

Aspects regarding the importance of using mushrooms in food and possibilities of their introduction in basic food products

Oana Maria Popa¹, Ovidiu Tița^{2*}

¹Doctoral School of "Lucian Blaga", University of Sibiu, 550024, Sibiu, Romania,

²Faculty of Agriculture Science, Food Industry and Environmental Protection, "Lucian Blaga" University of Sibiu, 550012, Sibiu, Romania

Abstract

The aim of the study is to investigate the impact of the introduction of mushrooms into basic food products such as sour dairy products to highlight the importance they bring and the very great benefits for improving the organoleptic characteristics of the products, increasing the intake of nutrients and an important source of vitamin D that helps fixation of calcium and phosphorus in the body.

For the proposed research the attention was focused on developing two sour dairy products enriched with mushrooms from the species *Chantarelus cibariu* for the first sample and *Boletus edulis* representing the second sample. The developed assortments together with a blank sample represented by a simple lactic acid assortment were subjected to a series of sensory and physico-chemical analyzes that took place over 14 days to determine the changes that occurs.

The obtained results showed that the addition of mushrooms added to the dairy assortments brings significant modifications both from an organoleptic and physico-chemical point of view. Sensory, the tasters responded positively to the developed assortments, and from the physico-chemical analyzes compared to the blank sample. The results were quite significant, especially in the case of acidity where, according to the graphs were recorded the largest increases.

The results support the idea of using mushrooms to enrich different products that constitute the basis of consumers' nutrition while presenting additional benefits.

Keywords: dairy products, mushrooms, organoleptic analysis, benefits

1. Introduction

Fermented milk belongs to the category of acidic dairy products whose purpose is to serve as food after the fermentation operation using lactic bacteria [1]. Buttermilk is a highly appreciated and consumed fermented milk product in the country, it is obtained by fermenting pasteurized milk with selected cultures of lactic streptococci. 4 types of buttermilk are cured, only from cow's milk:

- Skimmed milk fat with 0,1% fat;
- Fat milk with 2% fat;
- Sana beaten milk with 3.6% fat;
- Extra fat beaten type with 4% fat.

To obtain the innovative product was added to the dairy product mushrooms powder from the species *Chantarelus cibariu* and *Boletus edulis*.

Cantharellus cibarius is a species of edible fungi of the *Cantharellaceae* family and *Cantharellus* genus, which co-habitates, being a symbiont of mycorrhiza (forming micorides on the roots of the trees). Mica formation is achieved through high glucose demand and due to good gas exchange with carbon dioxide [2]. The sponge grows in Romania, Bessarabia and Northern Bucovina in deciduous forests (under beech, oak), such as conifers, often

on mussels and among blueberries, or through raspberries and blackberries from May to October (November).

Description:

- **The heat:** It has a diameter of 3-8 cm, it is smooth and glossy, yellow in color, as in the orange or white sponge variations, in the young, with regular edges downwards, and in maturity it takes the shape of a deeply deep funnel with curled, lumbar or curled edges, and sometimes cracked. On the surface there are often small holes. It is very rarely attacked by worms.
- **Himenophore:** The mushroom has no blades but pseudo-lamellae, like bifurcated and protruding twigs, of the same color as the hat, which often draw almost to the foot. Spores are elliptical and smooth, their powder is slightly yellowish.
- **The foot:** He has a height of 3-8 (10) cm and a thickness of 0.7-2 cm, being the same color as the hat, is robust, hard, smooth, in the shape of a truncated cone, first full and fleshy, in old age.
- **The meat:** It is hard, fibrous, generally white-yellow with a slightly peppery taste but pleasant and smells a little like peach and a little like apricot. Almost never wormed.

Boletus edulis is a genus of fungi of the phylum Basidiomycota in the *Boletaceae* family that includes well over 100 species and coexists as a mycorrhizal symbiont. The generic name is derived from the latin word (*boletus*) which in turn derives from the ancient Greek word bolitos which means "mushrooms from the ground" and is popularly known as hribi [3].

Description:

- **The heat:** it has a smooth and non-glossy hat of various colors from white-grey and yellowish to dark brown with a diameter of up to 30 cm. At first, the hat is hemispherical, later always having the shape of a pillow.
- **Tubes and Pores:** It has tubes fixed vertically under the hat. These tubules fall after the spore maturation process. Their color differs a lot, in most cases they are white, yellow or red.
- **The foot:** it has a stout, fleshy leg up to 10 cm wide, generally short with a bulbous base up to 12 cm wide, sometimes fusiform. The colors are

very different: white, yellow, brown, reddish brown [4].

Vegetable protein obtained from mushrooms ranks second, worldwide after soybean. Edible mushrooms are generally considered foods of high nutritional value. The edible part of a mushroom represents more than 3/4 of the product used by the consumer. The chemical composition of fungi differs from one species to another depending on the stage of development, the nutrient substrate they grow, the morphological aspect taken into account, the growth period, the microclimate conditions, etc. Laboratory analyzes have shown that 100-200 g of dried mushrooms consumed daily by humans can replace meat consumption.

The mushroom species was chosen because of the variety of ingestions it gives and the high protein content compared to most vegetables.

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2. Materials and methods

2.1. Materials:

- raw material milk from Horticola Seviş farm in Sibiu County
- blank sample
- cultures DVS, from DR.Ch. Hansen
- mesophilic and aromatic lactic bacteria culture
- mushroom powder *Chantarelus cibariu* and *Boletus edulis* species

2.2. Methods:

The raw milk was pasteurized at 85-95 °C for 20 minutes, cooled to 30-32°C and then sowed using DVS cultures. Downy milks were introduced into the seeded milk, then thermostated at 30-32 °C for 7 hours, and finally the obtained dairy product was cooled to 6-8 °C. After that the milk was enriched with mushrooms powder from the species *Chantarelus cibariu* for the first sample and *Boletus edulis* for the second.

Sensory analysis: the proposed method was the low point score method, the order-by-order method, and the sensory characteristics appreciated were: external appearance and consistency, taste and smell [6].

Acidity determination: was performed by titration with sodium hydroxide, 0.1 n solution, in the presence of phenolphthalein as an indicator, expressed in °T [7].

Lactose content:

- was analyzed by the polarimetric method II, which consists in the deproteinization of the milk, the obtained filtrate is polarized and the percentage of lactos is calculated from the measured rotation [7].
- was determined using the "Novasina" device. The homogenous sample was placed in special plastic ampoules, after which the ampoules were inserted one by one into the apparatus, where the activity of the water in the product was determined.

3.Results and discussion

Following the study over a 14-day period, the results presented and interpreted below were obtained.

- The analyzed samples were noted as follows:
- PM- blank sample, simple buttermilk;
- CB- buttermilk with *Cantharellus cibarius* mushroom powder;
- BE- buttermilk with *Boletus edulis* mushroom powder.

A.Sensory analysis

For the evaluation of the external appearance, we used the ordering method by ordering the samples. All samples were evaluated successively by each taster on all proposed days, and the results are presented in Fig. no.1.

The resultant results show that the appearance of the samples are close to the blank sample in day 1, but in the last day, the sample BE had the best score.

For the evaluation of the odor, we used the ordering method by ordering the samples according to the intensity of the sensory characteristics. The results are presented in Fig. no. 2.

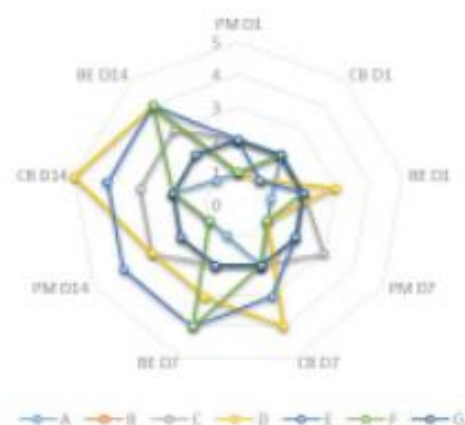


Fig. no. 1. Evolution of the external appearance for the 3 samples

Legend:

- PM - blank sample; CB - buttermilk with *Cantharellus cibarius*; BE - buttermilk with *Boletus edulis*
- D1 – day 1; D7 – day 7; D14 – day 14
- A, B, C, D, E, F, G – taster

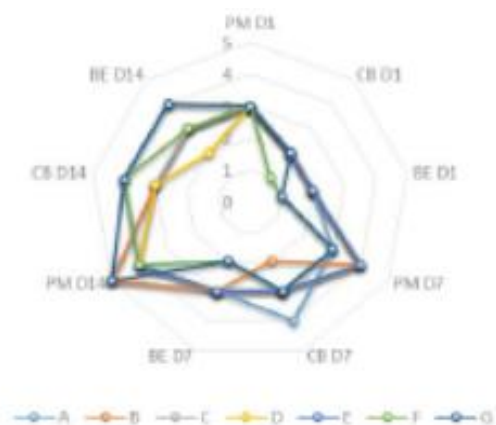


Fig. no. 2. Evolution of odor for the 3 samples

Legend:

- PM - blank sample; CB - buttermilk with *Cantharellus cibarius*; BE - buttermilk with *Boletus edulis*
- D1 – day 1; D7 – day 7; D14 – day 14
- A, B, C, D, E, F, G – taster

The order of the samples according to the results obtained by the smell appreciation by the tasters is the following: PM followed by CB and BE with almost the same value. It can be said that the innovative product obtained is quite well appreciated but the testers preferred the blank sample.

For the taste analysis, a scale of intensity was used as follows: 0 - not taken into account, 1 - weak, 2 - moderate, 3 - strong. The seven tasters tasted successively the 3 samples on days 1, 7 and 14 and scored for each sample the sensation by the intensity value using the scoring scale from 0 to 3. The results of the analysis are shown in Fig. no. 3.

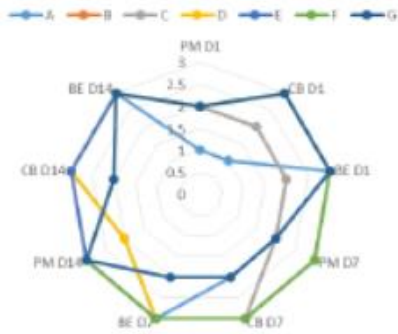


Fig. no. 3. Taste evolution for the three samples

Legend:

- PM - blank sample; CB - buttermilk with *Cantharellus cibarius*; BE - buttermilk with *Boletus edulis*
- D1 – day 1; D7 – day 7; D14 – day 14
- A, B, C, D, E, F, G – taster

Following graphic representation, a variety of values can be found according to each taster's preferences. After calculating an average for each sample over the 14 days, the order of product rating is as follows: BE with 60 points, CB with 55 points and PM with 48 points. It can be concluded that the innovative product obtained is appreciated in comparison to a classic product.

A. Acidity determination

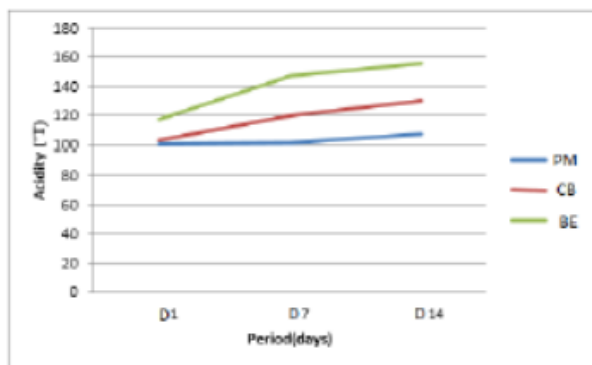


Fig. no. 4. Evolution of acidity for the 3 samples

Legend:

- PM - blank sample; CB - buttermilk with *Cantharellus cibarius*; BE - buttermilk with *Boletus edulis*
- D1 – day 1; D7 – day 7; D14 – day 14

All 3 samples were analyzed for acidity determination. After processing the results from the obtained graph an increase in acidity is observed over the 14-day period, from the blank sample to the addition of mushroom powder, mostly in the case of *Boletus edulis* sample.

C. Lactose results

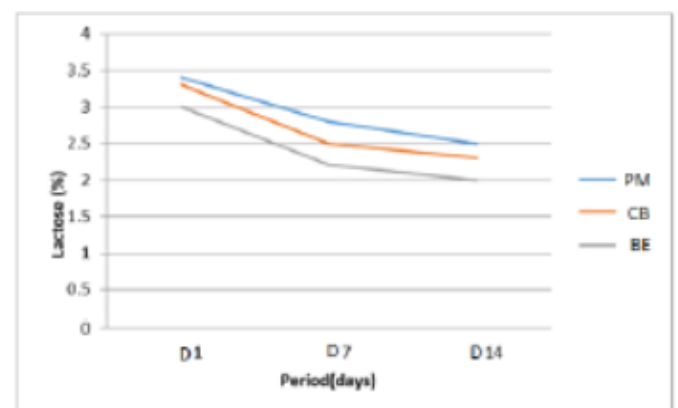


Fig. No.5. The evolution of lactose for the 3 samples

Legend:

- PM - blank sample; CB - buttermilk with *Cantharellus cibarius*; BE - buttermilk with *Boletus edulis* ;
- D1 – day 1; D7 – day 7; D14 – day 14

For determination of lactose content, all three samples were subjected for 14 days as in the case of acidity. The results from the graph following the determinations show a decrease in the lactose content, which is justified because by increasing the acidity the lactose decreases.

4. Conclusions

The obtained results showed that the addition of mushrooms added to the dairy assortments brings significant modifications both from an organoleptic and physico-chemical point of view. Sensory, the tasters responded positively to the developed assortments and from their results we can see that they are willing to accept useful additions and a product like this can be accept on the market.

The most obvious changes resulted from the physicochemical analysis, which has a greater increase in acidity compared to the blank sample.

In conclusion, the products obtained by the mixture of beaten milk and mushroom powder is an appropriate product, according to the sensory analysis, whose characteristics are not very different from those of simply milk products.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exist) respect the specific regulation and standards.

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