

**University "St. Kliment Ohridski" - Bitola, Republic of North Macedonia  
Faculty of Technology and Technical Sciences - Veles**



**Book of proceedings of the 1<sup>st</sup> International Scientific Conference -  
Food Science, Nutrition, Innovative Technologies  
and Sustainability**

**Veles, North Macedonia  
February 2026**

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## ETHNICITY, SOCIAL STATUS, LOCATION AND INCOME – FACTORS IN THE USE OF FUNCTIONAL DAIRY PRODUCTS

Nevena Gruevska<sup>1</sup>, Selvije Zenku<sup>2</sup>, Tatjana Kalevska<sup>1</sup>, Daniela Nikolovska Nedelkoska<sup>1</sup>,  
Vezirka Jankuloska<sup>1</sup>, Tanja Stojanovska<sup>1</sup>

<sup>1</sup>Faculty of Technology and Technical Sciences - Veles, University "St. Kliment Ohridski" - Bitola, Republic of North Macedonia

<sup>2</sup>MSS Drita-Kicevo

E-mail: [nevena.gruevska@uklo.edu.mk](mailto:nevena.gruevska@uklo.edu.mk)

### Abstract

The aim of this paper is to examine the impact of demographic and socio-economic factors on dietary habits regarding the consumption of functional dairy products (such as probiotic yogurt, milk with added vitamins, etc.). These products are gaining increasing significance due to their proven health benefits as part of a healthy diet. The research was conducted through an online survey using an anonymous questionnaire consisting of 48 questions, answered by 373 respondents who differed in terms of place of residence (urban/rural), ethnic affiliation, social status, and income. For statistical processing and data analysis, Microsoft Office Excel and SPSS 21 were used. According to the results, in terms of ethnic affiliation, Albanians consume the most functional dairy products – 3.5 points, Macedonians - 3.2 points, and Turks - 3.15 points. Urban residents scored 3.5 points on average, compared to 3.3 for rural residents. Regarding employment status, employed individuals consume the most functional dairy products – 3.6 points, while unemployed individuals consume the least – 3.13 points. Pensioners and students had an average score of 3.3 points, while school-aged children scored 3.4 points. Individuals from families with a high monthly income (over 50,000 MKD) consume the most functional dairy products. The analysis shows differences in the level of awareness, access, and consumption of these products among individuals with higher social status. Ethnic affiliation plays a role, mostly through cultural habits and traditional diets. Targeted educational campaigns and policies are needed to increase awareness and accessibility of functional dairy products.

**Keywords:** Functional dairy products, ethnic affiliation, social status, income, place of residence

### 1. Introduction

An individual's quality of life depends, among other factors, on their genetic predispositions and the type and manner of their diet. Proper growth and development, the ability to perform daily activities, and the regeneration of body tissues all require a quality and balanced diet. Such a diet meets the body's energy and nutritional needs and is essential for maintaining physiological functions.

This is particularly important for children and adolescents (Горџев, 2008), but also significantly impacts other age groups by contributing to a healthier and more active lifestyle. The formation of healthy habits during childhood and adolescence is crucial, as it increases resilience to certain non-communicable diseases later in life (e.g., anemia, osteoporosis, digestive and cardiovascular disorders, malignant diseases, and stroke) (Панова et al., 2014). In older individuals, a healthy diet contributes to longevity and the prevention of chronic diseases (Kennedy, 2006; Samieri et al., 2013; Blanca-Roman & Serra-Majem, 2014).

Milk and dairy products, particularly fermented varieties, are an essential component of a healthy diet. They provide high-quality proteins, essential and non-essential fatty acids, minerals, and vitamins that support growth and development (Daphna & Lindsay, 2014). They are especially beneficial for individuals exposed to physical and mental stress (Tratnik & Božanić, 2012). Fermented dairy products contain probiotic cultures that positively affect gut microbiota and may help alleviate digestive disorders and lower cholesterol levels (Spence, 2006; Siró et al., 2008).

## 2. Functional dairy products

Functional foods are those that naturally contain functional components, are enriched with them, or are modified to remove certain ingredients in order to improve health and bodily functions, thus reducing the risk of developing diseases (Miletić et al., 2008). Beyond their nutritional content, such foods receive considerable attention for their biologically active compounds that may play a role in disease prevention (Jašić, 2010). The primary goal of functional food consumption is to provide the body with essential energy and nutrients while simultaneously enhancing its overall physiological condition (Čalić et al., 2011).

Growing health concerns, obesity, aging populations, and the demand to reduce public health expenditures have opened a vast market for functional foods (Niva, 2007). Due to their high protein, mineral, and vitamin content, milk and dairy products are considered vital for growth and development in youth and remain important for other age groups as well (Dorić et al., 2019).

The production of animal-based functional foods is steadily increasing. Products such as omega-3-enriched meat and eggs, as well as probiotic-fermented dairy products, are widely accepted by consumers (Kalevska et al., 2020). Among these, functional dairy drinks are the most commercially popular, as they facilitate the intake of probiotic microorganisms into the human digestive system (Tamime et al., 2003).

In addition to probiotic cultures (typically *Lactobacillus spp.* and *Bifidobacterium spp.*), starter cultures are also added to functional dairy products to give them unique organoleptic characteristics and to extend shelf life (Tamime, 2002). Prebiotics are also included to stimulate the growth and metabolic activity of probiotics. Prebiotics are defined as indigestible or poorly digestible food components that benefit the host by selectively promoting the growth or activity of one or a limited number of probiotic bacteria in the colon (Kalevska et al., 2020).

Given their positive health effects, the regular consumption of appropriately selected fermented dairy products is increasingly recommended across all age groups (Zárate, 2002).

The most commonly consumed fermented dairy products include:

- **Yogurt** – One of the oldest fermented dairy products, traditionally consumed in many cultures and regarded as nutritionally rich (Domiter, 2019). Probiotic cultures can be used to produce bioyogurt or probiotic yogurt (Ozden, 2008). In addition to traditional types, newer varieties such as fruit yogurts are gaining popularity, especially among schoolchildren due to their taste and nutritional content (Горфев, 2008).
- **New market trends** include Greek yogurt (a functional yogurt with probiotics), organic yogurts, and yogurts enriched with proteins and dietary fiber (Kim & Oh, 2013).
- **Kefir** – A fermented, yogurt-like beverage with a tangy flavor, rich in proteins, vitamins, antioxidants, minerals, and specific bioactive compounds derived from kefir grains (Hatmal et al., 2018).
- **Cheese** – A highly valued food product rich in proteins, minerals, vitamins, and enzymes (Tewari et al., 2019).
- **Whey** – A by-product of cheese production, formed during the acidic or enzymatic processing of milk (Solak & Akin, 2012). Due to its recognized potential as a raw material, an increasing number of studies are focusing on its maximum utilization and the production of whey-based foods (Mrvčić et al., 2007).



### 3. Aims of the research

#### 3.1. Aims of the research

The primary objective of this research is to analyze and determine the dietary habits of various respondent categories regarding the consumption of functional foods, with a specific focus on functional dairy products, as the most common group containing bioactive ingredients for functional purposes (Menrad, 2003). The study investigates potential differences based on ethnicity, social status, place of residence, and income.

The findings will serve as a basis for recommendations to support health promotion and prevention strategies and could inform a more effective approach to encouraging the consumption of functional foods. This could also lead to increased consumer awareness about the connection between nutrition and health and contribute to the development of new dairy products with enhanced functional characteristics.

#### 3.2 Materials and methods

To assess the general characteristics of purchasing behavior and consumption patterns related to functional foods—especially functional dairy products—as well as respondents' dietary habits, a 48-question anonymous questionnaire was developed. The aim was to determine the frequency of consumption of food items such as milk and dairy products.

The questionnaire was distributed electronically (via Google Forms) to targeted groups via email. A total of 373 individuals participated in the study.

#### Demographic characteristics:

- **Ethnicity:** 87% Albanian (n = 323), 11% Macedonian (n = 42), 2% Turkish (n = 8)
- **Place of residence:** 92% urban, 8% rural
- **Social status:** 47% employed, 33% pupils, 10% retired, 5% students, 4% unemployed
- **Monthly household income:** 96% earn more than 24,000 MKD; 56% earn over 50,000 MKD; 2 individuals earn less than 12,000 MKD, and 11 respondents (≈3%) earn between 12,000 and 24,000 MKD

Statistical processing and analysis were conducted using Microsoft Excel, SPSS 21, and ANOVA tests. The questionnaire data were qualitative in nature, and average values were calculated based on the frequency of consumption of functional dairy products (milk, fermented dairy products, probiotic dairy drinks with added fruit, cereals, nuts, honey, cocoa, whey, cheese).

### 4. Results and discussion

According to the results, 56.5% of respondents consume milk and dairy products daily; 18.7% every third day; 12% at least once a week; 7.3% once every three months; and 5% do not consume them at all.

Table 1. Frequency of consumption of various dairy products (% of total respondents)

| Product                               | Never | Rarely | 2–3x per month | 1–2x per week | Daily |
|---------------------------------------|-------|--------|----------------|---------------|-------|
| Milk                                  | 0.3   | 33.8   | 13.1           | 24.9          | 27.9  |
| Fermented dairy products              | 1.3   | 11     | 10.2           | 56.6          | 20.9  |
| Probiotic dairy drinks with additives | 4.6   | 14.2   | 10.7           | 46.4          | 24.1  |
| Whey                                  | 39.4  | 28.2   | 16.4           | 16            | 0     |
| Cheese                                | 0.8   | 4.3    | 5.9            | 51.7          | 37.3  |

#### 4.1 By ethnicity

Albanians showed the highest consumption level (average = 3.5), followed by Macedonians (3.23, SD = 0.51), and Turks (3.15, SD = 0.45).

Table 2. Functional dairy consumption by ethnicity

| Ethnicity  | N   | Mean   | SD     | 95% CI      |             | Min  | Max  |
|------------|-----|--------|--------|-------------|-------------|------|------|
|            |     |        |        | Lower bound | Upper bound |      |      |
| Macedonian | 42  | 3.2333 | .51118 | 3.0740      | 3.3926      | 2.00 | 4.00 |
| Albanian   | 323 | 3.5015 | .47033 | 3.4501      | 3.5530      | 2.20 | 4.60 |
| Turkish    | 8   | 3.1500 | .45040 | 2.7735      | 3.5265      | 2.40 | 3.80 |
| Total      | 373 | 3.4638 | .48316 | 3.4146      | 3.5130      | 2.00 | 4.60 |

#### 4.2 According to place of residence

Respondents residing in urban areas reported an average consumption of 3.48 (SD = 0.471), while those living in rural areas had a slightly lower average of 3.31 (SD = 0.596). The ANOVA test ( $F = 3.474$ ,  $p = 0.063$ ) indicates that the difference is not statistically significant ( $p > 0.05$ ).

Table 3: ANOVA Test for consumption of milk and dairy products by place of residence

| Product group           | Place of residence | N   | Mean | SD    | F   | p-value |
|-------------------------|--------------------|-----|------|-------|-----|---------|
| Milk and dairy products | Urban              | 343 | 5.13 | 1.331 | .33 | .568    |
|                         | Rural              | 30  | 5.27 | .828  |     |         |

According to the conducted analysis, at a 0.05 significance level, the results indicate that on a scale from 1 to 5 points, the consumption of functional dairy products among urban residents averages around 3.5 points. In contrast, the average consumption among rural residents is approximately 3.3 points. However, the ANOVA test results show that this difference is not statistically significant, with an F-value of 3.474 and a p-value of 0.063, which is above the 0.05 threshold.

Table 4: Consumption of functional dairy products by place of residence

| Place of residence | N   | Mean   | SD     | 95% Confidence interval |             | Min  | Max  |
|--------------------|-----|--------|--------|-------------------------|-------------|------|------|
|                    |     |        |        | Lower bound             | Upper bound |      |      |
| Urban              | 343 | 3.4776 | .47059 | 3.4276                  | 3.5275      | 2.20 | 4.60 |
| Rural              | 30  | 3.3067 | .59592 | 3.0841                  | 3.5292      | 2.00 | 4.40 |
| Total              | 373 | 3.4638 | .48316 | 3.4146                  | 3.5130      | 2.00 | 4.60 |

#### 4.3 According to social status

The ANOVA analysis shows statistically significant differences ( $F = 26.07$ ,  $p < 0.001$ ) in the frequency of milk and dairy product consumption among different social categories (pupils, students, employed, unemployed, retirees).

Consumption levels of functional dairy products by status are as follows:

- Employed: 3.58 (highest average)
- Unemployed: 3.13 (lowest average)
- Retirees and students: approximately 3.25
- Pupils: 3.43

Table 5: Consumption of functional dairy products by social status

| Status     | N   | Mean   | SD     | 95% Confidence interval |             | Min  | Max  |
|------------|-----|--------|--------|-------------------------|-------------|------|------|
|            |     |        |        | Lower bound             | Upper bound |      |      |
| Pupil      | 124 | 3.4339 | .44592 | 3.3546                  | 3.5131      | 2.40 | 4.40 |
| Student    | 20  | 3.2900 | .58929 | 3.0142                  | 3.5658      | 2.00 | 4.40 |
| Employed   | 176 | 3.5784 | .49982 | 3.5041                  | 3.6528      | 2.20 | 4.60 |
| Unemployed | 15  | 3.1333 | .52190 | 2.8443                  | 3.4224      | 2.20 | 4.00 |
| Retired    | 38  | 3.2526 | .22629 | 3.1783                  | 3.3270      | 2.80 | 4.00 |
| Total      | 373 | 3.4638 | .48316 | 3.4146                  | 3.5130      | 2.00 | 4.60 |

#### 4.4 According to monthly income

The ANOVA test indicates a statistically significant difference in consumption habits related to income level ( $F = 27.44$ ,  $p < 0.001$ ). Based on the obtained results, the following averages were found:

- Respondents with income up to 12,000 MKD (only 2 respondents): average 3.60 (not representative due to small sample)
- Income between 12,001–24,000 MKD: average 3.35
- Income between 24,001–50,000 MKD: average 3.41
- Income above 50,000 MKD: average 3.51

Table 6: Consumption of functional dairy products by monthly income

| Income range        | N   | Mean   | SD     | 95% Confidence interval |             | Min  | Max  |
|---------------------|-----|--------|--------|-------------------------|-------------|------|------|
|                     |     |        |        | Lower bound             | Upper bound |      |      |
| Up to 12,000 MKD    | 2   | 3.6000 | .00000 | 3.6000                  | 3.6000      | 3.60 | 3.60 |
| 12,001 – 24,000 MKD | 11  | 3.3455 | .57335 | 2.9603                  | 3.7306      | 2.00 | 4.20 |
| 24,001 – 50,000 MKD | 151 | 3.4132 | .49297 | 3.3340                  | 3.4925      | 2.20 | 4.40 |
| Over 50,000 MKD     | 209 | 3.5053 | .47111 | 3.4410                  | 3.5695      | 2.20 | 4.60 |
| Total               | 373 | 3.4638 | .48316 | 3.4146                  | 3.5130      | 2.00 | 4.60 |

## 5. Conclusion

The research shows that health benefits are the main motivation for choosing functional foods: 51.8% cited health improvement, followed by disease risk reduction (15.5%) and gastrointestinal function enhancement (12.3%).

More than 60% of respondents prefer domestically produced dairy products, while about one-third do not consider origin important. About 45% believe domestic functional products exist but are limited in choice, and 30% think they are not sufficiently available.

#### Key findings:

- Statistically significant differences in consumption were found across ethnicity, social status, and income.
- No significant differences were observed based on place of residence.

- Educational and policy interventions are recommended to increase awareness and accessibility of functional foods, especially functional dairy products.

### Recommendations:

Functional foods—particularly functional dairy products—are a valuable source of dietary fiber, vitamins, minerals, and probiotic microorganisms that can positively influence gut microbiota composition and function, indirectly improving the physiological functions of the digestive tract. The modern dairy industry, as an integral part of the food sector, offers a wide range of fermented dairy products tailored to different consumer age and health profiles. Regular and controlled consumption of these products, in appropriate quantities, can have beneficial effects on overall physiological condition and homeostasis.

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