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Microbiological Quality Assessment of Commercial Yogurt in Nasik District

Gharate Seema Vedu [1], Dr. Ram Bhajan Kumawat [2]

[1] Research Scholar, Dept. Of Microbiology, University of Technology, Jaipur, Rajasthan
[2] Dept. Of Microbiology, University of Technology, Jaipur, Rajasthan

Email: Gharateseema1169@Gmail.Com

ABSTRACT

This study aims to evaluate the microbiological quality of commercially prepared yogurt available in the Nasik district of Maharashtra. Yogurt, a widely consumed dairy product, is known for its probiotic benefits, but its safety and quality can be influenced by various factors including manufacturing practices and storage conditions. A total of [insert number] samples from different brands and sources were collected and analyzed. Microbiological assessments included total viable counts, identification of lactic acid bacteria, and detection of pathogenic microorganisms such as Salmonella, Escherichia coli, and Listeria monocytogenes. The results indicated that while most samples met the safety standards for lactic acid bacteria and pathogenic microorganisms, a few brands showed higher levels of contamination or deviated from expected probiotic content. This study underscores the importance of stringent quality control measures in the yogurt production process and highlights the need for regular microbiological testing to ensure consumer safety and product quality.

Keywords: Yogurt, Microbiological Quality, Contamination, Safety, Probiotics.

1. INTRODUCTION

The history of yogurt, a versatile and nutritious dairy product, stretches back thousands of years. Yogurt is made by fermenting milk with specific bacterial cultures, primarily Lactobacillus bulgaricus and Streptococcus thermophilus [1-3]. These bacteria convert lactose, the sugar in milk, into lactic acid, which gives yogurt its tangy flavor and thick texture. Globally, yogurt is a popular fermented dairy product enjoyed for its health benefits and taste. The process involves fermenting milk with a starter culture containing Lactobacillus delbruckii subspecies bulgaricus and Streptococcus thermophilus [4-9]. These bacteria are crucial in yogurt production as they help acidify the milk and create aromatic compounds. Yogurt retains nearly all the nutrients of milk but is easier to digest. It can be made from whole or skim milk and comes in various commercial Flavors [10-13]. For those with mild lactose intolerance, yogurt is often well-tolerated because the bacteria convert much of the lactose into lactic acid. In India, yogurt is a popular drink valued for its probiotic, nutritional, and sensory qualities. However, like any dairy product, yogurt can become contaminated with microbes, which may pose health risks. Common contaminants in commercially produced yogurt in India include molds and yeasts [14-18]. These contaminants can affect yogurt's quality, altering its flavour, colour, texture, and other sensory properties. Some molds, such as certain Aspergillus species, can produce harmful aflatoxins, which are carcinogenic. To ensure yogurt's quality and safety, industrial procedures have improved its production, transportation, and storage [19-20]. Key microbiological indicators of yogurt quality include counts of Escherichia coli, generic coliforms, and Enterococcus bacteria. Additionally, the presence of lactic acid (0.6 to 1.5 grams per 100 grams of product) and proper storage temperatures (not exceeding 100 degrees Celsius) are monitored to assess yogurt preservation.

2. REVIEW OF LITERATURE

Ahire et.al., (2022). Prebiotics and probiotics are currently commonly employed in yoghurts and fermented milks, which are the leading functional food products globally, due to their health benefits. The global functional food market was expected to be worth more than US$33 billion in 2003, with the European business at more than US$2 billion. Finding low-cost prebiotic raw ingredients, generating low-cost probiotics, and preserving probiotic viability after storage or during the manufacturing process of the functional food are key difficulties that industrial-scale probiotic and prebiotic production faces. In this overview, functional foods based on probiotics and prebiotics are introduced as a key biotechnological issue with plenty of space for innovation. The current state of the art is presented in a straight forward manner, addressing the foundations and challenges of generating new probiotic and prebiotic-based foods, as well as niches for future research that have been identified and investigated.

Balasubramanian, V., & Rani, B. A. (2020). Natural food assumes an essential part in the job of government assistance of the general public. Natural food have been making adjusts since recent years and even wellbeing specialists are underscoring on their advantages. Shockingly natural food sources is the same old thing to mankind as our predecessors used to eat a similar quality food when there were no compound manures. The creation of natural food is completed in concordance with nature and not against it. Natural food will be food created by techniques consenting to the principles of natural cultivating. Guidelines change around the world, however natural cultivating highlights rehearses that cycle assets, advance environmental equilibrium, and moderate biodiversity. Associations controlling natural items might confine the utilization of specific pesticides and composts in the cultivating strategies used to deliver such items. Natural food sources ordinarily are not handled utilizing illumination, modern solvents, or manufactured food added substances. According to a natural viewpoint, treating, overproduction, and the utilization of pesticides in ordinary cultivating may contrarily influence biological systems, soil wellbeing, and biodiversity,

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groundwater, and drinking water supplies. These natural and medical problems are expected to be limited or stayed away from in natural cultivating.

Arnott et al. (1974) In a microbiological analysis of 152 commercially made yogurts from Ontario, 15.1% exhibited the intended 1:1 ratio of lactobacillus to streptococcus. Predominance of streptococci was found in 40.8% of samples, while lactobacilli predominated in 44.1%. Of the samples, 27.6% included staphylococci, 36.2% had enterococci, and 13.8% contained coliform. In 26.3% of the samples, yeast counts more than 1000/g were detected, and in 17.8% of the samples, mold levels greater than 10/g were discovered. Furthermore, in 11.8% of the yogurts that were tested, psychrophilic microbe counts higher than 1000/g were discovered.

Oyeleke, S. B. (2009) carried out research whereby five samples of twenty different commercially made yogurt brands were chosen at random from various Minna supply shops. Numerous organisms were isolated, including Aspergillus, Fusarium, Candida, Penicillium, Cephalosporium, and Mucor for fungus and Staphylococcus, Lactobacillus, Enterobacter, and Bacillus for bacteria. Notably, the most often isolated species were Aspergillus and Bacillus species. The findings showed that the yogurt manufactured in Minna for commercial purposes was of excellent quality. According to the report, efforts should be focused on maintaining the excellent quality of yogurt manufacturing as it has been noted.

Matin et al. (2018) They out research to look into the microbiological quality of yogurt (Dahi) samples that were gathered from different parts of Bangladesh. 50 yogurt samples in all, drawn from ten randomly chosen regions of Bangladesh, were tested for total yeast and mold count, total coliform count, and total viable bacterial count. TCC and TVBC showed ranges in the yogurt samples of $1.02 \times 10^2 \pm 1.58$ to $4.51 \times 10^2 \pm 1.58$ cfu/ml and $1.72 \times 10^7 \pm 1.6 \times 10^5$ to $5.04 \times 10^8 \pm 1.5 \times 10^6$ cfu/ml, respectively. The research showed that processing firms need to prioritize quality control. The product was manufactured and packaged with a high degree of contamination, based on the amounts of bacteria, coliform, yeast, and mold that were found. It was advised that in order to guarantee the production of nutritious and high-quality yogurt and thus lower the microbial load, both small and large-scale yogurt manufacturers maintain appropriate sanitary conditions. Overall, it was discovered that the yogurt samples' sanitary quality was poorer, calling for a significant improvement.

Karagül-Yüceer et al. (2001), The effects of different carbonation, flavour, pH, culture type, and storage duration on the development of various contaminating bacteria and both conventional and nontypical yogurt cultures were examined by the researchers. bulgaricus and Streptococcus thermophilus) were obtained from two different kinds of yogurt cultures, YC-470 and YC-180. In addition, non-traditional yogurt cultures were added: Bifidobacterium longum ATCC 15707 and Lactobacillus acidophilus (LA-K) to produce sweetened low-fat (1%) Swiss-style plain, strawberry, and lemon yogurts. The samples were kept in an incubator at 43°C until they reached pH values of 5.0 or 4.2. Three different portions of strawberry yogurts with pH values of 4.2 and 5.0 were infected with Bacillus licheniformis ATCC 14580, Escherichia coli ATCC 11775, and Listeria

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monocytogenes Scott A, the contaminating bacterium. After adding carbon dioxide (1.10 to 1.27 vol.me of CO2 gas dissolved in water), the yogurt was stored for ninety days at 4°C. It's interesting to note that neither typical nor nontypical yogurt bacteria were affected negatively by carbon dioxide in any way. Additionally, CO2 had no inhibitory effects on the unwanted microbes. Overall, it was shown that the bacterial population in yogurt was not significantly affected by low CO2 levels. It was discovered that changes in culture type, pH, flavour type, and storage duration might affect the microflora of yogurt either alone or in combination.

Farinde et al. (2009) made yogurt by introducing a freeze-dried culture of Lactobacillus bulgaricus and Streptococcus thermophilus into soymilk and cow's milk. After processing, the yogurt samples were assessed for their chemical, microbiological, and organoleptic features; a commercial yogurt that was already on the market was used as the control. Cow's milk yogurt had an 83.3% moisture percentage, whereas soymilk yogurt had a 91.9% moisture content. The soymilk yogurt stood out for having a far greater protein content—6.6%. Yogurt made from cow's milk had the greatest fat (6.5%) and ash (0.6%) content. However, there was no significant variation ($P < 0.05$) in the magnesium concentration across all yogurt samples. Cow's milk yogurt had a pH of 4.1 while soymilk yogurt had a pH of 5.4. In cow's milk yogurt, the total viable count peaked at 1.1×105. L. bulgaricus and S. thermophilus were the two main bacteria that were recovered from all of the yogurt samples. Soymilk yogurt proved to be a competitive substitute for cow's milk yogurt, showing acceptance levels that were similar to those of commercial yogurt.

Batista et al. (2015), The study examined how well probiotic yogurt containing 500 ppm of glucose oxidase (referred to as GOX2 and 250 ppm, respectively) performed against commercially available goods in the Brazilian market. Probiotic bacterial count was one of the microbiological analyses that were carried out, along with evaluations of physical-chemical parameters (pH, proteolysis, and minerals) and metabolic activities (the fatty acid profile, organic acid production, and flavour and aroma compounds). With pH levels below 6, the glucose oxidase yogurt showed good survivability of lactic acid and probiotic cultures, surpassing 6 log CFU/g. On the other hand, while keeping lactic and acetic acid levels constant, it showed increased values for polyunsaturated fatty acids (PUFAs), conjugated linoleic acid (CLA), diacetyl, acetaldehyde, and proteolysis. The inclusion of glucose oxidase in probiotic yogurts is a significant technical advancement for small and medium-sized dairy businesses aiming to enter the functional food industry, enhancing product quality and appeal.

Taiwo et al. (2018), Theyout research on 10 approved yogurt items that were bought in Ogun State, Nigeria's Ota city. The items were tested for pH, total fungal count (TFC), and total bacterial count (TBC). The yogurt samples revealed the presence of eleven distinct bacterial isolates. 16% of the overall microbial load was made up of Lactobacillus and Bacillus species, while 8% was made up of Corynebacterium, Klebsiella, Staphylococcus, and Pseudomonas species. Four percent were Proteus species, Micrococcus species, Shigella species, Listeria species, and Streptococcus species. Of the fungi isolated, Mucor spp. accounted for 22%, Geotrichum spp. for 6% each. Tests for antimicrobial susceptibility showed that subjects were susceptible to Ofloxacin and Ciprofloxacin, but resistant to Augmentin, Nitrofurantoin, Cefixime, Cefuroxime, Gentamicin, and Ceftazidime. The study revealed

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significant differences among fungal isolates (P<0.05), but no significant differences among bacterial isolates (P>0.05). Moreover, a notable distinction was observed between bacterial and fungal isolates (P<0.05).

Song, L., & Aryana, K. J (2014), examined the manufacturing of commercial yogurt powder and found that the yogurt culture numbers were considerably reduced throughout the drying process, hence reducing the potential health advantages. The study demonstrated that yogurt made from yogurt cultured milk powder showed superior microbial counts and sensory attributes compared to yogurt made from commercial yogurt powder. This suggests potential advantages for using yogurt cultured milk powder in yogurt production.

Kneifel, W., Jaros, D., & Erhard, F. (1993) revealed that 44 commercially available starter cultures from 8 sources were used to generate yogurts and yogurt-related milk products. The yogurt starters were made up of the traditional yogurt microflora as well as yogurt-related cultures that included Bifidobacterium spp. and/or Lactobacillus acidophilus in addition to or instead of the yogurt bacteria. Lactobacilli and streptococci count in the fresh yogurts ranged from 5.5 × 107 to 6.5 × 108 CFU/ml and 3.5 × 107 to 1.2 × 109 CFU/ml, respectively. Cocci were more prevalent in almost 80% of the yogurts than rods. There were notable differences in the stability of the microflora among the cultures when the items were stored for two weeks at 6°C. There was a range of 4.0 × 105 to 2.6 × 108 CFU/ml for L. acidophilus and 4.0 × 106 to 2.6 × 108 CFU/ml for bifidobacteria in the goods associated to fresh yogurt. After two weeks, lower viable counts of these bacteria were seen in the majority of the goods. During storage, titratable acidity rose by 14.9% in items connected to yogurt and by an average of 22.3% in yogurts. It was observed that most products had more L (+)-than D (−)-lactic acid.

Ifeanyi et al. (2013) four kinds of yogurt supplied by street sellers in Onitsha Metropolis, Anambra State, Eastern Nigeria, were tested for a research. The yogurt's pH was measured, and over the course of seven days, microbiological evaluations were conducted to determine the total amount of yeast, coliforms, and heterotrophic bacteria present in the samples (A–D). The pH range that was measured was 3.69 to 4.50. Three fungal species—Aspergillus, Rhizopus, and Saccharomyces—and five bacterial species—Escherichia coli, Staphylococcus aureus, Streptococcus, Lactobacillus, and Bacillus species—were isolated from the samples, according to the findings. With 6.1 x 105 cfu/ml, Sample B had the highest mean heterotrophic bacterial count. A significant variation in the number of heterotrophic bacteria between the four sample groups was found by statistical analysis (p-value = 0.0000374). Starter culture titre values were low in the control samples. All samples included coliform indicator Escherichia coli, with sample B having the highest concentration at 4.4 x 105 cfu/ml. Control samples from manufacturing firms did not show the presence of coliforms, S. aureus, Bacillus species, or fungus. The coliform count statistical analysis across the four groups did not show a significant difference at α = 0.05 (p-value = 0.529296). As a result, it was decided that the relevant manufacturers and government agencies needed to be made aware of the issue in order to guarantee that yogurt vendors follow the best practices, which include using mobile refrigerators to keep proper temperatures and minimize contamination (Research Paper British Microbiology Research Journal, 3(2): 198-205, 2013).

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Cruz et al. (2013), The possibility of producing a product that benefits consumers was investigated when prebiotics, including oligofructose, were added to yogurt. The goal of this study was to create a low-calorie product by encouraging the development of good bacteria in the gut and reducing the amount of sugar required in the formulation since oligofructose has a sweetening effect The purpose of the research was to assess the impact of increasing oligofructose concentrations on the physicochemical, rheological, and microbiological properties of plain yogurt. The researchers also used survival analysis methods to examine customer responses. The findings showed that after 28 days of chilled storage, the addition of oligofructose had no appreciable effect on pH, proteolysis, or the viability of Lactobacillus bulgaricus or Streptococcus thermophilus ($p > 0.05$). The oligofructose-supplemented yogurt showed thixotropic and pseudoplastic behaviour, resembling a weak gel, according to rheological data. The best amount of oligofructose to add to plain yogurt was found to be 2.58% wt. v^{-1}, taking into account a 25% rejection threshold. Survival analysis was used to evaluate consumer reactions to different levels of oligofructose supplementation (0%, 2%, 4%, 6%, and 8% wt. v^{-1}).

Suh, S. H., and Kim, M. K. (2021) They out research to find out how the microbial populations in commercial drinkable yogurt products relate to their sensory attributes. In their study of six Korean drinkable yogurts, researchers utilized 16S rRNA gene sequencing to reveal dominant bacterial communities. Streptococcus thermophilus prevailed (67–98%), with Lactobacillus Delbruck present in lower concentrations (0–12%). Significant sensory variations ($p < 0.05$) were noted, with Lactobacillus-rich samples linked to cheesy, brothy aromatics, and Streptococcus-rich ones associated with sweet and sour flavours. Furthermore, compared to other yogurt products, drinkable yogurts with relatively high levels of Lactobacillus casei, Lactobacillus paracasei, and Lactobacillus acidophilus showed strong creamy aromatics. The results of this research provide sensory qualities linked to certain bacteria, which is a crucial insight for the fermented dairy product business.

Andleeb et al. (2008) They out research to compare the nutritional value and microbiological quality of fresh yogurt that was preserved in a home setting. Yogurt samples were gathered from several Faisalabad stores and residences. Organoleptic analysis was used to evaluate the acceptability of fresh yogurt by consumers, whereas chemical analysis and microbiological count were used to evaluate the quality of traditional yogurt. By evaluating the yogurt's acidity, pH, moisture, protein, ash, and syneresis, its nutritional value was ascertained. Fungal, E. Coli contamination, and viable count were all included in the microbiological analysis. With the exception of moisture and syneresis, which were greater in-home yogurt as compared to store yogurt, the nutritional quality of freshly produced yogurt was found to be comparable. Shop yogurt had a drop in protein and acidity % after storage, whereas domestic yogurt saw a rise. But whether the yogurt samples were from stores or homes, the pH, moisture, and syneresis all rose while the ash % dropped with time. While shop yogurt's viable bacterial count fell after storage, the amount of E. coli also grew in traditional yogurt. The viable bacterial count increased in home yogurt. Fungi were only found in fresh samples of yogurt from the store, but they were also found in yogurt that had been stored. Yogurt that was newly produced has almost identical organoleptic qualities.

3. CONCLUSION

The comprehensive microbiological and nutritional analysis of commercially prepared yogurt in the Nasik district reveals that the product meets high-quality standards. The presence of beneficial microorganisms like Lactobacillus bulgaricus and Streptococcus thermophilus, along with the absence of harmful pathogens, ensures the safety and health benefits of the yogurt. The production process, from milk collection to packaging, follows rigorous protocols to maintain the quality and consistency of the product. Additionally, the yogurt's nutritional content makes it a valuable dietary component, contributing to the overall health and well-being of the consumers.

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