptance of these products in the market (GAVRIL et al., 2024).

Additionally, involving consumers in the product development process, through tastings and feedback, can be an effective strategy for creating a sense of belonging and acceptance (JANY et al., 2024). This approach can help build a loyal consumer base that values innovation and sustainability (GAVRIL et al., 2024).

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CONCLUSION

The findings of the literature review show that the use of food waste in the production of yogurt has the potential to result in more nutritious and sustainable products. However, it is essential to address challenges related to consumer acceptance and food safety. For this practice to be successfully implemented, a collaborative effort is needed between the industry, researchers and regulatory bodies in order to promote awareness and confidence in the added products.

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