

Eftime, Mariana; Petrescu, Viorel; Constandache, Mihaela

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Comparative analysis of nutritional quality and functional effects of some functional bakery products from Romanian market

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COMPARATIVE ANALYSIS OF NUTRITIONAL QUALITY AND FUNCTIONAL EFFECTS OF SOME FUNCTIONAL BAKERY PRODUCTS FROM ROMANIAN MARKET

EFTIMIE MARIANA¹, PETRESCU VIOREL², CONSTANDACHE MIHAELA³

Abstract

One solution to improve the nutritional level of the population, especially in disadvantaged areas, is the enrichment and fortifying consumer foods. This study aims at analyzing the possible beneficial effects of bread fortified with various micronutrients that gives product functionality. The aim of research is a comparative analysis of nutritional quality and functional effects of bakery products of three major producers in Romania, respectively SC DobrogeaGrup S.A. Constanta, Smart Food Solutions Company and the VelPitar Group. We could identify thus the most efficient bakery product from the nutritional perspective as well as from the functional one. Thus, Whole Wheat bread is an important source of dietary fiber which can reduce blood cholesterol levels thereby decreasing the risk of heart disease, can promote proper digestion, can regulate blood glucose, thereby preventing type 2 diabetes and can provide a quick sensation of satiety helping to maintain body weight. Sana Bongrana Ultrafibre is rich in fiber and may reduce risk of diabetes It can also lower blood cholesterol levels, being a functional product recommended for health of cerebral, cardiovascular and digestive systems. BenecolDobrogea product is a threefold functional bread that, in addition to the lowering cholesterol effect, has a high content of fiber, which helps regulate bowel movements and at the same time, a low-carbohydrate, which recommends it to the people with diabetes. Sana BongranaBenexia bread has a remarkable nutritional value and its content of Benexia sage seeds brings an important contribution to the body of ω 3 and ω 6 fatty acids, with beneficial effects on the functioning of the cardiovascular and immune systems.

Key words: *nutritional intervention, functional effects, functional foods, nutritional quality, synthetic indicator of quality*

INTRODUCTION

An important issue in the development of nutritional intervention programs is the counteraction of resistance factors of the population in terms of changing consumer habits. Lack of time or knowledge regarding healthy eating, family preferences for consumption of fatty foods or those which contain significant amounts of salt, sensory motivations (taste, smell), psychological ones (lack of will) and also economic constraints are the main barriers in an attempt of changing dietary habits. Prescriptions based on scientific legitimacy may be rejected as well as those based on ideological reasons, so a key role in defining nutritional policies is to obtain population's acceptability about the intended changes.

A solution to avoid these barriers is the introduction of functional foods in the diet in order to achieve certain long term health benefits, thus reducing the risk of chronic diseases among the population.

Assuming that one of the solutions for improving the nutritional level of the population, especially in disadvantaged areas, is the enrichment and fortification of consumer foods [1, 2, 3], this study aims to examine possible beneficial effects of bread fortified with various micronutrients that give functionality to the product.

Bread can be considered a food vector because it is a stable product consumed by the entire population, also because in many cases the culinary practices may introduce significant losses of nutrients compromising the success of the enrichment program. Bread is the food of greater use in the daily diet of Romanians and therefore it can be used for efficient leading of a supplementary

¹ Assoc. prof. Ph.D. Mariana Eftimie, Oil and Gas University of Ploiești, Faculty of Economics, maryeftimie@yahoo.com

² Prof. Ph.D. ViorelPetrescu, The Bucharest University of Economic Studies, Faculty of Commerce, rainaconst@yahoo.com

³ Assoc. prof. Ph.D. MihaelaConstandache, „DimitrieCantemir” Christian University of Bucharest, Faculty of Touristic and Commercial Management Constanța, mihaela_constandache@yahoo.com

feeding program with a number of biologically active substances that give the finished product functionality.

MATERIAL AND METHODS

To assess the quality of functional bakery products we will calculate the synthetic indicators of quality products as a quantitative expression of key quality characteristics to identify the most effective solution in terms of energy and nutrients to ensure the health of the population through the consumption of functional bakery products. The methodology of implementing the quality synthetic indicator involved the following steps:

- Selection of functional bakery products offered by three competing companies such as SC DobrogeaGrup S.A. Constanta, Smart Food Solution Company and the VelPitar Group, that have the same basic feature;
- Selection of key quality characteristics specific to the analyzed functional products, extracted from standards, technical standards, analysis bulletins;
- Characteristics' classification according to the specific of the product in energy, nutritional and economic characteristics;
- Grouping selected characteristics, according to their importance in determining the quality of the consumer's point of view in main, secondary and minor features;
- Turning of attributive judgments in points or notes;
- Providing the share of characteristics through quadratic matrix method;
- Calculate of the complex index of quality;
- Hierarchy of functional products in descending order of values of the complex indicator of quality [5].

RESULTS AND DISCUSSIONS

Many local bakery manufacturers have launched on the market in recent years, a number of functional products that are designed both for the consumers that have different affections and for the consumers showing a major interest in healthy eating to reduce the risk of certain chronic diseases. Next, we will make a comparative analysis of the nutritional quality and functional effects of three major bakery product manufacturers in Romania such as SC DobrogeaGrup S.A. Constanta, Smart Food Solution Company and the VelPitar Group.

Figure 1 comparatively shows the energetic, nutritive and economic efficiency of Graham Toast bakery products of most representative three producers in Romania. The most efficient in terms of energy and nutrients is considered the product with the lowest energy value, the higher content of protein and dietary fiber and the lower content of carbohydrates, simple sugars, saturates fatty acids and sodium. Based on economic reasons, the most efficient product is considered the lowest priced one which is more accessible to the consumers. As it can be seen in figure 1 an intake of 100 g BongranaToast Graham provides 20% of the body's daily requirement of protein, a sufficient intake of dietary fiber (14% EDA) under the conditions of a low intake of carbohydrates (16% EDA), simple sugars (2% EDA), lipids (7% EDA) and respectively saturated fatty acids (10% EDA) and sodium (18% EDA). From an economic perspective, the product Bongrana Toast Graham is the most accessible for population compared with other homologue products of their competitors. The product Savoria Toast Bio with Multigrains have the same protein value (20% EDA), a higher fiber content than BongranaToast Graham product (18% EDA compared with 14% EDA), but in terms of carbohydrates, simple sugars, lipids, saturated fatty acids and sodium intake, these are higher than homologue products of the competition. Economically speaking, Savoria Toast Bio with Multigrains is the least accessible to the public, however it should be kept in mind that it is a Bio product obtained by a careful monitoring of raw materials and related processes, which explains the higher price.

In order to form a clearer picture of the quality of Toast Graham bakery products of the three manufacturers we will make a comparative analysis by calculating synthetic indicators of quality. Quality characteristics used in the analysis were:

- C₁ – energy intake by eating 100 g product, EDA [%];
- C₂ – protein intake by eating 100 g product, EDA [%];
- C₃ – carbohydrates intake by eating 100 g product, EDA [%];
- C₄ – simple sugars intake by eating 100 g product, EDA [%];
- C₅ – fiber intake by eating 100 g product, EDA [%];
- C₆ – lipids intake by eating 100 g product, EDA [%];
- C₇ – saturated fatty acids intake by eating 100 g product, EDA [%];
- C₈ – sodium intake by eating 100 g product, EDA [%].

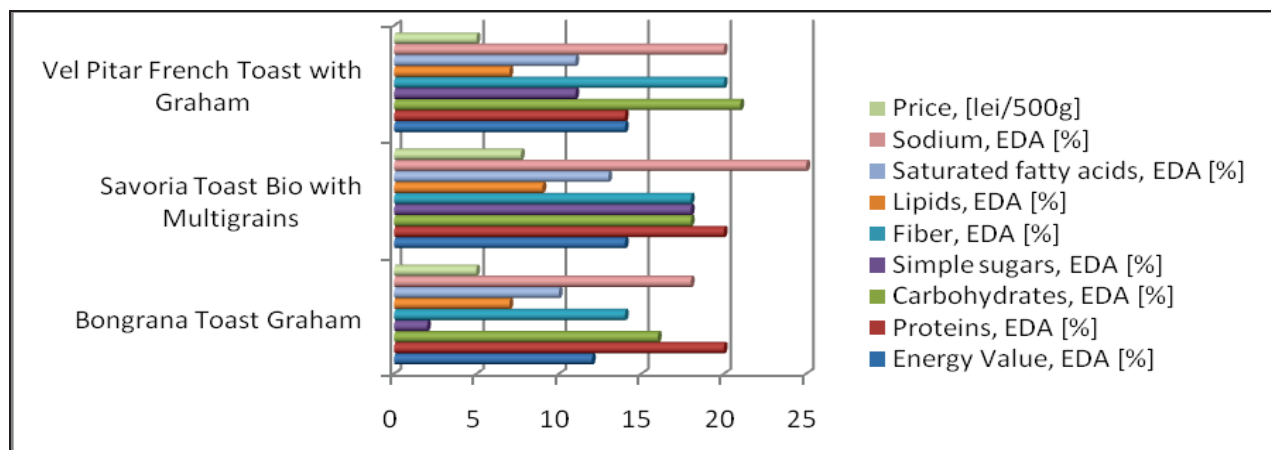


Figure1. Energetically, nutritive and economic efficiency of Toast Graham bakery products of some representatives Romanian manufacturers

EDA – Estimated daily amount for a person weighing 70 kg (adult), a normal level of physical activity and a caloric need of 2000 kcal/day

Taking into consideration the nutritional recommendations, we are considering that the values of C₂ and C₅ characteristics have a directly proportional influence on the quality of the functional product while the influence of C₁, C₃, C₄, C₆, C₇ and C₈ is quite the opposite. To calculate the complex quality indicator we will calculate the shares of the characteristics by quadratic matrix method (Table 1). Quality characteristics and their shares for Graham Toast bread products and product prices are shown in Table 2. These data will be used to calculate the complex indicator of quality.

The synthetic indicator of Toast Graham bakery products quality will be:

$$I_q^{BTG/R} = \frac{12}{12} \times 0,056 + \frac{20}{20} \times 0,194 + \frac{16}{16} \times 0,056 + \frac{2}{2} \times 0,111 + \frac{14}{20} \times 0,194 + \frac{7}{7} \times 0,139 + \frac{10}{10} \times 0,194 + \frac{18}{18} \times 0,056 = 0,942$$

$$I_q^{STBM/R} = \frac{12}{14} \times 0,056 + \frac{20}{20} \times 0,194 + \frac{16}{18} \times 0,056 + \frac{2}{18} \times 0,111 + \frac{18}{20} \times 0,194 + \frac{7}{9} \times 0,139 + \frac{10}{13} \times 0,194 + \frac{18}{25} \times 0,056 = 0,736$$

$$I_q^{VPFTG/R} = \frac{12}{14} \times 0,056 + \frac{14}{20} \times 0,194 + \frac{16}{21} \times 0,056 + \frac{2}{11} \times 0,111 + \frac{20}{20} \times 0,194 + \frac{7}{7} \times 0,139 + \frac{10}{11} \times 0,194 + \frac{18}{20} \times 0,056 = 0,806$$

The synthetic indicator of the quality / price ratio of Toast Graham bakery products will be:

$$I_{q/p}^{BTG/R} = \frac{4,99}{4,99} \times 0,942 = 0,942$$

$$I_{q/p}^{STBM/R} = \frac{4,99}{7,7} \times 0,736 = 0,477$$

$$I_{q/p} \text{ VPFTG/R} = \frac{4,99}{5,01} \times 0,806 = 0,803$$

Table 1 Share of the quality characteristics of Toast Graham bakery product of the most representative Romanian producers, obtained by quadratic matrix method

	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	Total C _i	C _i /total	p _i
C ₁	1	0	1	0	0	0	0	0	2	2/36	0,056
C ₂	1	1	1	1	0	1	1	1	7	7/36	0,194
C ₃	0	0	1	0	0	0	0	1	2	2/36	0,056
C ₄	1	0	1	1	0	0	0	1	4	4/36	0,111
C ₅	1	1	1	1	1	1	0	1	7	7/36	0,194
C ₆	1	0	1	1	0	1	0	1	5	5/36	0,139
C ₇	1	0	1	1	1	1	1	1	7	7/36	0,194
C ₈	1	0	0	0	0	0	0	1	2	2/36	0,056
Total									36		$\sum_{i=1}^8 p_i = 1$

Table 2 Quality characteristics, their weight sand prices of Graham Toast bakery products of the most representative producers in Romania

Characteristics Products	Proportional Characteristics		Inversely Characteristics						Price, [lei]
	C ₂	C ₅	C ₁	C ₃	C ₄	C ₆	C ₇	C ₈	
P _{DG} , Bongrana Toast Graham	20	14	12	16	2	7	10	18	4,99
P _{SFS} , Savoria Toast Bio with Multigrains	20	18	14	18	18	9	13	25	7,70
P _{VP} , Vel Pitar French Toast with Graham	14	20	14	21	11	7	11	20	5,01
Reference product	20	20	12	16	2	7	10	18	4,99
Weights	0,194	0,194	0,056	0,056	0,111	0,139	0,194	0,056	

Graham Toast bakery products hierarchy given that the synthetic indicator of quality and respectively the synthetic indicator of quality / price ratio are presented in Figure 2. It can be seen that both in terms of energy and nutrients efficiency, and in terms of economic efficiency, the most valuable product is Bongrana Toast Graham, followed by VelPitar French Toast with Graham and Savoria Toast Bio with Multigrains. Due to economic reasons Savoria Toast Bio with Multigrains is the least accessible to the public, but it should be kept in mind that it is a Bio product obtained by careful monitoring of raw materials and related processes, which explains the higher price.

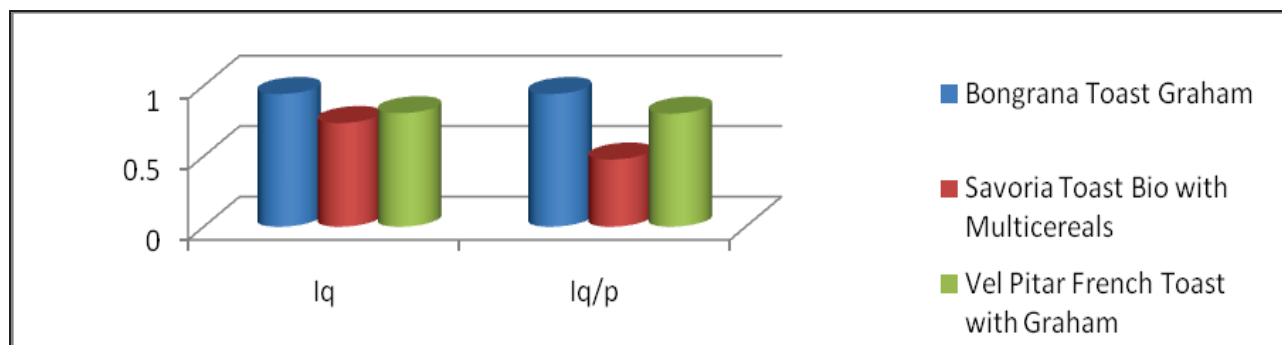


Figure 2. Graham Toast bakery products hierarchy of the most representative producers in Romania, by synthetic indicators of quality

Figure 3 presents energy, nutritive and economic efficiency of high fiber bakery products promoted on the Romanian market of most representative domestic producers. The most effective products both economically and in terms of nutritional products are Whole Wheat Round and Whole Wheat Loaf. Thus, under the conditions of low energy values, covering 11% of daily energy needs, consumption of 100 g Whole Wheat Loaf provides 25.5% of the daily protein requirement, 41% of the fiber, due to a low intake carbohydrate (15% EDA), simple sugars (7.8% EDA), lipids (3% EDA) and saturated fatty acids (3.5% EDA). It is also very important the potassium intake (22% RDA), magnesium (40% RDA) and folic acid (31% RDA), mineral bioactive compounds that multiplies the product functionality. Nutritionally valuable, Bongrana Sana Ultrafibre ensures a high protein intake (31% EDA) and dietary fiber (28% EDA) under a moderate intake of carbohydrates (13% EDA) and simple sugars (3% EDA), but it has a reduced accessibility due to its higher price. Savoria Toast 4 Corn Bio is a Bio product with considerable nutritional value, but with a much higher price compared to other products.

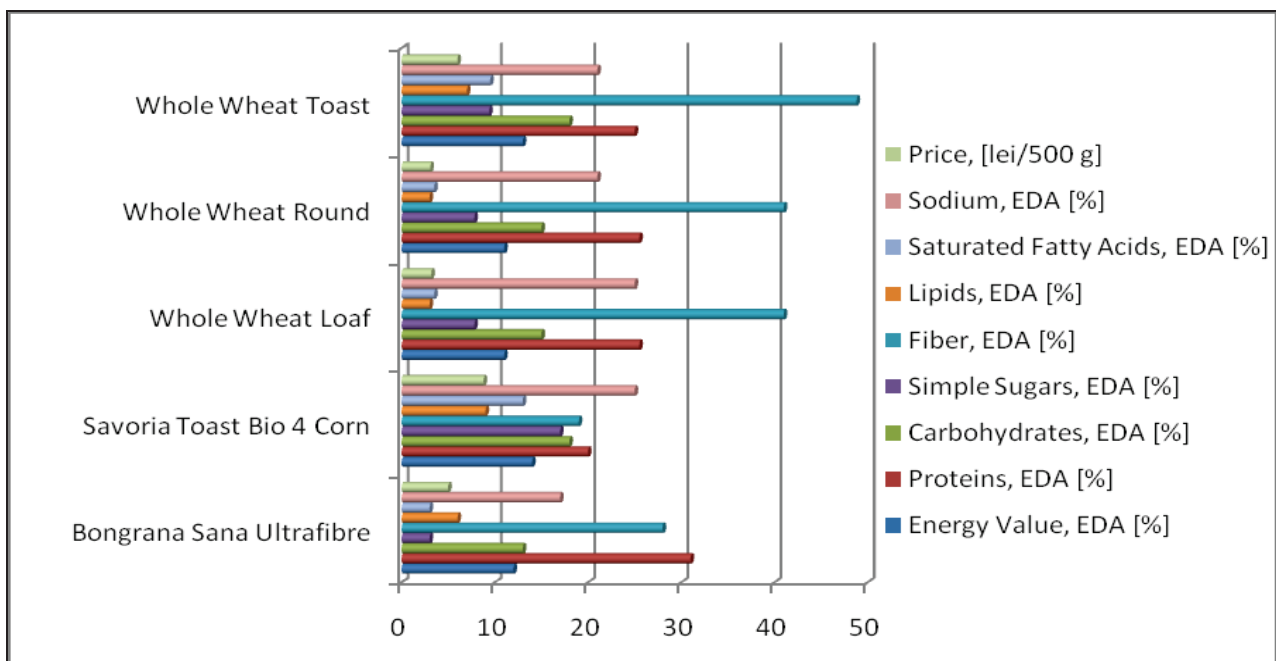


Figure 3 Energy, nutritive and economic efficiency of bakery products rich in fiber of the most representative producers in Romania

In order to form a clearer picture of the quality of bakery products with high fiber content of the three manufacturers we will comparatively analyze their quality by calculating the synthetic indicators of quality, using the same quality features as in the previous case. Quality characteristics and their weights for bakery products rich in fiber, calculated by quadratic matrix method and product prices are shown in Table 3. These data will be used to calculate complex indicator of quality.

The synthetic indicator of quality of bakery products rich in fiber will be:

$$I_q = \frac{11}{12} \times 0,056 + \frac{31}{31} \times 0,194 + \frac{13}{13} \times 0,056 + \frac{3}{3} \times 0,111 + \frac{28}{48,8} \times 0,194 + \frac{3}{6} \times 0,139 + \frac{3}{3} \times 0,194 + \frac{17}{17} \times 0,056 = 0,843$$

$$I_q = \frac{11}{14} \times 0,056 + \frac{20}{31} \times 0,194 + \frac{13}{18} \times 0,056 + \frac{3}{17} \times 0,111 + \frac{19}{48,8} \times 0,194 + \frac{3}{9} \times 0,139 + \frac{3}{13} \times 0,194 + \frac{17}{25} \times 0,056 = 0,434$$

$$I_q = \frac{11}{11} \times 0,056 + \frac{25,5}{31} \times 0,194 + \frac{13}{15} \times 0,056 + \frac{3}{7,8} \times 0,111 + \frac{41}{48,8} \times 0,194 + \frac{3}{3} \times 0,139 + \frac{3}{3,5} \times 0,194 + \frac{17}{25} \times 0,056 = 0,814$$

$$I_q = \frac{11}{11} \times 0,056 + \frac{25,5}{31} \times 0,194 + \frac{13}{15} \times 0,056 + \frac{3}{7,8} \times 0,111 + \frac{41}{48,8} \times 0,194 + \frac{3}{3} \times 0,139 + \frac{3}{3,5} \times 0,194 + \frac{17}{21} \times 0,056 = 0,821$$

$$I_q = \frac{11}{13} \times 0,056 + \frac{25,5}{31} \times 0,194 + \frac{13}{18} \times 0,056 + \frac{3}{9,4} \times 0,111 + \frac{48,8}{48,8} \times 0,194 + \frac{3}{7} \times 0,139 + \frac{3}{9,5} \times 0,194 + \frac{17}{21} \times 0,056 = 0,638$$

The synthetic indicator of the quality / price ratio for bakery products with high fiber content is:

$$I_{q/p \text{ BSU/R}} = \frac{3,08}{4,99} \times 0,843 = 0,520$$

$$I_{q/p \text{ STBC/R}} = \frac{3,08}{8,79} \times 0,434 = 0,152$$

$$I_{q/p \text{ WWL/R}} = \frac{3,08}{3,19} \times 0,814 = 0,786$$

$$I_{q/p \text{ WWR/R}} = \frac{3,08}{3,08} \times 0,821 = 0,821$$

$$I_{q/p \text{ WWT/R}} = \frac{3,08}{5,99} \times 0,638 = 0,328$$

Table 3. Quality characteristics, their weights and prices of high fiber bakery products of the most representative producers in Romania

Characteristics Products	Proportional Characteristics		Inversely Characteristics						Price, [lei]
	C ₂	C ₅	C ₁	C ₃	C ₄	C ₆	C ₇	C ₈	
P _{BSU} , Bongrana Sana Ultrafibre	31	28	12	13	3	6	3	17	4,99
P _{STBC} , Savoria Toast Bio 4 Corn	20	19	14	18	17	9	13	25	8,79
P _{GfR} , Whole Wheat Loaf	25,5	41	11	15	7,8	3	3,5	25	3,19
P _{GfR} , Whole Wheat Round	25,5	41	11	15	7,8	3	3,5	21	3,08
P _{GfR} , Whole Wheat Toast	25	48,8	13	18	9,4	7	9,5	21	5,99
Reference product	31	48,8	11	13	3	3	3	17	3,08
Weights	0,194	0,194	0,056	0,056	0,111	0,139	0,194	0,056	

It can be seen that in terms of energy and nutritive efficiency the most valuable product is Bongrana Sana Ultrafibre, closely followed by Whole Wheat Round and Whole Wheat Loaf and then by Whole Wheat Toast and Savoria Toast Bio 4 Corn and according to quality / price ratio most valuable product is Whole Wheat Round followed by Whole Wheat Loaf, Bongrana Sana Ultrafibre, Whole Wheat Toast and Savoria Toast Bio 4 Corn (Figure 4). Should be kept in mind that Savoria Toast Bio 4 Corn is a Bio product obtained by a careful monitoring of raw materials and related processes, which explains the higher price.

Figure 5 comparatively presents the energy, nutritive and economic efficiency of some products with special functionality of the main bakery producers in Romania. Comparing Bongrana Sana Benexia with Savoria Toast Kornfit, both enriched with vegetable sources of ω_3 and ω_6 , it can be seen that, in nutritive terms, Savoria Toast Kornfit is more efficient, but because of its higher price it has a lower accessibility among consumers. Thus, in nutritive terms, in terms of a lower energy values covering 12% of daily energy requirements (compared to 11% for the competing product) and a moderate intake of carbohydrates (14% EDA versus 16% EDA properly Bongrana Sana Benexia) Savoria Kornfit Toast is a great source of protein (20% EDA compared with 17%

EDA corresponding Bongrana Sana Benexia), dietary fiber (40% compared with only 10% EDA properly Bongrana Sana Benexia) and polyunsaturated fatty acids type ω_3 (6.5% RDA compared to 34% RDA, according Bongrana Sana Benexia) and ω_6 (39% RDA compared to 2.4% RDA corresponding Bongrana Sana Benexia). It should be noted that the ratio of polyunsaturated fatty acids ω_3 / ω_6 is optimal for the body needs for Savoria Toast Kornfit and it is unbalanced for the Bongrana Sana Benexia product. It is also remarkable the intake of micronutrients and vitamins brought by consumption of 100 g Bongrana Sana Benexia: iron (5.8% RDA), magnesium (4% RDA), calcium (3.3% RDA), potassium (4.3% RDA) and vitamin A (0.06% RDA), compared to bring micronutrients intake by eating 100 g Savoria Toast Kornfit: magnesium (1.5% RDA), potassium (4.3% RDA) and phosphorus (40% RDA). Despite the more balanced intake of ω_3 and ω_6 polyunsaturated fatty acids of the product Savoria Toast Kornfit due to lower prices, Bongrana Sana Benexia enjoy greater accessibility to consumers, being at the same time, a valuable source of bioactive elements with functionality for the body.

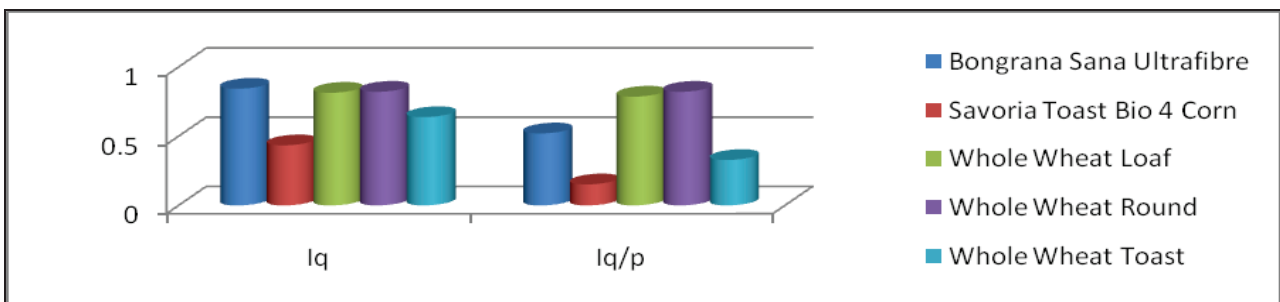


Figure4. Ranking the high fiber bakery products of the most representative producer in Romania, by synthetic indicators of quality

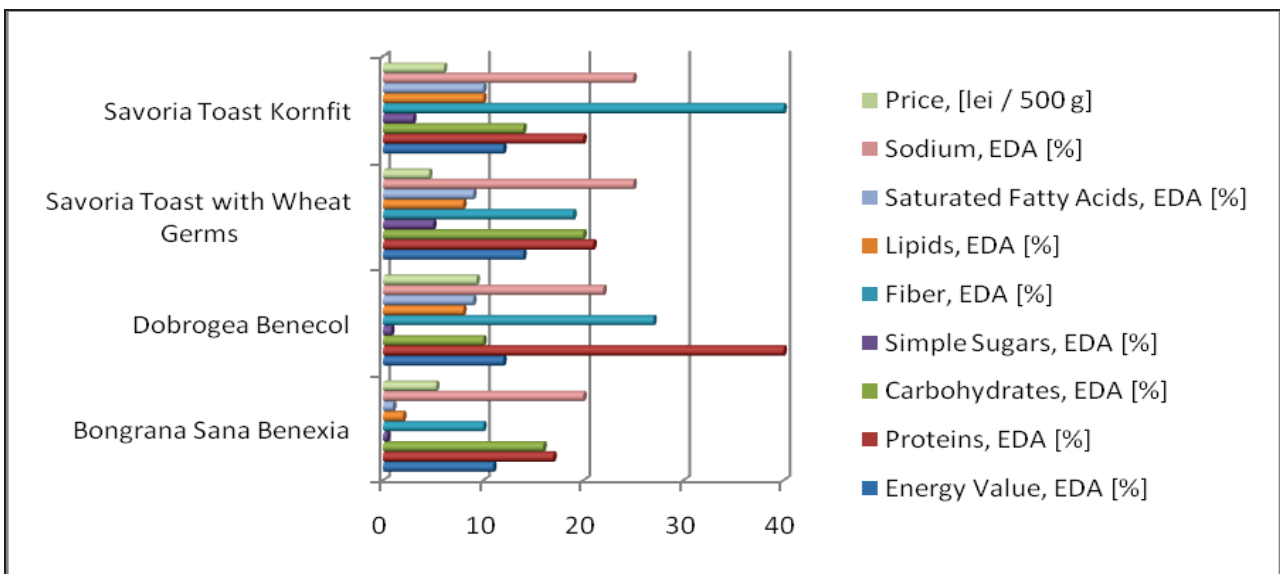


Figure5. Energy, nutritive and economic efficiency of products with special functionality of the most representative bakery producers in Romania

The comparative analysis of energy, nutritive and economic efficiency of other two products with special functionality that addresses the same segment of the population, DobrogeaBenecol and Savoria Toast with Wheat Germs (Figure 5), reveals a special nutritive intake, superior of the DobrogeaBenecol product, coupled with a better efficiency of its functionality, proven clinically to reduce blood cholesterol levels, but the level of their accessibility is diminished by its relatively high price. Thus, under a low energy value (12% EDA), a daily consumption of 100 g DobrogeaBenecol provides, in addition to a 10% reduction in blood cholesterol levels, a substantial contribution of protein (40% EDA) and dietary fiber (27% EDA),

much higher than the protein intake (21% EDA) and of dietary fiber (19% EDA) provided by consumption of 100 g Savoria Toast with Wheat Germs. It is also remarkable the micronutrient intake of Savoria Toast with Wheat Germs such as: magnesium (15% RDA) and phosphorus (43% RDA). Under these conditions, due to the more affordable price and considerable nutritional value, Savoria Toast with Wheat Germs remains a more economical alternative for consumers.

CONCLUSIONS

With multiple health benefits, the introduction of functional foods in the diet may reduce the risk of chronic diseases and provide health insurance for population on long term. Bakery products can be successfully used in nutritional intervention programs because bread is a stable food, the most used in Romanian daily diet and as a result it can be achieved through its consumption an efficient mastering of a supplementary feeding program with a number of biologically active substances that give the finished product functionality.

The analysis made in this study allowed the identification of several bakery products with special functional effects and important benefits for health consumers.

Whole Wheat bread is an important source of dietary fiber that reduces blood cholesterol levels and the risk of cardiovascular diseases. It also promotes proper digestion and regulates blood glucose, thereby preventing type 2 diabetes. Moreover, it provides a quick feeling of satiety helping to maintain a proper weight body.

Sana Bongrana Ultrafibre is rich in fiber and may reduce the risk of diabetes and also the cholesterol levels in blood, being a functional product recommended for the health of cerebral, cardiovascular and digestive systems.

Dobrogea Benecol product is a threefold functional bread that, in addition to its cholesterol lowering effect, it has a high content of fibers, which helps regulate bowel movements and provides at the same time a low content in carbohydrates, being suitable for people with diabetes. A Benecol daily consumption reduces the total cholesterol by 10%, reduce the LDL-cholesterol by up to 15% and lowers blood triglyceride levels and these remain low for a period of 12 months, which ensures the prevention or slowing the development of coronary heart disease and atherosclerosis.

Sana Bongrana Benexia bread has a remarkable nutritional value and its content of 25g sage seeds Benexia (non-marine richest source of ω_3 fatty acids) makes an important contribution to the body of ω_3 and ω_6 fatty acids, with beneficial effects to the functioning of the cardiovascular and immune systems and are also needed in normal growth and development of the child.

However, the list of functional bakery products on the Romanian market is a much larger one. A deeper analysis could provide the identification of most valuable bakery products with functional effects, which consumption could lead to improving the health of consumers.

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