

# COMPARATIVE STUDIES REGARDING THE USE OF GRAPE SEED POWDER (GSP) IN BAKERY PRODUCTS

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**Abstract:** The paper presents the benefits of grape seed consumption, its properties regarding health and nutrition. The technology and quality control of bakery products with grape seed flour addition is presented in the second part of the paper. The bread quality is defined according to the quality indices that must correspond to the minimum conditions stipulated by STAS. The organoleptic control of all 4 samples is made by appreciating the appearance of the bread, the symmetry of the shape, the volume, the color and structure of the shell, the color, the elasticity and the porosity of the core, the taste, the smell, and the signs of microbial alteration and the presence of the foreign bodies are appreciated.

**Keywords:** grape seed flour, cholesterol, functional food, antioxidants;

## 1. Introduction

Grape seed flour is an extraordinary food. It can substitute a portion of wheat flour from bread, substantially reducing carbohydrate consumption.

It is recommended in vegetarian diets, in fasting or in detoxifying cures, besides being used by athletes, protecting the joints, stimulating anabolism and antidepressant properties.

It helps to protect the heart (can prevent oxidation of LDL or bad cholesterol, this cholesterol can cause hardening of the arteries or even atherosclerosis when it is oxidized).

Due to the flavonoids present in the grapes, it has antioxidant capacity 20 times higher than vitamin E and 50 times higher than vitamin C.

Applied externally, grape seed flour tonifies the skin. It is proposed to make a bakery line at the Hotel Mercur restaurant, from Covasna, which will create new jobs, and bring on the market a new food product of great value [6, 12, 13].

The implementation of the project contributes to the technological development of the bakery industry and to the increased competitiveness of the enterprise.

At the same time, being provided with modern technology will ensure the production of the necessary transportation of the products to the resort hotels and to the cardiology hospital.

Citizens of the city as well as tourists will be more impressed with this innovation because they will have the certainty of healthy food. Functional foods are those foods that treat serious illnesses.

Food is a source of nutrient for the body but also one of the greatest pleasures of life. Moderately consumed foods can be part of a healthy diet provided they are not rich in fats, salt, sugar and calories [4].

Functional foods are those foods that can be consumed in the normal diet and contain biologically active compounds with potential for improving health or reducing the risk of disease. From a practical point of view, functional foods can be:

- Conventional foods containing natural bioactive substances (ex: oat beta-glucan);
- foods that have been modified by enrichment with bioactive substances (ex: margarine with added phytosterol);
- Synthesized food ingredients (ex: special carbohydrates with probiotic effects).

A functional food can be:

- a natural food;
- a food to which a component has been added;
- a food in which a component has been replaced;
- a food whose bioavailability has been modified;
- any combinations of these.

A food product can become functional by using any of the following five ways:

- a. eliminating a component that causes harmful effects when consumed (ex: allergenic proteins);
- b. Increasing the concentration of a natural component present in the food up to a point where it can induce beneficial effects (ex: fortification with a micronutrient to increase daily intake over recommended);
- c. addition of a component which is not normally present in many foods and which is not

necessary a macro- or micronutrient but for whose beneficial effects it has been used (ex: non-vitamin anti-oxidants or prebiotic fructan);

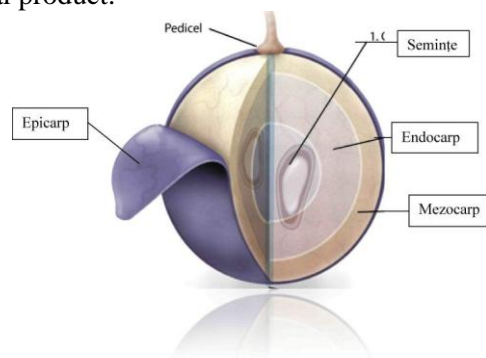
d. replacement of a component, usually macro-nutrient (fatty acids), which is excessive with a component with beneficial effects (modified starch);

e. increasing the bioavailability or stability of a recognized component for its functional effects or reducing the potential risk of disease [7].

The grapes are made up of:

- peel (7-12%),
- core (pulp) (80-92%),
- seeds (2-8%).

The chemical composition of these types of tissue is different and affects the quality of the final product.



**Fig. 1.** Grape seed structure

The peel is the outer shell of the grape, which protects the core and the seeds, while being the headquarters of the coloring and aromatic substances. It consists of 6 to 10 layers of membrane cells with a thickness between 1.5 and 4  $\mu$ . The skin may be thick or thin, elastic or stiff, dense or loose. The outer part of the skin is called cuticle, it represents 1.5% of the weight of the skin and consists of a layer of cells with very thin walls.

The cuticle is coated with a thicker or thinner layer of pruin, which is a waxy substance, composed of palmitic and cerotic acid.

Pulp, also known as core or mesocarp, it is the part of the grain between the skin and the seeds. It comprises several cell layers (20-30) with thin cellulosic membranes. The cell walls represent only 0.5% of the core weight.

The mesocarp cells have the largest dimensions and contain the largest amount of worth, which is also the richest in carbohydrates. The consistency of the grain is different.

The color of the pulp, in most varieties, is golden yellow except for the tincture varieties (Gamay Freaux, Alvarna, black tinctorial) in which the pulp is red. Also, flavor substances in

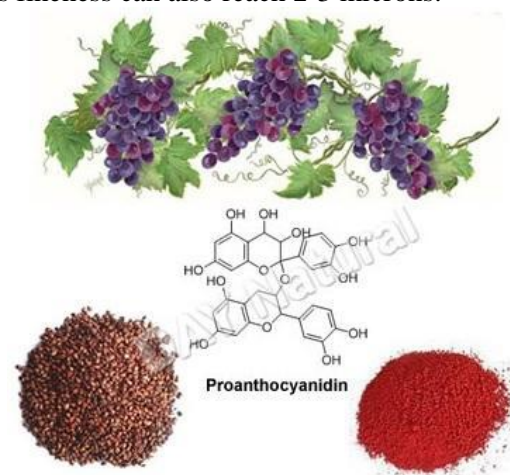
some varieties are also found in the first layers of the core not only in the skin.

Seeds are the most compact parts of the grape composition. They are pyriform and form as a result of the development of fertilized ova. On the outside they have a skin that protects the embryo and the endosperm with back-up substances. In each grain there are up to 4 seeds, but in many grains there are only 1-2-3 seeds.

For this reason, the seed propensity, relative to the weight of the grain, is variable. It is 2-4% in noble varieties, reaching American and direct producer hybrids (HPD) to over 10%. It has been found that there is a certain correlation between the number of seeds, the weight or the size of the grain, the sugar content and the acidity. Grains that have many seeds are larger, accumulate fewer sugars and more acids; Instead, those with fewer seeds are smaller and accumulate higher amounts of sugars [9].

## 2. Composition of grape seed flour

Generally, in grape seed flour, all antioxidants are found in good concentration. The flour is rich in routine, kampferol, quercetin, resveratrol, catechin, epicatechin, antocianidok, P1, P2, B1, B2, B3, vitamins A, C, E and the vitamin B complex [4]. Also contains some minerals such as manganese, potassium, magnesium. Flour powders typically have a size of 10 microns, but its fineness can also reach 2-3 microns.



**Fig. 2.** Composition of grape seed flour

Grape seed flour is pulverized, has a neutral taste, is neither sour nor bitter. The grape seed is found inside the grape, usually in each grain there are up to 4 seeds, but in many grains there are only 1-2-3 seeds, it has a red-brown color.

The smell is similar to the smell of fermented grape in winemaking. They are considered as functional foods because they can be consumed in the normal diet and contain biologically active compounds with potential to improve health or to reduce the risk of disease.



**Fig.3.** *Unmilled grape seeds*

### 3. Benefits of grape seed flour consumption

The earliest records of the benefits of grape seed consumption came in 1936 thanks to Dr. Szentgyörgyi Albert, who also received the Nobel Prize. He was the person who said the grape seed probably contained the most natural antioxidants [9].

American researchers at the University of Kentucky, according to laboratory experiments, have noticed that grape seed extract is prone to the destruction of cancer cells. Within 24 hours, not less than 76% of the cells exposed to the extract were killed, while under the same conditions, healthy cells were not affected in any way [15].

Grape seed flour demonstrated self-destructive activity in cancer cells of the breast, skin, lung, colon, stomach and prostate.

Antioxidant components of flour are polyphenols, which contribute to the inhibition of harmful oxidative processes occurring in the human body.

Harmful materials from our environment, such as contaminated water and air, preservatives, stress or pollen, in the body, lead to the destruction and damage to healthy cells. Grape seed flour is an extraordinary food [15].

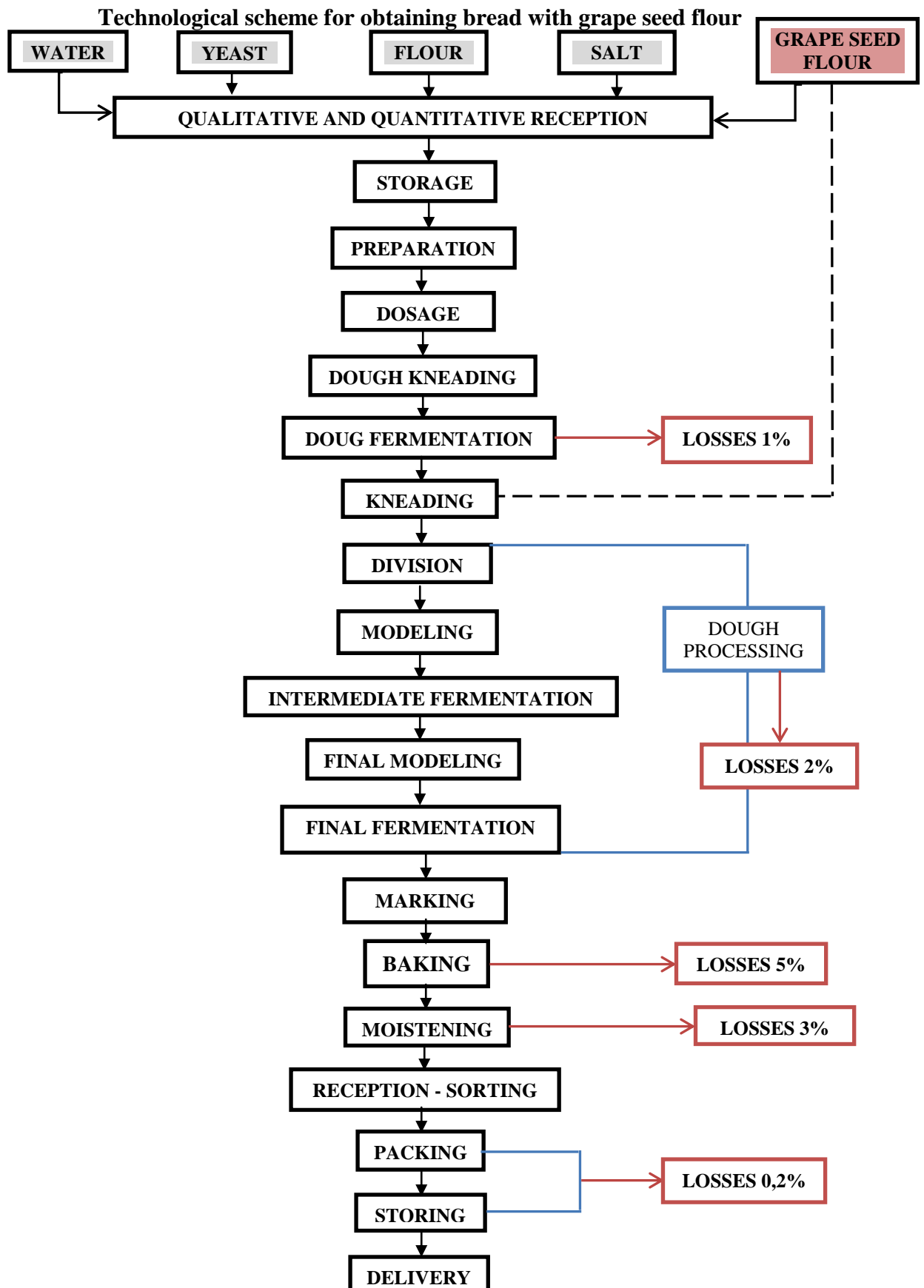
It can substitute a portion of wheat flour from bread, substantially reducing carbohydrate consumption. It has the following benefits:

- They are an excellent source of antioxidants.
  - Protects the body against free radicals.
  - Helps prevent premature aging of tissues, organs and cells.
  - Keep the younger body.
  - Helps prevent stains from aging and wrinkles.
  - Improved circulation.
  - Protects the body against pollution, tobacco and other harmful agents.
  - Cleans the blood from the negative effects of drugs and excessive alcohol consumption.
  - Strengthens the walls of the veins and arteries (due to the flavonoid content).
  - Improve cardiovascular health, being recommended to patients who have had a myocardial infarction.
  - They have anti-inflammatory properties that help treat diseases such as arthritis, gastritis, sinusitis and dermatitis.
  - Cleans the intestines.
  - Maintain optimal vision, skin and brain.
  - Prevent degenerative diseases.
  - Prevent the formation of atheroma plates in the arteries.
  - Fight hair loss and stimulate new hair growth.
  - Maintain healthy and young connective tissues.
  - They have anti-allergic, anti-ulcer and antihistamine properties.
  - Helps prevent cancer.
  - Slow down cataract and glaucoma development.
  - Strengthen the lungs and prevent respiratory failure.
- Strengthen the immune system, preventing many diseases [11].

### 4. Technology and quality control of bakery products with grape seed flour addition

The following diagram shows the possibility of grape seed flour addition in different parts of the technology.

Working mode for bread with wheat flour and grape seed flour (in 5%, 10% and 15% quantities) is shown in table 1.



**Fig. 4.** Technological scheme for obtaining bread with grape seed flour [3]

**Table 1.** Dough preparation the following recipe [3]

Raw, auxiliaries materials and technological regime	U.M.	Dough		
		5%	10%	15%
Wheat white flour	g	475	450	425
Grape seed flour	g	25	50	75
Yeast	g	8,5		
Salt	g	6,5		
Sugar	g	7,5		
Water	l	0,25		
<b>Kneading</b>				
Time	min	8-10		
Temperature	°C	29-30		
<b>Fermentation</b>				
Time	min	150		
Kneading I	sec	30(after 60 min)		
Kneading II	sec	30(after 120 min)		
Temperature	°C	30		
<b>Division</b>	pcs	1		
<b>Modeling</b>	-	Toast bread shape (manual)		
<b>Final fermentation</b>				
Time	min	30-40		
Temperature	°C	30-32		
<b>Baking</b>				
Time	min	25		
Temperature	°C	230		

## 5. Bread quality control

By bread designation is generally meant the product obtained by baking a leavened dough prepared from wheat or rye flour, possibly mixed with other cereals, legumes or potatoes.

Bread and bakery products according to the quality indices must correspond to the minimum conditions stipulated by STAS [5].

**Fig.5.** Bread with grape seed flour**Table 2.** Admissibility conditions for the 3 samples of bread with grape seed flour added [3]

Characteristics		White bread	Bread with 5 % grape seed flour	Bread with 10 % grape seed flour	Bread with 15 % grape seed flour
<i>Admissibility Conditions</i>					
Aspect	Exterior (general)	Specific format to the assortment, non flattened			
	Crust	Ruddy, golden yellow	Ruddy, light brown	Ruddy, brown to reddish brown	Reddish brown
	Core (in section)	Mass with fine uniform pores	Mass with uniform pores		Not moisty at palpation
		Elastic (after a slight pressure, immediately returns to the original state), without dents or traces of unpeeled flour			
Flavor		Pleasant, characteristic of well baked bread, no foreign smell (mold, rancid etc.)			
Taste		Pleasant, characteristic of well-baked bread, no sour or bitter taste, no scratch due to mineral impurities (earth, sand, etc.)			



## 6. Organoleptic appreciation of bread quality

By the organoleptic way, the appearance of the bread, the symmetry of the shape, the volume, the color and structure of the shell, the color, the elasticity and the porosity of the core, the taste, the smell, and the signs of microbial alteration and the presence of the foreign bodies are appreciated.

### 6.1. Appreciation of exterior bread aspect

The exterior appearance of the bread is controlled by examining the whole bread, following the symmetry and regularity of the shape.

There will be considered the following aspects:

- bread volume: raised, flattened or bulging;
- general appearance of the surface of the crust: smooth, glossy, cracked, burnt, stained;
- color of the crust: normal, corresponding to the bread type, uniform;
- Crust resistance: soft, elastic, hard, brittle.

### 6.2. Appreciation of core aspect

The state and appearance of the core is verified by section examination of the bread. Controls:

- the thickness of the upper and lower crust;
- the overall appearance of the uniform core, if it shows traces or dents of flour or uncooked dough;
- Color of the core: white, yellow, gray, uniform.

The porosity structure is determined by tracking the pore size and uniformity of distribution on the cut surface. It may consist of:

- Small oval-shaped pores evenly distributed over thin walls;
- large or medium sized pores distributed evenly or unevenly with medium or thick walls;
- irregular vacuoles.

Good quality bread has oval, uniformly distributed pores, inclined to about 45 °, with fine walls, no voids or vacuoles. The presence of small, round pores indicates poor porosity. The

mechanical properties of the core are being tracked:

- elasticity: by gently pressing with finger against the surface of the core so as not to destroy the pore structure;

- Resistance to the core when pressed.

If the core resists high finger pressure and deforms slightly, it is compact, dense.

According to the type of return after a slight pressure, the core is classified into:

- Very elastic: returns immediately;
- Elastic: returns slowly;
- Not elastic (insufficiently elastic): does not return to its initial state.

### 6.3. Taste and smell (flavor) appreciation of bread, signs of microbial alteration

In order to verify the flavor, of signs of microbial alteration and presence of foreign bodies, the products are examined as whole, after that are cut and examine the core.

The taste is established by tasteing the crust and the core.

The taste can be normal, pleasant, sweet, slightly sour, sour, unsalty, bitter. The flavor is determined by smelling the core.

Standards provide for the minimum conditions that products have to fulfill in order to be put into consumption.

For a qualitative grading of bakery products in order to stimulate the achievement of a higher quality, a quality assessment method based on a 30-point scheme was introduced. This scheme contains the main qualitative indices of the product that determine its overall quality, combining the organoleptic and physico-chemical examinations.

For each of these indices, a certain score is given. When the product is of superior quality, the maximum score is given, and as the quality decreases, the score is reduced accordingly.

**Table 3. Organoleptic appreciation of bread quality [3]**

Product indices	Scoring scale	Characterization	Score awarded			
			P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>
1. Shape and volume	4	The product has the correct (long), symmetrical, esthetic shape, proving the care it has been worked with, and as volume is well developed, "grown", unpaired or bulging.	4	4	4	-
	2	The product has no fixed shape, it is asymmetric and its	-	-	-	-

		volume is sufficiently developed, it is sufficiently grown.				
	0	The product has no fixed shape, it is deformed, is flattened.	-	-	-	0
<b>2. Color and aspect of the crust</b>	4	The product has a well-rounded crust (from brown to red brown for black bread, from golden brown to light brown for semi-white bread and golden yellow for white bread), the coloration is uniform and appealing, the surface of the crust is smooth, glossy, without cracks or other defects, the crust is crispy.	4	4	4	
	2	The product is unevenly browned, has too dark or pale areas, has a rough, matte surface, or with flour traces, superficial spoilage, or has cracks below 1 cm in width and under 5 cm in length, the crust is not crispy, being a little soft.				
	0	The product has a whitish crust due to insufficient baking, especially at the sides, or has browned parts larger than 1:4 of the surface of the crust, has a wrinkled surface with cracks of 1cm wide and 5cm long.				0
<b>3. The degree of baking. Condition and appearance of the core</b>	6	The product is well baked, so that when bumping into the crust produces a clear, clean sound, characteristic to baked product, has elastic core, presuring the core it immediately returns to the initial state (pressing should be done lightly so that the pore structure is not destroyed) the core has a uniform color, it is dry to the touch, and when cutting the knife blade remains clean, without core adhesions, the core is not broken when it is cut, is smooth.	6	6	6	
	3	The product is baked enough, so that when bumping into the crust produces a muffled sound (not so pure), it has a slightly soft peel; when pressed with the finger, the core returns to the initial state more slowly, cutting it, the knife blade remains clean and the core is not crushed.				3
		The product presents unbaked dough, by pressing the core is irreversibly deformed and easily broken by cutting				
<b>4. Porosity. Core and Pore Structure</b>	6	The product has uniform core porosity and fine pore structure, possibly with a maximum of 2 holes up to 1x1 cm in section, and the determined porosity is: <ul style="list-style-type: none"> <li>- Minim 63% for black bread;</li> <li>- Minim 67% for semi-white bread;</li> <li>- Minim 77% for white bread.</li> </ul>	6	6	6	
	4	The product has uniform core porosity and fine pore (fluffy) structure, but has up to 3 holes of 1x1 cm in section and the determined porosity is within the limits: <ul style="list-style-type: none"> <li>- 60%-62%-for black bread;</li> <li>- 64%-66%-for semi-white bread;</li> <li>- 72%-75%- for white bread.</li> </ul>				4
	2	The product has uneven core porosity, has up to four holes of approx. 2x2 cm in section.				
	0	The product has large section holes and porosity is very low				

<b>5. Flavor (aroma)</b>	<b>4</b>	The product has a pronounced, pleasant aroma (smell), characteristic for well-fermented and well-baked bread	4	4	4	
	2	The product has less pronounced aroma (smell), with no foreign nuances.				2
	0	Is missing or the product has foreign aroma				
<b>6. Taste and acidity</b>	<b>6</b>	The product tastes good (weak sour, sweet), characteristic for the assortment, and the determined acidity is within the limits: - 5,2-5,8 grades for black bread; - 4,4-4,8 grades for semi-white bread; - 2,2-2,8 grades for white bread.	6	6	6	
	4	The product has a satisfactory taste and the determined acidity is within the limits: - 4,8-5,1 or 5,9-7,2 grades for black bread; - 4,0-4,3 or 4,9-5,2 grades for semi-white bread; - 1,8-2,1 or 2,9-3,4 grades for white bread.				4
	0	The product has a pronounced sour, faded or salty taste and the determined acidity is below the minimum or previous limit.				
<b>Total score</b>			<b>30</b>	<b>30</b>	<b>30</b>	<b>13</b>

## Conclusions

Starting from the biological study on grape seeds and the chemical composition of grape seed, different samples of bakery products were made. On them were made comparative organoleptic analyzes between the four samples taken in the discussion.

In conclusion, the optimal addition of grape seed flour is between 5% and 7,5%.

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