

TRENDS IN DAIRY PRODUCTS CONSUMPTION AND CONSUMER'S PERCEPTION ON SPIRULINA-ENRICHED COWCHEESE IN ROMANIA

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Abstract

In the context of increasing demand for sustainable and healthy products, the dairy industry is exploring innovative alternatives to meet the needs of consumers concerned about environmental impact. This paper aims to investigate the potential of Spirulina, a nutrient-rich microalga, in enhancing the nutritional value and marketability of dairy products, particularly cheese, while analyzing its acceptance among consumers. The study employed a comprehensive approach, including scientific literature review, statistical analysis of milk and dairy consumption patterns, and a pilot marketing survey to understand consumer perceptions and behavior. The results suggest that Spirulina can bring significant benefits to dairy products by improving nutritional value, offering a competitive marketing advantage, and aligning with consumer priorities related to health and environmental responsibility. Trends indicate a shift towards higher-value dairy products, though the unique flavor profile of Spirulina may pose acceptance challenges. Consumer education about the environmental and health benefits of Spirulina could foster greater acceptance. This integration of Spirulina in dairy products represents a promising step towards more sustainable, health-conscious alternatives in the food market.

Key words: healthy products, dairy industry, consumer perception, sustainability

INTRODUCTION

Functional foods are defined as foods that contain biologically active compounds capable of improving health or reducing the risk of diseases when included in the diet [12]. In the context of rising demand for sustainable and health-oriented products, the dairy industry is exploring innovative solutions to address consumer concerns about environmental impact. Beyond focusing on nutrition and sustainability, market dynamics and trade practices within the dairy sector are critical factors. Recent studies have highlighted that perceptions of unfair trading practices can negatively affect contractual relationships and influence farmers' trust in the EU dairy sector [8]. Moreover, analysis of trade dynamics reveals significant shifts in dairy trade linkages within the European Union, reflecting a reorganization of commercial networks and economic flows [10]. These economic insights are highly relevant in a landscape where consumers are increasingly drawn to products that promote health and well-being. Additionally, research

on packaging and labeling suggests that oversized geographical indications, such as those on bonus packs, have a limited effect on consumer purchasing decisions [22]. This finding emphasizes the need for more direct consumer education that focuses on communicating the tangible benefits of products, such as the nutritional and environmental advantages of spirulina-enriched dairy products. One example is cow cheese enriched with *Spirulinaplatensis*, a microalga that is not traditionally part of the human diet and is not classified as an essential macro- or micronutrient. However, Spirulina has long been recognized for its beneficial effects, transforming regular dairy products into functional foods [18]. The integration of Spirulina in cheese adds substantial nutritional value, providing a unique combination of vitamins, minerals, proteins, and antioxidants, thus enhancing the health benefits of dairy products [20].

As global awareness of health and environmental sustainability rises, the dairy industry is actively exploring innovative alternatives to cater to an increasingly

conscientious consumer base. Spirulina's inclusion in dairy products, such as cow cheese, demonstrates how the sector can meet both nutritional and environmental demands [21], [3]. This research focuses on how Spirulina, a highly nutritious microalga, can transform dairy products, offering a potential solution for both enhanced health benefits and sustainability [28], [14]. The study highlights that while Spirulina fortifies dairy products with key nutrients, it also carries a distinct flavor profile that may hinder its broad acceptance among some consumers. Nevertheless, the integration of Spirulina into dairy products aligns with the growing demand for health-conscious and eco-friendly choices [14], [7]. Milk production is a vital component of Romanian agriculture, second only to meat production in significance. Given milk's perishable nature, it necessitates an efficient and well-organized logistics system to ensure that dairy products reach consumers promptly while maintaining their quality, freshness, and safety [17], [5]. From production to consumption, the milk supply chain plays an integral role in meeting consumer expectations and adhering to the high standards set for dairy products.

Historically, Romanians have been known as a "milk-consuming people," as noted by Dr. Ion Claudiu in his 1939 work, *Food of the Romanian People*. This assertion is rooted in the nation's agricultural heritage, where animal husbandry was tightly intertwined with farming. Milk has long been a staple in the Romanian diet, reflecting cultural traditions that emphasize its nutritional value and importance in daily nutrition. This strong cultural connection underscores the enduring role of dairy in the nation's food practices [25], [9], [11].

Professor Dr. Victor Săhleanu, in his publication *Man and Food*, identifies three key principles that guide food choices: instinctive guidance, cultural models, and rational nutrition. The principle of instinctive guidance suggests that individuals are often drawn to foods based on sensory cues, such as taste, smell, and color, which indicate nutritional and biological value. Cultural models emphasize the role of tradition and

heritage in shaping food preferences, particularly in societies like Romania, where certain foods are deeply ingrained in cultural identity. Finally, rational nutrition highlights the scientific and health-oriented aspects of food selection, encouraging consumers to make choices based on nutritional benefits. These principles demonstrate the complex factors influencing dietary habits and the importance of aligning food production with consumer preferences, especially in a nation where milk consumption remains a central part of the diet.

The incorporation of Spirulina into dairy products is a promising innovation that aligns with both health trends and cultural values [19], [15]. This functional food innovation could meet the rising consumer demand for nutritionally enhanced and environmentally sustainable options. As the dairy industry continues to evolve, Spirulina's potential to offer these benefits could pave the way for a new era of healthier, more sustainable food choices.

The purpose of this paper is to evaluate the potential of Spirulina-enriched dairy products, particularly cheese, in addressing consumer demands for health and sustainability. It aims to analyze consumption trends, assess the impact of Spirulina on nutritional value and marketability, and explore consumer attitudes towards such innovative products.

MATERIALS AND METHODS

This study adopted a comprehensive approach to analyze milk consumption patterns and trends in dairy products in Romania, drawing on diverse data sources to provide an in-depth perspective. The research framework comprised the following components:

Scientific Literature

An extensive review of scholarly articles and research studies was conducted to examine milk consumption, the nutritional value of dairy products, and their societal impact. These publications established a foundational understanding of the health, economic, and cultural importance of dairy products in Romania.

Statistical Data

Data regarding milk and dairy consumption, household food expenditures, and the caloric contributions of dairy products were sourced from the National Institute of Statistics, covering the period from 2017 to 2020. The data were analyzed through tables, comparisons, and statistical correlations to identify consumption trends, highlighting both fluctuations and consistent patterns over time.

Institutional Reports

Reports and statements from European institutions, dairy industry associations, and other authoritative sources were integrated to validate findings and enhance the reliability of the data. These reports provided crucial context on market trends and policy developments affecting dairy consumption.

Historical and Societal Context

This aspect of the research delved into the historical, cultural, and societal influences on milk consumption in Romania. The study explored the role of traditional diets, agricultural practices, and the enduring significance of milk and dairy products in Romanian cuisine, offering a deeper understanding of consumer behavior.

Focus on Data Analysis

The analysis emphasized identifying quantitative trends in milk and dairy product consumption across various demographic groups, including household types (e.g., farming, unemployed, single-person households) and regional differences. Key indicators examined included:

1. Average Monthly Consumption

Per capita monthly consumption of milk, cheese, and cream was analyzed (Table 1) to assess changes in consumption habits over time.

2. Caloric Contribution

The study evaluated the proportion of total caloric intake derived from milk and dairy products, noting variations across different household types and demographics.

3. Expenditure Patterns

Household spending on food, particularly dairy products, was analyzed to understand the economic factors influencing consumption and consumer behavior.

Table 1. Purchase of milk and milk products, on average

Total purchases,	Total households, monthly averages per person, in 2017, kg	Total households, monthly averages per person, in 2018, kg	Total households, monthly averages per person, in 2019, kg	Total households, monthly averages per person, in 2020, kg
Milk, totally	4.461	4.509	4.497	4.523
Cheeses and cream, of which	1.121	1.208	1.219	1.319
- cow's cottage cheese (telemea)	0.357	0.370	0.369	0.387
- sheep's cheese	0.187	0.211	0.204	0.212
- fresh cow's cheese	0.198	0.221	0.227	0.235
- cheese	0.123	0.132	0.136	0.150
- other milk products	0.231	0.245	0.251	0.297

Source: NIS Database, 2022 [29].

Methodological Focus

The research aimed to provide a holistic understanding of the interplay between dietary patterns, economic factors, and societal influences in Romania, with a focus on improving public health and quality of life. Data correlation was conducted to:

- Assess the influence of household characteristics (e.g., farming, unemployed, single-person households) on consumption habits.

- Explore regional and urban-rural disparities in milk and dairy consumption.

- Identify trends in food expenditure, particularly regarding dairy products.

- By combining statistical data with historical and societal insights, the study sought to create a nuanced profile of milk and dairy consumption in Romania, exploring implications for public health and nutritional strategies.

Exploratory Marketing Survey

To complement the quantitative analysis, an exploratory marketing survey was conducted to assess consumer behavior related to dairy products with high biological value. This pilot survey consisted of 15 questions and included 74 participants, conducted between January and February 2022.

The survey focused on qualitative variables such as gender, environment, profession, and perceptions of innovative food products, specifically cow's cheese enriched with *Spirulina platensis*. It aimed to evaluate consumer attitudes towards functional foods, purchase intentions for Spirulina-enriched products, and perceptions of their health benefits.

Qualitative variables were measured using nominal scales, offering categorical insights into the demographics and attitudes of respondents. This qualitative component enriched the broader statistical analysis, providing a more comprehensive understanding of consumer preferences and attitudes toward innovative dairy products.

By integrating diverse methodologies, this study provides a detailed analysis of milk and dairy consumption trends in Romania. The findings offer valuable insights into consumer behavior, economic influences, and cultural factors, helping to inform strategies for promoting functional foods like Spirulina-enriched dairy products. This approach could ultimately contribute to enhancing public health, meeting consumer demands, and fostering innovation within the dairy sector.

RESULTS AND DISCUSSIONS

1. Trends in Milk and Dairy Consumption

Analysis of data from the National Institute of Statistics between 2017 and 2020 highlighted notable trends:

Milk Consumption: Average monthly per capita milk consumption exhibited minor fluctuations, increasing slightly from 4.461 liters in 2017 to 4.523 liters in 2020 [24], [2], [26].

Cheese and Cream Consumption: A more significant rise was observed in cheese and cream consumption, which increased from 1.121 kg per capita in 2017 to 1.319 kg in 2020 [27], [13], [6].

Cow's Cottage Cheese (Telemea): The most widely consumed cheese type, with consumption rising modestly from 0.357 kg in 2017 to 0.387 kg in 2020.

Sheep's Cheese: Consumption increased from 0.187 kg in 2017 to 0.212 kg in 2020.

Fresh Cow's Cheese: Steady growth was noted, with consumption climbing from 0.198 kg in 2017 to 0.235 kg in 2020.

Other Dairy Products: This category experienced the most substantial growth, increasing from 0.231 kg in 2017 to 0.297 kg in 2020 [1] [4].

These trends suggest a gradual shift towards higher-value dairy products, reflecting evolving dietary preferences and potentially increased economic capacity among consumers.

2. Caloric Contributions and Household Characteristics

Caloric Contributions: Dairy products contributed significantly to overall caloric intake, with noticeable variations based on household types. Farming households consumed more dairy, likely due to self-production, while unemployed households showed lower consumption levels, reflecting economic constraints [23], [16].

Household Influence: Demographics, such as employment status and household composition, emerged as key determinants of consumption patterns. Farming households displayed higher consumption of milk and traditional cheeses, consistent with agricultural traditions.

3. Regional and Urban-Rural Disparities

Urban Preferences: Urban areas exhibited a stronger preference for processed and premium dairy products, such as cheese and cream.

Rural Consumption: Rural regions leaned towards unprocessed milk and traditional cheeses, influenced by cultural practices and local production.

Regional Differences: Regions with established agricultural traditions reported higher dairy consumption, emphasizing the role of local production in shaping dietary habits.

4. Expenditure Patterns

Household expenditure on milk and dairy products represented a significant portion of food budgets, with incremental increases observed during the study period. This trend aligns with rising consumption levels and suggests a growing preference for dairy products, particularly higher-value options.

5. Societal and Historical Context

Romania's agricultural heritage and traditional diet continue to influence contemporary consumption patterns. Dairy products, particularly cheeses like telemea (cottage cheese), hold a prominent place in traditional cuisine. However, urbanization and economic changes are gradually encouraging a shift towards processed and diversified dairy products.

6. Insights from the Consumer Survey

A survey of 74 respondents provided additional insights into dairy consumption trends:

Demographics:

-Gender Distribution: Women comprised 83.87% of respondents, while men accounted for 16.2%.

-Income Levels: Most participants (97.3%) reported monthly incomes exceeding 1,650 lei, indicating a relatively stable socio-economic demographic.

-Consumption Habits:

A substantial majority (95.9%) reported regular consumption of dairy products, underscoring their integral role in Romanian diets.

-Health concerns emerged as the primary driver of food choices, with 61.6% of respondents prioritizing family health and well-being, followed by nutritional quality (31.5%).

-Economic factors (5.5%) and preferences for natural, preservative-free food (1.4%) played secondary roles.

Urban-Rural Dynamics:

Urban respondents accounted for 81.1% of the sample, with 18.9% from rural areas. Interestingly, place of residence had minimal influence on overall dairy consumption, although urban households favored processed products, while rural households leaned towards traditional options.

7. Consumer Interest in Functional Foods

Respondents demonstrated an increasing interest in functional foods, with notable findings:

Popular Choices:

-23.3% consumed foods fortified with vitamins and minerals.

-20.5% preferred products with dietary fiber.

-Other choices included alcohol-free (17.8%), caffeine-free (15.1%), sugar-free (12.3%), and low-fat (8.2%) foods.

Spirulina-Enriched Cow's Cheese:

-Perceived Benefits: 68.9% believed this product offered health benefits, recognizing the nutritional potential of Spirulina, known for its protein, vitamins, and antioxidants.

-Skepticism and Knowledge Gaps: 24.3% doubted its benefits, and 4.1% were uncertain, reflecting a need for better consumer education about functional foods.

-Awareness and Acceptance:

73% of respondents associated functional foods with nutritional benefits.

Only 1.4% were unfamiliar with the concept of functional foods or Spirulina-enriched products.

31.1% indicated a willingness to recommend Spirulina-enriched cow's cheese, suggesting potential for growth if taste, benefits, and accessibility are effectively communicated.

CONCLUSIONS

The study underscores the pivotal role of health and nutrition in shaping food choices among Romanian consumers. While dairy products remain dietary staples, shifting preferences point to a growing interest in functional foods such as Spirulina-enriched dairy products. However, skepticism and limited awareness among some consumers highlight the importance of targeted education and strategic marketing efforts.

By addressing taste preferences, informing the public about health benefits, and emphasizing product quality, the functional dairy market in Romania holds substantial growth potential. These efforts can contribute to healthier dietary patterns and improved public health outcomes.

This research provides an in-depth analysis of current milk and dairy product consumption trends in Romania, highlighting key factors influencing consumer behavior. The primary findings include:

-Rising Demand for Value-Added Dairy Products

The consistent growth in the consumption of cheese, cream, and other processed dairy

items indicates a shift in consumer preferences toward more diverse and premium dairy products. This trend suggests that Romanian consumers are increasingly prioritizing products with perceived nutritional and health benefits, reflecting greater awareness and interest in higher-value dairy options.

-Persistence of Traditional Consumption in Rural Areas

Despite the growing interest in processed and functional dairy products, rural and farming households continue to favor traditional consumption patterns, such as fresh milk and homemade cheeses. These preferences reflect Romania's strong agricultural heritage and the cultural significance of dairy in daily diets. Preserving these traditions while encouraging innovation presents a unique challenge and opportunity for policymakers.

-Impact of Economic and Demographic Factors

Consumption patterns vary significantly across demographic and economic groups. Farming households consume more dairy products due to self-production, while urban and unemployed households exhibit more diverse consumption behaviors influenced by factors such as income levels and product accessibility. Addressing these disparities requires tailored interventions that account for the socio-economic realities of different population segments.

Implications and Recommendations

1. Policy Interventions

To improve dietary quality, there is a need for policies that promote nutritional education about the benefits of balanced diets, including a variety of dairy products. Awareness campaigns should focus on urban areas, where processed dairy products are in higher demand, while simultaneously ensuring access to high-quality dairy in rural regions. Such initiatives can help reduce urban-rural disparities and support informed consumer choices.

2. Support for Local Economic Development

Investments in the dairy industry, particularly in modernizing production and processing facilities, are crucial for sustaining growth. Supporting small- and medium-sized dairy

producers, especially in economically disadvantaged regions, can promote sustainable dairy consumption and strengthen local economies. These efforts can also help reduce regional disparities in consumption patterns by ensuring locally sourced, high-quality dairy products are widely available.

3. Research and Innovation

Further studies are needed to assess the long-term impacts of urbanization and economic transitions on dietary habits in Romania. Research focusing on the interplay between modern dietary trends and traditional food systems will provide valuable insights for policymakers and industry stakeholders. Additionally, exploring opportunities to integrate functional foods, such as Spirulina-enriched dairy products, into mainstream diets could unlock new avenues for health improvements and product innovation.

This study sheds light on the evolving landscape of dairy consumption in Romania, offering critical insights into consumer preferences, economic influences, and the persistence of traditional dietary practices. By leveraging these insights, stakeholders can develop targeted strategies to enhance nutrition and improve the overall quality of life.

A collaborative, holistic approach involving policymakers, producers, and consumers is essential to promote sustainable growth in the dairy sector. These efforts will ensure that the benefits of dairy consumption, including better health and nutrition, are accessible to all Romanians, regardless of geographic location or socio-economic status.

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