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Nutritional impact of the pre-backed pizza dough made of the nutritive flours vs the classic pizza dough on the food diet

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Abstract

In this experimental research were followed the quality characteristics of the flours and the quality of pizza dough obtained from the dietetic flour, gluten-free flour and rye flour comparative with more processing flours T 000 and T 650.

The types of cereals Genius, Spelta, and Secale cereale were used for obtained the types of flour. These three types of flour were chosen due to the beneficial nutritional influence on some diets. Thus, two control samples were made from T650 flour and T 480 or T 000 flour and the new technological recipes for the pizza doughs made from Graham or dietetic flour, gluten-free flour and rye flour. The characteristics of the innovative recipes analysed were followed through comparative analysis with the characteristics of classic pizza doughs, analysing: the hydration capacity of flours, the moisture of flours, porosity of pre-baked pizza dough. The caloric value and energy intake of the studied of pizza types were calculated. It was also monitored some classic pizza assortments, estimating by simulation their caloric impact on the finished product - different pizza assortments – Pizza Caltzone, Pizza Quatrofromage, Pizza Margerrita, Pizza with tuna, pizza with corn and pineapple. The results shown lower humidity, hydration capacity and dough porosity in the case of gluten free flour.

Key words: pre-backed pizza tops, nutritive flours

1. Introduction

The flour is an extremely used ingredient in the processing of flour products, being used in the preparation of bread, pizza doughs, cake and cake tops, as well as sauces. It is an important source of carbohydrates, starch, minerals and vitamins [1].

Many times, the flour is devoid of all the beneficial properties for our health, which are lost through the excessive processing, also called refining, as well as through the addition of food additives. The wholemeal flour is the one obtained by grinding, which still contains all the fibres of the bran, as well as the minerals and vitamins from the grains.

The flour obtained with the help of a grain mill is nutritionally superior to most industrially obtained products because it contains higher amounts of vegetable fibres, minerals and implicitly vitamins than refined or processed flours [2]. That is why the trend to innovate new manufacturing recipes that contain the nutritious flours and less processed flours is a priority today. The bread is a basic food that is consumed daily, which is why the bakery industry occupies an important place in food production. Through its components, these products contribute to optimal nutrition, restoring the energy levels, maintaining health and the working capacity. In order to meet the ever-increasing and diversified requirements of a modern diet, the bakery industry in Romania produces a wide variety of assortments, which can be grouped as follows: the white bread, the black bread, the intermediate bread, the wholemeal bread, the simple pastry products, the bakery products, the bakery products with additions, the special bakery products, the dietary products, the pretzels products, the pizza products [3].

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The proposed technology allows the formation of different types of dietary flour (for bread, confectionery, pastry, pizzeria, etc.) and cereals such as "semolina" to carry out advanced processing of bran and nutritious flour, using biotechnological methods (by enzymatic modification) for the enrichment and creation of new products with new properties like humidity, hydration capacity and porosity of pizza doughs. Thereby, these could be contributing to the expansion not only of the raw material base, but also of the range of finished products. The nutritional credentials of flours made from nutritious grains: similar to wheat, with 13% protein, but lower in lysine and niacin, lower in gluten-forming protein complex, represent a good source of phosphorus and magnesium, and a very good source of manganese, the content of them being enhanced with B vitamins, especially thiamin and folic acid, grains could be a food source that reduces the obesity and the diabetes complications [4].The fundamental difference between the wheat flour and rye flour is the limited gluten-forming proteins in rye flour, which leads to the reducing of the amount of the rye flour that can be introduced into the dough without decreasing the volume of the bread. It is impossible to obtain an aerated bread, with the normal volume, only from the rye flour, because the obtained dough has neither elasticity, nor capacity to retain gases [5].

In the case of the gluten-free flours, to ensure the carbohydrates necessary for fermentation processes, some amounts of sugar are added to the preparation of these products (leavened with yeast). In celiac disease, the gliadin must be eliminated from the diet. When preparing the gluten-free bread or dough, the wheat and rye flours are replaced with the corn, rice, buckwheat flours. These flours, due to the gluten free or mucilaginous substances, as in the case of the rye flour, although these are nutritional, they do not possess baking properties. Thus, along with the mentioned flours, gluten substitutes such as the gel, the potato starch, the carob flour, the pectin, the alginates, the xanthan are used [6].

2. Material and methods

The experiment aimed to test different flours on prebaked pizza crusts for new recipes using rye flour, diet flour, gluten-free flour compared to T 000 flour and T 650 flour made from wheat.The moisture, hydration capacity and porosity of pizza doughs were studied by comparison.

2.1. The analysed samples

The flours used in this study were: the rye Flour T120, the wheat flour T 650 (Genius), the wheat flour T000 (Spelta), the dietary flour (Genius) and the gluten-free flour (Schars).

2.2. The analysed samples

Moisture determination

To determine the moisture, the infrared drying method was used at the Kern thermobalance, 10 g of each variety of flour was used, the infrared drying parameters were set, the working temperature 100±3ºC and the drying time 30', correction factor 0.98, precision interval 15 seconds. The drying of the sample ends when the final humidity of the sample to be analysed is reached, a value preset and set in the parameters of the device. The initial mass before drying M1 was weighed on the thermobalance, and after drying the mass M2 was weighed. M3 is the residual value read on the device display. The results are calculated using the formula:

W % = (M1 – M2)x 100/M3 [7].

Determination of the hydration capacity by the centrifugation method. Determining the water absorbed by a known amount of flour, by treating it with an excess of water, stirring, separating the unabsorbed water by centrifugation and weighing the flour, which has absorbed the water. The equipment used was a balance with a precision of 0.01 g, a centrifuge, an adjustable oven at 50°C. Way of working. 5 g of flour were weighed to the nearest 0.01 g, placed in a 50 ml centrifuge tube, previously tared. 30 ml of water was added, the flour was mixed with the water for 30 s using a glass rod, so that all the flour was suspended. This operation was repeated at 10-minute intervals for an hour, washing each time the upper walls of the tube, and at the end the glass rod was washed with 10 ml of water above the centrifuge tube. The suspension was centrifuged at 2300 rpm for 25 minutes. The supernatant was removed, the centrifuge tube was placed on a rack, at an inclination of 15...20°, inside an oven at 50°C for 25 minutes. After cooling in the desiccator, the centrifuge tube was weighed.

The hydration capacity is expressed in ml of water per 100 g of flour and is calculated with the relation:

Hydration capacity (%) = [(M2 – Mo) – M1] x

100, where:
Mo is the mass of the centrifuge tube, g ,
M1 is the initial mass of the flour taken in the analysis, g,
M2 is the mass of the flour tube that absorbed the water, g [7]

Determination of porosity by the volume of the core section. The method consists in determining based on reading the difference in oil level, before and after immersing the lumps of bread from which the pores have been completely removed. From a 3 cm thick pizza dough, cut 2 cubes with a side of 3 cm, a cube is cut from the middle of the dough, a cube is cut from the lower crust at a distance of 1 cm. The cubes are pressed between the palms until the pores disappear, forming 2 compact lumps, devoid of air. The lumps are immersed in a graduated cylinder, filled with oil to a well-determined level (V1). By introducing the compact lumps, the oil level rises by a volume equal to the volume of the cubes, without pores (V2). The difference in level serves to determine the volume of the pore-free core. Subtracting the volume of the lumps without pores, expressed in cm^3, from the volume of the two core cubes with pores 54 cm^3, the pore volume is found in percentage with the formula:

$$P\% = [\ 54-(V2-V1)] \times 100/54,$$

where:
V1 is the volume of oil before sinking the lumps,
V2 is the volume of oil after sinking.

Calculation of caloric content for pizza tops and classic pizza assortments. The nutritional value means the protein, lipid and carbohydrate content of the food, which is expressed in percentages. To calculate the caloric value of the food product, the amount of carbohydrates, lipids, proteins, cellulose and vegetable fibers corresponding to the amount of raw or secondary materials included in the manufacturing recipe will be calculated, after which the obtained values will be multiplied by the caloric valuescorresponding to one gram of proteins: 4.1 cal/g, one gram of lipids, 9.3 cal/g, respectively 4.1 cal/g of carbohydrates. To calculate the caloric value of the food product, the following formula will be used:

$Vn = 4.1 \times P + 9.3 \times L + 4.1 \times G,$

where:
Vn – is the energy value of the analysed food product,
P – protein content of the food product,
L – lipid content,
G – carbohydrate content;
4.1 is caloric coefficient corresponding to one gram of protein;
9.3 is caloric coefficient corresponding to one gram of lipids;
4.1 is caloric coefficient corresponding to one gram of carbohydrates [7].

3. Results and Discussion

The humidity, hydration capacity and porosity of pizza doughs have been studied through comparison and are presented in the figures 1-4.
The moisture content of the studied flours varies from T 000 flour and T 650 flour with values of 12.93% and 12.16% to lower values for rye flour with a moisture content of 11.83%, gluten-free flour with a moisture content of 8.9% and dietary flour with a moisture content of 8.86%. The low moisture values of nutritional flours also justify the increase in hydration capacity of the rye flour. (fig.1)

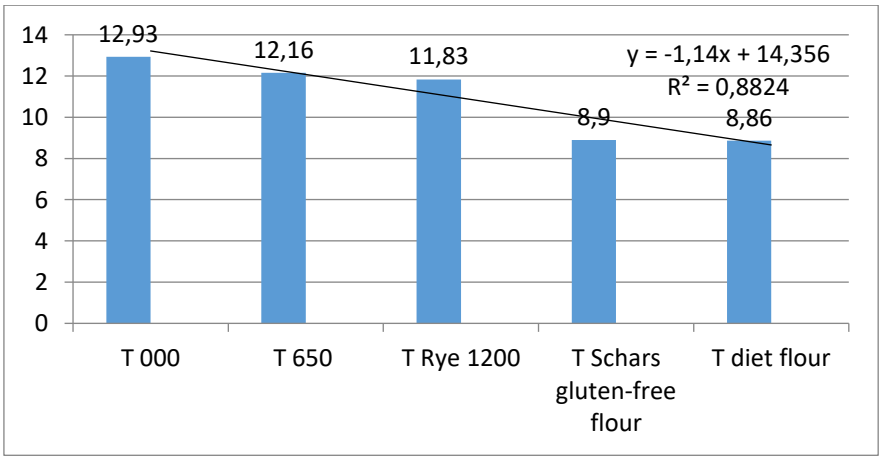

Figure 1 Evolution of flour's humidity

The hydration capacity of flours varies decreasingly from rye flour to gluten-free flour, linearly with a high confidence level R^2 = 0.9681. The significance of the obtained results is positive because the hydration capacity of the nutritious flours – the rye flour, the dietary flour and the gluten-free flour, have influenced the viscosity of the dough, in values close to the hydration capacity of wheat flour T 650 and T 000. (fig. 2).

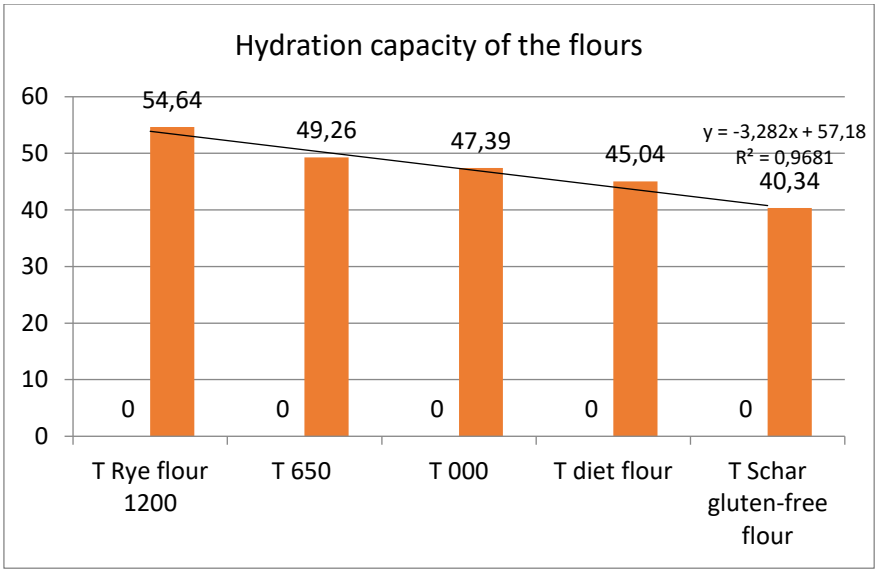

Figure 2 Dynamics of hydration capacity of flour (%)

The evolution of the surface porosity of the different pizza assortments indicated a trend of the porosity increase from 50% to 67% in the high quality flour T 000, as well as an increase from 42% to 65% porosity in the T650 flour, this being considered the standard manufacturing flours. By comparison with the flour samples used in industrial pizza production, a significant decrease in the porosity of the doughs can be observed for the rye flour, the porosity being only 30-40%, for the gluten-free flour the porosity was 20-26%, and for the dietary flour the porosity recorded values of 21-23%. Consequently, regardless of the type of pizza, the porosity of the nutritional flours was 2.5-3 times lower than the the porosity obtained in the case of standard manufacturing flours (fig.3).

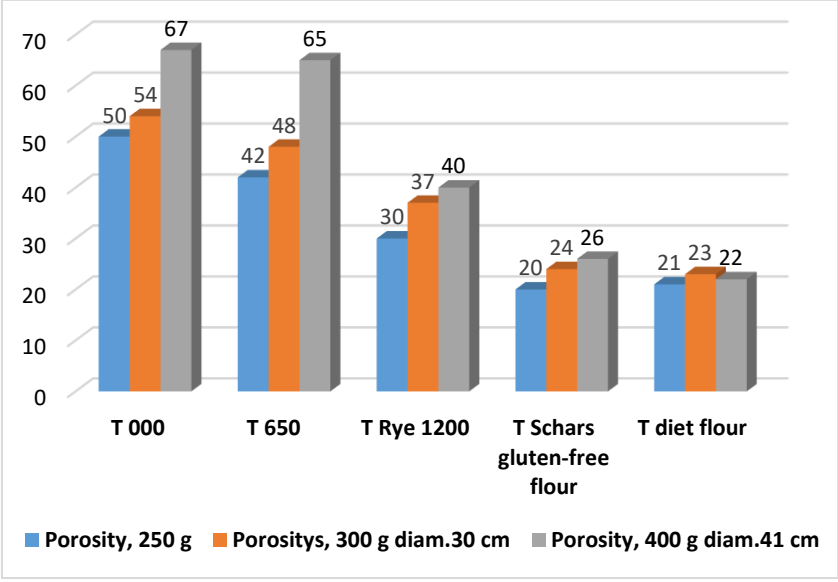

Figure 3 Evolution of the doughs porosity

This quality index, the porosity, is a technological argument that influences the

manufacture of pizza doughs, since the quality characteristics of the finished product are decisive in the consumer's purchase decision. Even though porosity and volume are two physical indicators, and they influence the shape and size of pre-baked pizza doughs, Consequently the two indicators determine the orientation of consumers for choosing or rejecting the finished product. The caloric content of pizza doughs is significantly influenced by the flours used, the size of the pizza assortment and the additions introduced in the manufacturing recipe.

Fig. 4 shows that the doughs obtained from the standard T 000 and T 650 flours have a higher calorie content, from 650 calories for pizza small with a diameter of 25 cm to 1120 calories for pizza extra-large with a diameter of 41 cm.

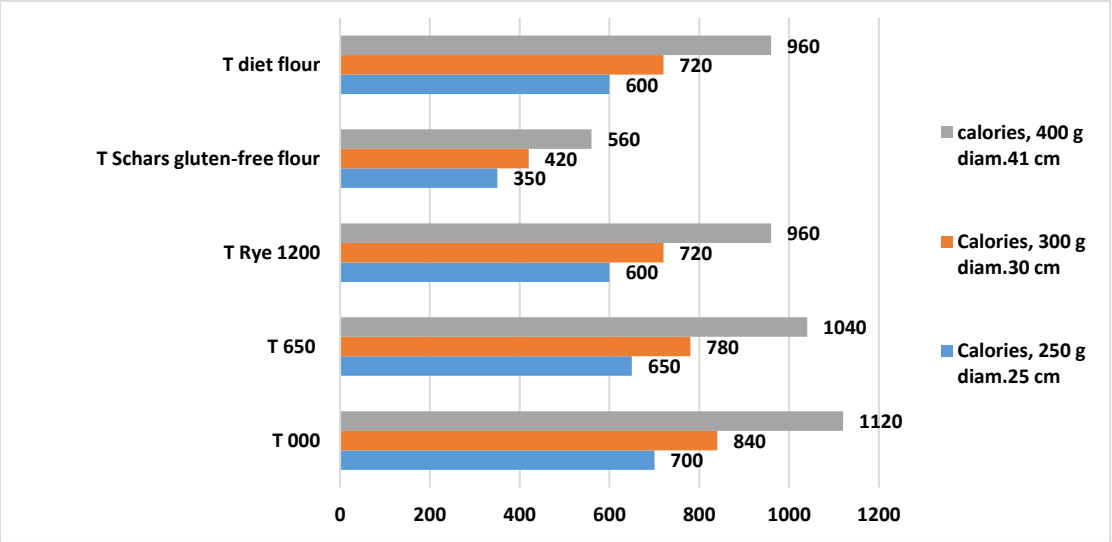

Figure 4 Dynamics of the calories of pre-backed pizza doughs

So more than 1000 calories of a pizza dough is not recommended in a diet of 2100 – 2500 calories/day. Also, it can be seen that fig.4 shows the caloric values for pizza doughs obtained from the nutritious flours – the rye flour and the dietary flour with a variation of 600-960 calories/dough, the gluten-free flour with the smallest variation of 350-560 calories/dough. So, the most recommended pizza dough as nutritional, at least according to the caloric weight, would be the pizza dough obtained from the gluten-free flour, which was highlighted with a minimum caloric level of only 560 calories/41 cm dough, that is, in the assortment of pizza extra-large. Unfortunately, the manufacture of this variety is not common because, on the one hand, the gluten-free flour is 5 or 6 times more expensive than T 000 flour or T 650 flour, and the manufacture of dough from the gluten-free flour gives a less porous product, without volume, which induces the impression of a smaller finished product. However, pre-baked pizza doughs made from gluten-free flour are better nutritionally. Related to the content of the cellulose, the vegetable fibers, the rye flour is significantly richer in cellulose (2.5-4%) compared to the gluten-free flour (0.25-0.4%) or the dietary flour (1.9-3.2%). The pizza doughs with a higher content of vegetable fiber, cellulose, are better for an easy digestion. Compared to standard flours frequently used in manufacturing today, T 000 flour had 0.25-0.4% cellulose and was very similar to the gluten-free flour which had 0.25-0.4% cellulose, while classic T 650 flour with 0.5-0.8% cellulose highlights an average position related to the vegetable fiber content. The most nutritionally recommended when we talk about fiber content, are the dietary flour and the rye flour (fig.5).

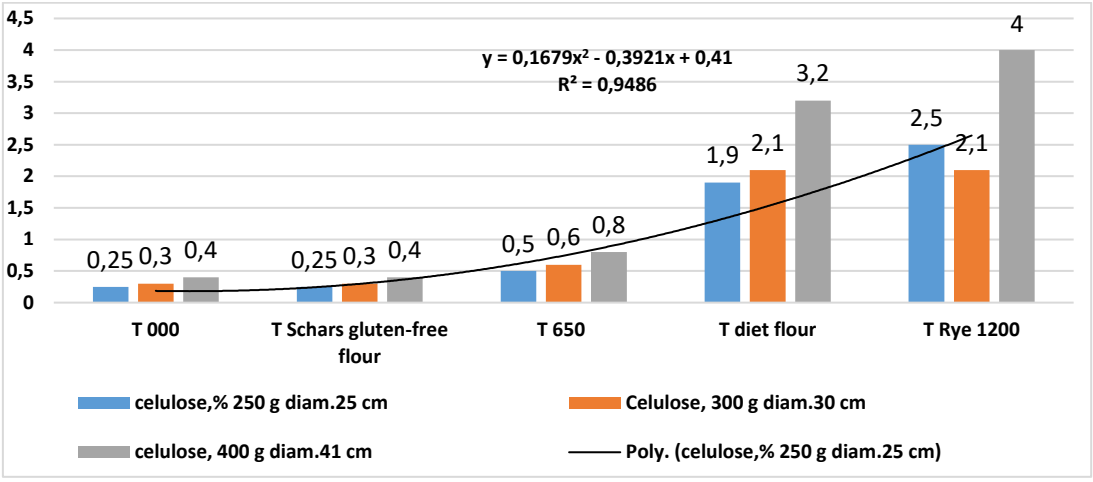

Figure 5 Dynamics of cellulose at different assortments of pizza small, medium and extra-large

The nutritional advantages and disadvantages in the case of the consumption of classic pizza assortments are presented in fig.6 and fig.7.

According to the number of calories, the most recommended assortment of classic pizza was Pizza Margherrita, having only 1345 calories / 250 g, and according to the weight of vegetable fibers, the most recommended could be Pizza with tuna, corn and pineapple, having 0.8% vegetable fibers and 0 .74% cellulose. From this it follows that the pizza with less protein is nutritionally more recommended than the pizza with an increased weight in protein, which also stood out with the highest weight in the vegetable fiber content. (Fig.7).

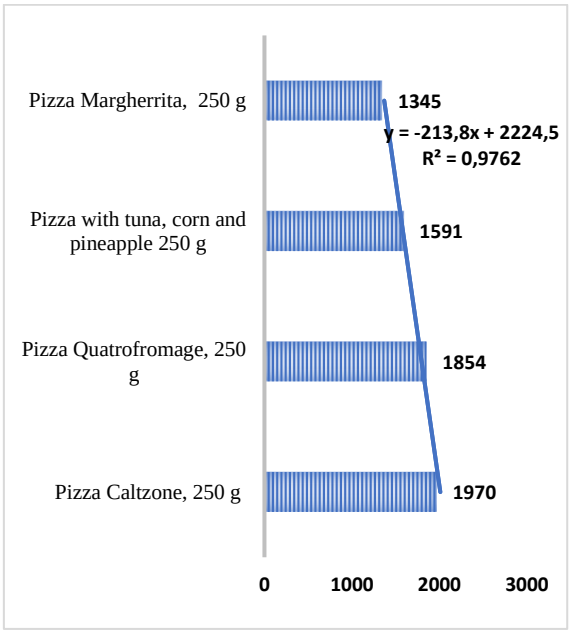

Figure 6 Dynamics of calories for the classic assortments of pizza, (calories)

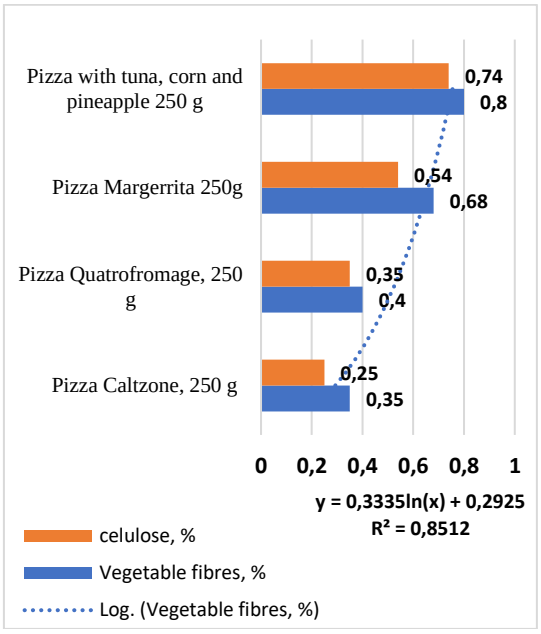

Figure 7 Evolution of the vegetable fibers and the cellulose for the classic assortments of pizza (%)

4. Conclusions

1. The flour moistures and hydration capacity evolved decreasingly from T 000 flour to the dietary flour. The gluten-free flour also has a lower hydration capacity.

2. As a result of the flour composition, the pizza doughs had a decreasing porosity from the doughs obtained from the wheat flour T 000 and T 650 with porosity of 65-67%, to the rye flour with an average porosity of 30-40% and the diet flour with 21-23% porosity and the gluten-free flour with 20-26% porosity.

3. The caloric content increased from the gluten-free flour to T 000 flour. Similarly, the rye flour and the dietary flour recorded a lower caloric weight. The lowest caloric weight

was registered with the gluten-free flour.

4. The content of cellulose, insoluble fibers varied increasingly from the dough made from T000 flour, to the dietary flour and to the rye flour, registering the highest intake of insoluble fibers.

5. The pizza dough made from the gluten-free flour is recommended as low-calorie and for people with the gluten intolerance, and the pizza doughs made from the rye and the dietary flours are recommended for better digestion, in the case of people with the digestive disorders.

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