



# Effect of Food Additives on Physical and Chemical Properties of Dietary Salt Free Bread

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**Abstract:** *Advanced research direction for expanding the range of bakery products is the production of dietary salt-free bread, with the addition of food additives of plant and animal origin. This paper presents the formulation of dietary salt free bread. Flax seeds, pollen, curd whey and DVS Bifidus bacteria preparation are used in preparation of bread. The physical and chemical indicators and sensory profile of dietary salt free bread evaluated. Developed dietary salt free bread contains more protein (9.0 g/100g), carbohydrates (53.4 g/100g), fibers (7.0 g/100g) and minerals (2.5 g/100g) compared with traditional wheat bread.*

**Index Terms:** *bread, salt free, flax seed, curd whey, formulation, fiber*

## I. INTRODUCTION

The production of high-quality bakery products is impossible without the targeted use of micro-ingredients - food additives, baking improvers, various types of ingredients and at the same time a stable technological process. The food additives have a wide range of functional properties, modify the properties of semi-finished products, improve the quality of finished products, increase the nutritional value of finished products [1].

Modern bakery industry is a dynamically developing system, the functioning of which is associated with following issues:

- trade development necessitates the transportation of products over long distances, which requires an extension of the shelf life of bread;
- developing of bread products that meet increasing consumer requirements for the quality and assortment of bread, while maintaining a low cost;
- the creation of new types of products that meet modern requirements of nutrition science;
- improvement of production technology of traditional and new bakery products;
- introduction of advanced resource-saving technologies in order to produce competitive products [2, 3].

The use of food additives in bakery allows to:

- intensify the technological process; introduce accelerated technology for the preparation of bread;
- improve the rheological properties of the dough (elastic properties for laminating the dough, visco-plastic properties, reducing the adhesion of the dough pieces).
- improve the quality of bakery products of a diverse assortment - viennoiserie dough, puff yeast and yeast-free products, products made from frozen semi-finished products;
- expand the range of products in accordance with ever-increasing consumer requirements; increase the nutritional and biological value of bread;
- improving the biotechnological properties of yeast;
- stabilize the quality of bread during the processing of flour with unstable baking properties;
- slow down the process of hardening and prevent microbiological spoilage of bakery products;
- extending the shelf life of bread freshness, reducing bread crumbly texture [4, 5].

All baking improvers and additives according to their properties and directions of use can be divided into following groups:

1. Improving the physico-chemical and organoleptic characteristics of bread products.
2. Extension of the preservation of freshness.
3. Increasing the water-absorbing ability of the dough, and the yield of finished products.
4. Correction of the baking properties of flour and dough (strengthening gluten, relaxation, increasing sugar-forming ability, increasing enzymatic activity).
5. The formation of the specified rheological properties of the dough.

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6. Improving the properties of yeast, the preparation of special enzymatic semi-finished products [6, 7].

In addition to a large number of additives that improve the physical and technological properties of bread products, vitamin and mineral supplements are used today to increase the value of products for the health of consumers - from ascorbic acid and iodine to protein and vitamin-mineral complexes [8, 9, 10].

The purpose of this study is to develop the dietary salt free bread with addition of bioadditives and study its physical-chemical properties.

II. MATERIALS AND METHODS

During the production of high-quality healthy products, the use of high-quality basic and additional ingredients is very important. The formulation of dietary, salt-free bread is presented in Table 1. The composition of the bread included the following ingredients: wheat flour of the 1st grade, flax seeds, pollen, DVS Bifidus bacteria preparation, curd whey. This technology of salt-free bread is developed for people those in need a dietary nutrition, with the aim of preventing cardiovascular diseases.

Table 1 – Formulation of dietary salt free bread

Ingredient	Amount, kg
Wheat flour of 1 grade	100
Sugar	2.5
Flax seeds	3.0
Pollen	2.5
DVS Bifidus bacteria preparation	1.0
Curd whey	65

Determination of moisture content.

For determining the moisture content of bread, only metal cups with a lid, 2.0 cm high, 4.5 cm in diameter (pre-calibrated with an accuracy of 0.01 g) are used. The prepared samples of bread (5 g) are put in the open cups and placed in preheated to 140-150 C electric oven with a temperature regulator. The temperature is brought to 130 °C for no more than 50 minutes and drying is carried out. Deviations from the specified temperature should not exceed 2 °C [11].

Determination of grain of bread

A piece with a width of at least 7-8 cm is cut from the middle of the bread. From the crumb of the chunk in the place most typical of its porosity, at least 1 cm from the crusts, hollows are made by a cylinder. The cylinder is rotationally introduced into the crumb of the piece. The bread crumb is pushed out of the cylinder with a wooden sleeve, about 1 cm, and cut at the edge of the cylinder with a sharp knife. The cut off piece of crumb is removed. The crumb remaining in the cylinder is pushed out by the sleeve to the wall of the tray and is also cut off at the edge of the cylinder. With an internal cylinder diameter of 3 cm and a distance from the tray wall to the slot of 3.8 cm, the volume of the notch of the crumb cylinder is 27 cm<sup>3</sup> [12].

To determine the porosity 3 hollows are made for wheat bread, and 4 for rye bread.

The prepared hollows are weighed simultaneously with an accuracy of 0.01 g on a technical balance. The porosity in percent is calculated by the formula:

$$\Pi = \frac{V - \frac{g * 1000}{\rho}}{V} * 100$$

где V- total volume of the hollows, cm<sup>3</sup>;  
g- weight of hollows, g;  
p- density of bread crumb, kg/m<sup>3</sup>.

Determination of bread acidity

25 g of crushed crumb is weighed to an accuracy of 0.01 g. A portion is placed in a dry bottle with a volume of 500 ml with a well-fitting stopper.

250 ml volumetric flask is filled to the mark with water, heated to a temperature of 60 °C.

About ¼ of the taken water is poured into a bottle with a sample of bread crumb, which is then quickly ground with a wooden spatula until a homogeneous mass is obtained. To the resulting mixture, all remaining water is added from the volumetric flask. The bottles are closed with a stopper and shaken vigorously for 3 minutes, then the mixture is settled for 1 minute. The settled liquid is carefully poured into a dry glass through a clean sieve. A 50 ml solution is taken from a glass pipette into two conical flasks with the volume of 100-150 ml and titrated with a 0.1N solution of caustic soda or caustic potassium with 2-3 drops of phenolphthalein until a faint pink color is obtained that does not disappear when the flask is standing still for 1 min [13].

III. RESULTS AND DISCUSSION

The acidity indicator of bread characterizes the quality of bread with a taste and hygiene. This indicator judges the correctness of the technological process of making bread. The acidity of the bread is determined by the presence in the bread of products obtained as a result of the fermentation process of the dough [14].

Table 2 – Physical and chemical indicators of dietary salt free bread

Indicator	Value
Moisture content in bread crumb, %	43
Bread acidity,	3,5 – 4°
Grain of bread, %	68

Table 3 – Sensory profile of dietary salt free bread

Taste	Flavor	Color	Appearance
Salt free, it conforms to the taste of bread with taste of food supplements	Fresh, clean flavor	Light brown, corn color	Low height bread, crumb with highly dispersed structure

Fig. 1 and 2 show the microstructure of bread crumb and bread crust.

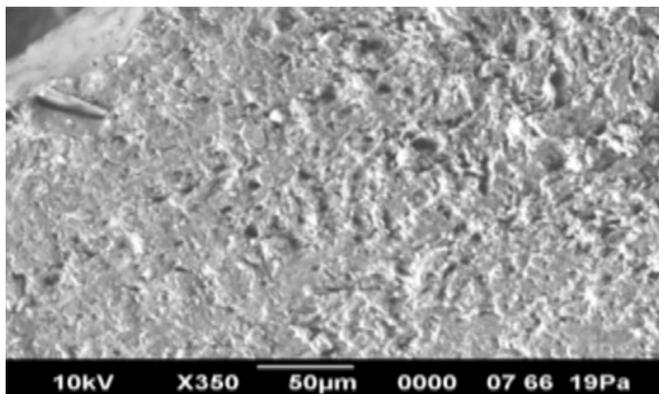


Figure 1 - Microstructure of bread crumb

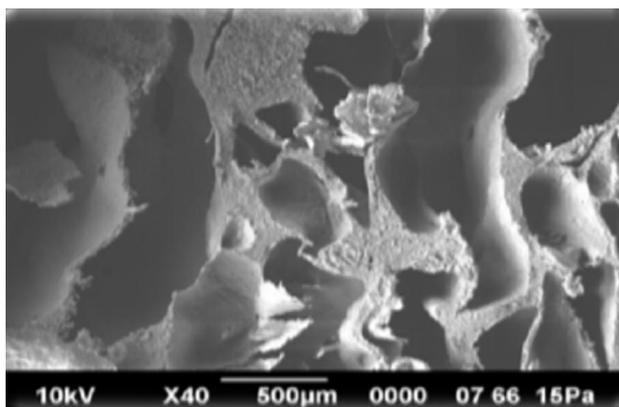


Figure 3 – Microstructure of bread crust

The final step in the experimental study was the evaluation of the nutritional value of bread. The dietary salt free bread contained an increased amount of fiber, minerals, digestible carbohydrates, due to the introduction of curd whey, pollen and flax seed.

Table 4 – Comparative characteristic of chemical profile of dietary salt free bread and wheat bread

Indicator	Dietary salt free bread	Wheat bread
Moisture, g	43.0	40.0
Protein, g	9.0	7.6
Fat, g	0.9	0.9
Carbohydrates, g	53.4	50.1
Fibers, g	7.0	0.02
Organic acids, g	0.6	0.2
Minerals, g	2.5	1.8
Energy value, kCal/100g	245	231

The physical and chemical indicators and sensory profile of dietary salt free bread evaluated. Developed dietary salt free bread contains more protein (9.0 g/100g), carbohydrates (53.4 g/100g), fibers (7.0 g/100g) and minerals (2.5 g/100g) compared with traditional wheat bread.

The complex use of flax seeds, pollen, and bifidobacteria promotes an intensive flow of biochemical processes in yeast cells and acid-forming microflora. Baked bread has a glossy, corn color surface. Its taste is improved - the flavor remains longer, the crumb becomes finely porous and elastic, the volume and shelf life of bread freshness increases, the nutritional and biological value of bread increases.

#### IV. CONCLUSION

Thus, enrichment of bread with natural ingredients, especially such nutritionally valuable additives as skimmed milk powder or whey, various types of flour, bran, flax and other raw

materials, is most effective and harmless to the body. Important factors in increasing the biological value of bread is increasing the amount of essential amino acids, vitamins and minerals (macro and microelements), dietary fiber, polyunsaturated fatty acids, improving the organoleptic characteristics of bread and physico-chemical parameters - such as bread volume, elasticity, porosity.

#### Conflict of interest

The authors declare no conflict of interest.

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