PHYSICO-CHEMICAL CHARACTERIZATION OF A FRUIT BAKERY PRODUCT

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Abstract. *Tests were carried out in order to obtain a bakery product with different types of addition. For a high intake of vitamins and antioxidants, but also for improving the appearance and flavor of the product, we used blueberries, blackcurrants, cranberries and goji. The following parameters were analyzed: porosity, elasticity, moisture, fat, minerals and acidity. The elasticity was 77.81% for the blueberry product, 65.17% for the black currant product, 62.18% for the cranberry product and 50.21% for the one with the addition of goji. Tests were conducted to obtain a bakery product with different types of fruits. For a high intake of vitamins and antioxidants, but also to improve the appearance and flavor of the product, we used blueberries, blackcurrants, blueberries and goji berries. Fat varied in the range of 1.27% for the product with the addition of blackcurrants and 2.59% for the product with the addition of blueberries. The mineral content varied in the range of 0.12% for the product with the addition of black currant and 0.41% for the one with goji. The goal of this study is to obtain a functional bakery product.*

Keywords: black currants, cranberries, blueberries, goji

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INTRODUCTION

Flour is the basic raw material used in the bakery industry and is obtained by milling wheat or rye kernels, resulting in three types of flour: white flour, semi-white flour and black flour. Flour extraction is the amount of flour obtained from 100 kg of wheat and by increasing the degree of flour extraction, the mineral content, the coating content and the colouring of the flour is increased (Ilarie et al., 2007). The addition of salt increases the dough forming time and reduces the dough softening. Fine-grained salt is preferred because it needs to be evenly distributed throughout the dough mass in order to display all its characteristics (Banu, 2009). Lipids also play a role in the baking process, mainly by forming complexes with amylose and amylopectin that prolong the freshness of the bread (Niculescu, 1987). The content of proteolytic enzymes increases only in flours from sprouted grains attacked by wheat weevil (Banu, 2009). The hydration capacity of flour is the amount of water absorbed by the flour to obtain a dough of standard consistency. This is possible due to the main components of flour: gluten, starch and cellulose, which absorb and retain water (Moldoveanu, 1973). Gluten if left behind as a "rubber-like proteinaceous mass" after the soluble components of wheat flour and starch granules have been washed off with water. Vital gluten is the name of the final powdered product that has been dried at low temperature under 55°C. When water is added again, it regains it's distinctive qualities, including elasticity, viscosity and the capacity to form films (Schopf and Scherf, 2021). The gluten of strong flour develops greater strength and elasticity, and the gluten of lean flour shows less strength, resulting in lower elasticity (Banu, 2009). "Weaker flours are those that contain such sugars in greater quantity, and those of higher extraction have more active ferments, which makes these categories of flours to have high capacity to form fermentation gases" (Moldoveanu, 1973). The hydration capacity of flour is represented by the amount of water absorbed by the flour to form a dough of standard consistency, expressed in millilitres of water absorbed per 100 g of flour. The standard consistency is 0.5 kgfm or 500 U.B. (Brabender units). The hydration capacity varies according to the quality and extraction of the flour (Moldovanu et al., 1973). Changes in temperature have an effect on the yield of transformation of the substrate into the desired product, on the nutrient requirements of the yeast, the composition of the biomass obtained and the growth rate (Voica, 2007). Yeasts need a quantity of free water to ensure an adequate transfer of nutrients into the cell for normal growth (Anghel, 1991). Most of the flavour-producing substances are formed during baking. It is very important that fermentation is controlled; only in this way can a pleasant flavour be obtained, because chemically a very acidic product is not able to ensure adequate quality (Kaseleht et al., 2011). During the fermentation process, starter cultures show an advanced performance due to the decrease in pH value, increase in total free acidity and

through the production of fatty acids (Gereková et al., 2011).

Benefits of fruits used to manufacture the product

Blueberries. In a study conducted on rats, adding blueberry powder to their diet for 90 days was found to be beneficial. The results showed a decrease in the percentage of fat in the abdominal area, the number of triglycerides was reduced, cholesterol was lower, but an increase in insulin sensitivity was observed (Cignarella et al., 1996). Blueberries may lead to cancer prevention due to their content of pterostilbene and aleagic acid which together with anthocyanin, vitamin C and copper make this possible. Blueberry leaves and fruits possess significant properties thanks to tannin, have antibacterial and antidiarrhoeal activity, modifying the intestinal pathogenic flora favourably. It is recommended for those with diabetes (lowers blood sugar), gout, enterocolitis, intestinal parasitosis, urinary infections, rheumatism, dermatological disorders, peripheral circulation disorders, urethritis, somatitis, eczema, (Preda, 1989). Blueberries have an antipurid effect and help to treat fermentation enterocolitis, dysentery and urinary infections. They are a liver tonic, contributing to the regeneration of liver cells. They also contain mytilin (plant insulin) which lowers blood sugar levels and is recommended for treating diabetes. Anthocyanins provide cranberries with vasoprotective properties and are recommended for treating atherosclerosis, coronary heart disease, heart attack sequelae, arteritis, varicose veins (Mihăescu, 2007). Jarwin C.D. (1976) proves that by drinking a glass of cranberry juice with meals, calcium deposition on the walls of blood vessels is prevented. Due to their high content of bactericidal substances, cranberries are a powerful intestinal antiseptic (Mihăescu, 2007).

Cranberries. They belong to the *Enicaceae* family, genus *Vaccinium Vitis Idaea L*. The cranberry fruits are rich in organic acids and are used in the production of marmalade and compotes, and for therapeutic purposes the leaves are used, under the careful supervision of a doctor (Răpeanu et al., 2001). The tannins have a synergistic action with hydroquinone, due to their astringent and antiseptic properties and qualities (Temelie, 2004). Antioxidants such as polyphenols, ascorbic acid and triterpene compounds are abundant in cranberries. They eliminate reactive oxygen species that oxidize biological matter and scavenge free radicals. Numerous illnesses can be brought on by oxidative stess, which is caused by excessive levels of free oxygen radicals in the body's biological fluids. Antioxidant substances can stop or lessen oxidative cell structure damage. They play a crucial role in halting the progression of chronic illnesses like cancer, diabetes, inflammation, cardiovascular disease and aging (Nemzer et al., 2022).

Blackcurrants. Part of the *Grossulariaceae* family, genus *Ribes cassis*. A few of the compounds that have been identified through biochemical profiling of blackcurrants are flavonoids, polyunsaturated fatty acids, structural and nonstructural carbohydrates, non-volatile organic acids, tannins and stilbenes. Anthocyanins and flavonols are two of the polyphenolic chemicals with a diphenylpropane structure found in blackcurrant flavonoids (Gopalan et al., 2012). Due to anthocyanins, blackcurrants contain vitamin C in a stable and biologically active state, due to the lack of the enzyme ascorbicoxidase, which inactivates vitamin C and converts it into dehydroascorbic acid. Polyphenols are found in fairly high quantities (0,16-0,33%), represented by tannins and anthocyanin pigments. They are used in the preparation of jams, syrups and cakes. they are mainly used in the form of wine, syrup, peel, and even in the manufacture of certain medicines (Mihăescu, 2007).

Goji. It belongs to the *Solanaceae* family, genus *Lycium*. This plant helps to lower blood pressure, blood sugar, has an antipyretic and haemostatic effect (Foster et al., 1992). The most significant bioactive components of goji berries are thought to be water-soluble polysaccharides. Studies using animal models have demonstrated that oral treatment of polysaccharides (5, 10 and 20 mg/kg/day) increases the rate at which food is converted into energy, lowers body weight, and lessens insulin resistance (Vidovic et al., 2022). It is a powerful antioxidant and aphrodisiac. Goji optimises the recovery processes and improves eyesight. It is a rich source of vitamin A, B1, B2, B6, C, E, amino acids and minerals, with healing properties. They have also been called "the elixir of youth", they are used to treat diabetes, hypertension and vision problems caused by ageing. The acceptable sensory qualities of raw and dried goji berries, as well as the reviving nature af various food products enhances with them, are due to the balanced amount of sugars

(fructose, glucose and sucrose), organic acids and certain secondary metabolites (Vidovic et al., 2022; Highway, 2014).

MATERIAL AND METHOD

Determination of the porosity of the finished product. Determine the total volume of pores in a total volume of core knowing its density and mass. Use a cylindrical punch (very sharp), a knife and cut two or three 20 mm thick slices from the bread. Use the perforator to remove three cylinders of core, one from the centre of the slice and the others at a distance of 1 cm from the crust or 2 cm when the crust is burnt. The cylinders are cut by pressing and twisting the perforator into the mass of the core, which is then oiled before use. The height of the cylinders is measured with a ruler. The two cylinders are weighed on a technical balance.

Elasticity is determined by pressing the core under certain conditions and measuring the height to which it returns. A cylindrical perforator (used to determine porosity), a device for determining elasticity, is used. A cylinder of 6 cm height is cut from the core, its initial height is read accurately, then the core cylinder is pressed to half its initial height and kept in this condition for 1 minute. After one minute the height is read off.

Determination of fat. Extraction of fat from the test sample using an organic solvent (petroleum ether) in the Soxhlet apparatus, removal of the solvent, drying and weighing of the extracted fat. Mineral substrates. Determination of the residue obtained by calcining the test sample at 550-600° C using a thermoregulated electric furnace.

Moisture. Oven-drying of an unmixed core sample until the mass remains constant and the percentage weight loss represents the moisture content of the test sample. We have carried out tests in order to obtain improved products with the addition of freeze-dried fruits (blueberries, goji, cranberries and blackcurrants).The following raw and auxiliary materials were used: white wheat flour, type 000, buffalo milk, compressed baker's yeast; salt, sugar, egg, sunflower oil and freeze-dried fruit. To make the product, we followed the technological parameters laid down in the technological scheme for obtaining a pastry product but improved it by adding freeze-dried fruit.

RESULTS AND DISCUSSIONS

The product obtained was analysed under physico-chemical (Table 1) and sensory aspects. In order to provide a high intake of vitamins and antioxidants and to improve the appearance and flavour of the product, we chose freeze-dried fruits, namely: blueberries, currants, cranberries and goji berries.

The elasticity was 77.81% for the blueberry product, 65.17% for the blackcurrant product, 62.18% for the cranberry product and 59.21% for the goji berry product. The fat content varied in the range of 1.27% for the product with added blackcurrant and 2.59% for the product with added cranberry. The mineral content varied in the range of 0.12% for the product with added blackcurrant and 0.41% for the one with goji (Table 1). The porosity showed the lowest average values in the product with goji 61.42%, followed by the product with blackcurrant 67.22%, blueberry 68.22% and the highest values were for the one with blueberry 73.31%. Moisture varied in the range of 35.2% for the cranberry product and 41.54% for the blackcurrant product. The mineral content was highest in the goji and cranberry product. Acidity showed the highest values in the blackcurrant and blueberry product. Following a questionnaire on the assessment of the sensory characteristics of the product, the product with added cranberries was the most appreciated from a sensory point of view, followed by cranberries, blackcurrant and goji. The products were tasted by a total of 30 people. 80% of the people who tasted the product said that they appreciated the added fruits because of the benefits they bring. 20% specified that they choose the products based on appearance, taste and price.

Table 1

Average values and variability of buffalo milk pastry

Freeze-dried fruit pastry				
Parameter	Blueberries	Blackcurrants	Cranberries	Goji
	x±sx	x±sx	x±sx	x±sx
Elasticity (%)	77.81±0.54	65.17±1.18	62.18±1.02	59.21±1.19
Porosity (%)	73.31±0.69	67.22±0.47	68.22±0.38	61.42±1.07
Moisture (%)	39.09±0.25	41.54±0.29	36.55±0.29	35.2±0.22
Fat (%)	2.59±0.17	1.27±0.08	2.53±0.06	1.95±0.42
Minerals	0.28±0.03	0.120±0.04	0.29±0.02	0.41±0.22
Acidity (°)	2.51±0.06	3.04±0.07	2.46±0.05	1.98±0.16

n=3 samples/product with blueberries/blackcurrants/cranberries/goji

CONCLUSIONS

The products obtained meet the physico-chemical and sensory characteristics in force for bakery products. From a sensory point of view, the fruit used added value to the product due to its benefits and chemical composition. The addition of buffalo milk also improved the sensory characteristics, which were appreciated by the tasters.

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