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## EVALUATION OF THE ACCEPTABILITY OF A PROBIOTIC YOGURT: PEOPLE'S PERSPECTIVE

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**Abstract:** Probiotics have gained an important place in contemporary food. They are live microorganisms which, if consumed at the right frequency and in the right quantities, have beneficial effects on human health. This research aims to evaluate the acceptability of probiotic yogurt by the population, which is important to understand the acceptance of this probiotic food, as well as the degree of knowledge of the population of the benefits for human health, through a literature review using academic databases. It also evaluates factors that influence the acceptability of probiotic foods, as well as addressing impossibilities that may limit the introduction of yogurt into the routine. The results concluded the importance of nutritional campaigns and the promotion of probiotic products to increase consumption, and this study contributes to understanding the population's attitudes towards functional foods.

**Keywords:** Functional foods, *Lactobacillus*, *Bifidobacterium*.

## INTRODUCTION

Probiotics are live microorganisms which, when ingested in adequate quantities, confer health benefits. Around 5,000 years ago, the Egyptians and Romans already enjoyed fermented milk containing probiotics. However, the term "probiotic" was only introduced in 1965 by microbiologist Emil M. Von Beijerinck. From the 1980s to the 1990s, more in-depth research and studies on probiotic foods began to be carried out.

According to Nunes *et al* (2018), probiotics should be consumed regularly, in adequate quantities, and have beneficial effects on the host's health by improving the intestinal microbial balance. According to the National Health Surveillance Agency (ANVISA), the recommended dose is  $5 \times 10^9$  CFU/day/g or ml, usually for a period of 15 days. Among the benefits of probiotics are improved digestion,

greater nutritional value in food, increased absorption and availability of minerals, colonization of the intestine, maintenance of the immune system and balance of the intestinal microbiota (Moraes *et al.*, 2007; Salgado, 2017; Santos *et al.*, 2016).

For a microorganism to be classified as probiotic, Santos *et al.* (2003) and Brizuela *et al.* (2001) state that it must meet seven criteria: it must not be pathogenic, it must be gram positive, it must be acid producing and acid resistant, it must be host specific, it must excrete anti-E. coli factor, it must be resistant to bile, and it must be viable/stable.

According to Nogueira *et al.* (2011), the main probiotics are *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus plantarum*, *Lactobacillus reuteri*, *Lactobacillus rhamnosus*, *Lactobacillus casei*, *Bifidobacterium bifidum*, *Bifidobacterium breve*, *Bifidobacterium infantis*, *Bifidobacterium lactis*, *Bifidobacterium longum*, *Bifidobacterium adolescentis*, *Saccharomyces boulardii*, *Propionibacterium freudenreichii*. Non-pathogenic strains such as *Escherichia*, *Enterococcus*, *Bacillus* and the fungus *Saccharomyces boulardii* are also considered. Therefore, probiotics belonging to the *Lactobacillus* and *Bifidobacterium* genera are the main targets of studies and the most widely used in food (Salgado, 2017; Santos *et al.*, 2016).

Probiotics are mainly used in fermented foods, such as dairy products, yogurts, ice creams and cheeses. Fermentation is essential for maintaining microbial viability and productivity, as well as preserving probiotic properties and improving the sensory quality of products (Isolauri *et al.*, 2004).

The problem of this research is to assess the population's understanding of probiotic foods and their benefits for intestinal health. Regular consumption of probiotics helps protect the intestinal microbiota, balancing it and preventing the absorption of toxic and

inflammatory substances. Probiotics can be found in different supplements and dairy compound foods (Cardoso, 2020).

This study arose from the need to explore and understand the topic more deeply, as well as to assess whether the population understands the benefits of consuming probiotic yogurts and the importance of incorporating them into the dietary routine.

Based on this general objective, the specific objectives are: to describe what probiotic yogurts are, the benefits of consuming probiotic yogurts, evaluating the acceptability of probiotic yogurts in the population, proposing practices to promote their proper consumption and analyzing the results of an online questionnaire.

The research is extremely important, as the benefits of probiotic yogurts need to be widely publicized. In addition, there is an expectation of collaborating with the food industry and helping to improve the population's well-being and quality of life.

## LITERATURE REVIEW

### PROBIOTICS

The word probiotic comes from the Greek meaning "for life". The Russian researcher Elie Metchnikoff, known as the "father of probiotics" and winner of the Nobel Prize for Medicine, was the first to put forward the idea that regular consumption of fermented milks offered health benefits (Santos *et al.*, 2016), and in 1910 this same researcher found that people from the Bulgarian culture had probiotic yogurts introduced into their diet and had a healthier life.

Probiotics are currently used in supplements and foods, with a focus on improving intestinal health, but they can also have an influence on health and for the prevention of certain diseases.

Once ingested, probiotic cells must be able to survive the conditions present in the gastrointestinal tract, such as gastric juice, the presence of bile salts and digestive enzymes, maintain their viability and metabolic activity in the intestine in order to exert their beneficial effects on their hosts.

As for the technological challenges for the industrial production of probiotic cells, they must remain stable and viable at satisfactory levels throughout the product's shelf life (Saad, 2006, Araújo, 2007).

According to Pimentel *et al.* three possible mechanisms of action of probiotics have already been well documented: modulation of the intestinal microbiota, maintenance of the integrity of the intestinal barrier and prevention of bacterial translocation, modulation of the immune response through interaction between the immune system and intestinal association. The effect of modulating the host microbiota is because probiotics act on resistance to colonization, through competition at the binding site and inhibition of adhesion, exerted against pathogenic bacteria, preventing or limiting their colonization and growth.

By improving the immune system, probiotic bacteria have an immunomodulatory effect, due to their ability to interact with epithelial and dendritic cells, such as monocytes, macrophages and lymphocytes, thus increasing the production of immunoglobulins, antibodies and cytokines (Pimentel *et al.* 2019).

The *Lactobacillus* and *Bifidobacterium* genera are the most widely used in the preparation of probiotics (Nunes, Garrido, 2018). The genus *Lactobacillus* currently has 56 recognized species, 5 of which contain subspecies (*delbrueckii*, *aviarius*, *salivarius*, *coryniformis* and *paracasei*). *Lactobacillus* are microaerophiles and, when cultivated in solid media, generally grow best in anaerobiosis or reduced oxygen pressure of 5% to 10% CO<sub>2</sub>.

Some are anaerobic in isolation and grow at temperatures ranging from 2°C to 53°C, with good values usually between 30°C and 40°C (Botelho, 2005).

In a healthy adult intestine, the predominant microflora is made up of health-promoting microorganisms. The main groups of probiotic microorganisms among the lactic acid bacteria of this genus are *Lactobacillus casei*, *Lactobacillus plantarum*, *Lactobacillus reuteri*, *Lactobacillus rhamnosus*, *Lactobacillus casei*, *Bifidobacterium bifidum*, *Bifidobacterium breve*, *Bifidobacterium infantis*, *Bifidobacterium lactis*, *Bifidobacterium longum*, *Bifidobacterium adolescentis*, *Saccharomyces boulardii*, *Propionibacterium freudenreichii* (Nogueira *et al.* 2011).

The health benefits attributed to the intake of probiotic cultures are the control of the intestinal microbiota, stabilization of the intestinal microbiota after the use of antibiotics, promotion of gastrointestinal resistance to colonization by pathogens, production of acetic and lactic acids, bacteriocins and other antimicrobial compounds, promotion of lactose digestion in lactose-intolerant individuals, stimulation of the immune system, relief from constipation and increased absorption of minerals and vitamins (Saad, 2006, p. 5).5).

For a food to be considered a probiotic, certain criteria must be met, such as not being pathogenic, showing tolerance to the gastrointestinal tract, having the ability to survive technological processes, remaining viable during shelf life and having proven health benefits. According to Salminen *et al.* (1998), the criteria for selecting probiotics relate to the genus to which the microorganisms belong, their stability and safety and their functional and physiological aspects.

## PROBIOTIC YOGURT

Probiotic yogurts are dairy products that are important in the diet, they contain live cultures, probiotic bacteria, such as *Lactobacillus* and *Bifidobacterium* that are lactic acid producing bacteria, knowing that they have a beneficial effect on the health and well-being of the host (Brand, 2019; Menezes, 2019; Pereira; Lusne, 2019; Santos *et al.*, 2021).

For a yogurt to be considered probiotic, it must have non-pathogenic properties, be resistant to the technological process, be live cells and in adequate quantities according to the Brazilian legislation of 5x10<sup>9</sup> CFU/day/g or ml generally over a period of 15 days, resist the adversities of the gastrointestinal tract, survive the effects of hydrochloric acid and bile salts through the digestive system, colonize the intestine, produce antimicrobial substances, have an influence on the immune system and metabolic activities (Brand, 2019; Menezes, 2019; Pereira; Lusne, 2019; Santos *et al.*, 2021).

If you add probiotic yogurts to your routine more often, these help to protect the intestinal microbiota, aiding balance and bringing a variety of benefits. According to Cardoso (2020), when there is a regular consumption of probiotics, the probiotic bacteria help to protect the intestinal microbiota, aiding its balance and thus preventing the absorption of toxic and inflammatory substances. They fight colds and flu, prevent and combat intestinal problems such as diarrhea, control allergic reactions, reduce the absorption of cholesterol and glucose, reduce blood pressure, help with weight loss, increase lactose tolerance, control pimples and acne, improve symptoms of depression and anxiety, prevent and combat irritable bowel syndrome, Crohn's syndrome, inflammatory bowel disease and ulcerative colitis, inhibit the growth of tumors in the intestine and rectal colon.

Francisco Guarner *et al.* (2017) other immunological benefits of probiotics are the activation of local macrophages to increase the presentation of antigens to B lymphocytes and increase the production of immunoglobulin (IgA), both locally and systemically, modulate cytokine profiles, induce tolerance to food antigens. And non-immunological benefits such as digesting non-digestible foods and competing with pathogens for nutrients, producing bacteriocins to inhibit pathogens, phagocytizing superoxide radicals, stimulating epithelial mucin production, increasing intestinal barrier function, competing for adhesion with pathogens, altering toxins of pathogenic origin.

### GENERA, SPECIES AND STRAINS USED IN PROBIOTIC YOGURTS

The genus *Lactobacillus* was identified in the 1990s and, over time, has expanded to include 261 species. This expansion has been accompanied by an increase in heterogeneity between species, taking into account genotypic, phenotypic and ecological aspects (Lima, 2021).

Strains of the *Lactobacillus* group act as bio-preservatives in food, as they have antimicrobial activity against pathogenic microorganisms, contaminants and food spoilers (Buriti; Saad 2007).

According to Cruz *et al.* (2015), for a yogurt to be classified as probiotic, it must contain strains of *Lactobacillus* and *Bifidobacterium*. In addition, these microorganisms must be present in adequate quantities to exert beneficial effects on the consumer's health, such as improving digestion, strengthening the immune system and balancing the intestinal microbiota. The quality and viability of these strains are essential for probiotic yogurt to offer the desired benefits.

Bifidobacteria were first isolated at the end of the 19th century by Tissier. They are gram-positive, non-spore-forming microorganisms, devoid of flagella, catalase negative and anaerobic. They can present a variety of forms including short, curved bacilli and bifurcated bacilli (Watanabes *et al.*, 2003).

The genus *Bifidobacterium bifidum* and *Bifidobacterium lactis* are strains that have demonstrated efficacy in modulating the intestinal microbiota and reducing gastrointestinal problems such as constipation (Sanders *et al.*, 2018). It is currently estimated that probiotic foods account for between 60% and 70% of the total functional food market. Among these, yogurts lead sales of dairy products, accounting for 36.6% due to their high sensory acceptance.

### DISCUSSION

Probiotics, when administered in adequate quantities, confer health benefits on the host. Several studies have shown that the administration of probiotics can positively influence the intestinal microbiota, promoting a healthy balance between bacterial populations.

In the study by Jiménez *et al.* (2019), it was shown that the probiotic strain *L. reuteri* V 3401 was able to help components of metabolic syndrome and lead a healthier lifestyle. As a result, a reduction in IL 6- and SVACAM levels was found in subjects with metabolic syndrome who consumed the probiotic strain along with a change in the intestinal microbiota with an increase in the genus *akkermansia muciniphila* from the phylum *verrucomicrobia* which is a contributor to the health of the intestinal microbiota and glucose homeostasis. Consumption of the probiotic *L. reuteri* V 3401 is an ally in conjunction with a low-calorie diet and physical activity, improving dysbiosis and reducing the post-inflammatory state.



The study by Castillo et al. (2021) analyzed consumers' perceptions of the health benefits of probiotic yogurt, especially with regard to intestinal health. The study sought to identify the population's level of knowledge about the beneficial properties of probiotics and investigated the barriers that hinder the acceptance and regular consumption of these products.

The results indicated that although probiotics offer significant benefits, such as modulating the microbiota and strengthening the immune system, the population's knowledge of these aspects is still limited. This lack of information was identified as an important barrier to the consumption of probiotic yogurt. The study therefore highlighted the importance of nutritional campaigns to educate the population about the positive impacts of probiotics. According to the authors, these campaigns could not only broaden knowledge on the subject, but also facilitate the incorporation of these products into the daily diet, promoting greater acceptance and contributing to public health.

A study also carried out at the Federal University of Pelotas (UFPEL) showed that 95.2% of consumers regularly consume conventional yogurts, while only 35.3% consume probiotic yogurts. The survey sought to understand consumer behavior in relation to these products, revealing that although many consumers are aware of the health benefits that probiotics offer, such as improved intestinal health and the immune system, the uptake of probiotic yogurts is still low. This lack of consumption may be linked not only to the higher cost of these products compared to conventional yogurts, but also to the absence of frequent and informative campaigns about their specific benefits. The study concluded that an investment in awareness and information campaigns could increase the consumption of probiotic yogurts, encouraging healthier and more conscious food choices among consumers.

According to Ribeiro and Gigante (2011), people associate the consumption of probiotic yogurt with benefits such as improved intestinal health and lower cholesterol levels. However, a more recent study indicated that a significant part of the population still doesn't fully understand the benefits of probiotic yogurts. For example, only 35.3% of yogurt consumers report consuming these products on a regular basis, as shown by a recent survey in a scientific journal specializing in nutrition (Smith et al., 2019).

In addition, Ribeiro and Gigante (2011) state that it is interesting to broaden the population's knowledge of the benefits and importance of probiotics for health, by means of awareness-raising campaigns that address everything from the benefits for intestinal health through to positive effects on immunity and metabolism. These campaigns should focus on informing the public about how probiotics can be integrated into the daily diet and the potential impact of this consumption on the prevention of chronic diseases and the promotion of general well-being. Through accessible and educational communication, it is hoped that the population will have a greater understanding of probiotics and will begin to include them more frequently in their dietary routine, adopting healthier and more informed choices.

In a study carried out by Holanda, C.C.M., et al. (2010), conducted by an institute in Viçosa (mg), 103 people were interviewed in a direct approach in four supermarkets in the city of Viçosa. Of those interviewed, 24% reported consuming probiotics and already knew about their health benefits, while 76% did not know what probiotics were, and 41.7% obtained their information mainly from nutritionists.

This survey was conducted directly, with voluntary and spontaneous participation, collecting responses over the course of a month.

It also used a questionnaire that covered topics such as knowledge about probiotics, reasons for consumption, as well as demographic characteristics of the interviewees such as age, gender, income and level of education.

The study concluded that the proportion of probiotic consumers among those interviewed is still small. These consumers demonstrate greater control over their dietary intake and often obtain information about products from nutrition professionals. Many respondents also showed confusion when identifying which brands of probiotics were most commonly used in their supermarket routine.

Barros et al. (2021) investigated the knowledge and consumption behavior of probiotics among students at a higher education institution in Maranhão. The study was approved by the Ethics Committee of the Federal University of Maranhão, under registration number 3.995.451. The study used an online questionnaire applied via Google Forms, with dissemination in WhatsApp groups and students' institutional emails between February and March 2021. The sample consisted of 327 participants, assessed using quantitative and qualitative methods, from a universe of 2,193 active students, covering nine undergraduate and four postgraduate courses.

The questionnaire had three sections: the first consisted of the terms of reference.

The second included six objective questions about the social profile (gender, age, course, income and routine); and the third contained two discursive questions and twelve objective questions related to the consumption of probiotic foods. The data was analyzed using Excel® 2016/365 spreadsheets and BioEstat® software. 5.0. The survey revealed that most of the students were aged between 18 and 24 (72.8%), had an income of between R\$1,100.00 and R\$2,200.00, and had a sedentary lifestyle (32.1%).

The analysis showed that the majority of undergraduate and postgraduate students in the areas of health and technology have an average age of 24, belong to the low-income middle class, have no health problems and are aware of the concept of probiotics. Among probiotic foods, fermented milk is the main product consumed, with a preference for probiotic yogurts. Despite this understanding, the consumption of probiotics by these students generally occurs on a monthly or biannual basis, influenced by sensory factors such as taste.

The study also revealed that many of these consumers were unfamiliar with products such as kombucha and tempeh, showing insecurity about the sensory acceptance of these foods. In the case of kefir, although it is a non-alcoholic product, some participants had an incorrect perception of its ethanol content due to the fermentation process. This lack of knowledge ends up limiting the market potential of these products. The data collected indicates the need for educational actions and market strategies to expand the knowledge and popularization of probiotics, meeting consumer preferences and expectations.

A study by Bruinsma et al. (2020), carried out at the Federal University of Pelotas (UFPEL), revealed that 95.2% of the consumers interviewed regularly consume conventional yogurts, while only 35.3% consume probiotic yogurts. The survey was conducted between August 13 and 17, 2021, using an online questionnaire distributed by Google Forms and shared on social networks such as Facebook, Instagram and WhatsApp. The questionnaire contained 17 questions and the percentage answers were automatically generated by the platform. The discursive responses were compiled in Excel spreadsheets, organized in alphabetical order and categorized to facilitate the graphical representation of the data.

The sample consisted of 310 participants aged between 18 and 35 (64%), the majority of whom were female (85.8%) and the rest male.

The study aimed to understand consumer behavior related to probiotic yogurts, showing that, despite knowledge of the benefits of these products - such as improving intestinal health and strengthening the immune system - the uptake of probiotic yogurts is still low.

This low uptake may be related not only to the higher cost of probiotic products compared to conventional yogurts, but also to the lack of information and awareness campaigns about their specific benefits. Although yogurt is widely consumed (95.2% of participants said they consume it regularly), it can be seen that consumption of probiotic yogurts remains restricted. The study concludes that investing in educational campaigns could promote healthier food choices and increase the consumption of probiotic products, encouraging more conscious eating among consumers.

It can be concluded from the evidence discussed that probiotics offer substantial health benefits, especially for balancing the intestinal microbiota and strengthening the immune system. Studies, such as that by Jiménez et al. (2019), show that certain strains, such as *L. reuteri* V 3401, are effective in controlling metabolic and inflammatory conditions, showing the therapeutic potential of probiotics when associated with a healthy diet and lifestyle. However, research such as that carried out by Castillo et al. (2021) and Bruinsma et al. (2020) shows that although knowledge of the benefits of probiotics is growing, regular consumption of probiotic products is still limited. This low consumption can be attributed to factors such as the cost of probiotic products and the lack of educational campaigns promoting their specific advantages.

In addition, studies show that consumer preferences and perceptions can restrict the uptake of probiotics. Many consumers are

unaware of products such as kombucha and tempeh, and there is a lack of clarity about the ethanol content in products such as kefir, which limits their acceptance. To overcome these barriers, both raising awareness through nutritional campaigns and adapting products to consumers' sensory preferences are essential.

Therefore, in order to raise awareness about the benefits of probiotic yogurts and promote their acceptance in the population, collaboration between food industries, researchers and health professionals is crucial. Industries can invest in educational campaigns and information labels, while researchers should conduct studies and disseminate results. Health professionals, such as nutritionists and doctors, can educate patients about the importance of probiotics and guide their proper consumption. This collaborative approach can improve public perception and maximize the positive effects of probiotics on intestinal health and the population's quality of life.

## FINAL CONSIDERATIONS

This review highlights the urgent need for an integrated approach to improve the acceptance and consumption of probiotics in the population. Although there is a great deal of research highlighting the health benefits of probiotics, there is still a significant gap in the knowledge and practice of regular consumption of probiotic yogurts.

Studies show that, despite basic knowledge about the benefits, consumption of probiotic yogurts remains low, which can be attributed to various factors, such as the lack of adequate awareness campaigns and the high cost of these products on the market. It is therefore of the utmost importance to implement effective awareness strategies that emphasize not only the health benefits of probiotics, but also promote the importance of incorporating them into the diet.



Collaboration between the food industry, researchers and health professionals is key to creating an environment where information about probiotic yogurts is accessible and understandable. Educational campaigns can demonstrate the beneficial effects of probiotics, such as improving intestinal health and strengthening the immune system, contributing to a better quality of life. In addition, industries can work on more accessible and attractive products, while health professionals and researchers work on disseminating up-to-date knowledge and recommending probiotics.

Investing in educational initiatives and community actions can transform this knowledge into healthy eating habits. To this end,

implementing public policies that encourage the consumption of functional foods is essential, as probiotics play a vital role in promoting health and preventing chronic diseases. A well-informed population is better able to make decisions conscious eating and adopting preventive habits.

With a continuous collaborative approach, maximizing the impact of probiotics on public health becomes possible, promoting not only the acceptance of these products, but also their inclusion in the population's dietary routine. Ultimately, this effort contributes to a healthier society, aware of the benefits of functional foods and committed to self-care and longevity.

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