JAP&T
TPA-Timişoara

Available online at http://journal-of-agroalimentary.ro

Journal of Agroalimentary Processes and Technologies 2020, *26*(4), 375-379

Journal of Agroalimentary Processes and Technologies

Development and characterization of an innovative prototype of pork sausage

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Abstract

The purpose of this study was to develop a new recipe to obtain a special innovative pork sausage, to develop the manufacturing process, technological stages, and nutritional analysis of the final product. We obtained this product starting from a classic recipe (of pork sausage), it was added blueberry fruit. Blueberries are fruits with a high content of antioxidants. The addition of antioxidants to meat products is done to prevent lipid oxidation, delay the development of off- flavours and improve colour stability.

The main features observed in the sample of sausage (simple sausage and sausages prepared with added blueberries) where: protein (%), fat (%), carbohydrates (%) and energetic value (kcal/100g).

Following the research that have been undertaken in this work, the obtained product (sausages with fruit) can be included in the category of secure products of consuming.

From an organoleptic point of view, these sausages were in line with the rules previously established.

This work demonstrate that this prototype can be considered a food variant due to its high nutritious properties and to its distinguished taste too.

Keywords: sausages, blueberry, pork, nutritional characteristics

1.Introduction

Sausages are one of the oldest forms of meat processing. It is possible that the origin of the manufacture of sausages began when people realized that salt is an effective preservative. There is evidence that the sausage existed for at least several thousand years. Sausages are a significant source of protein. The quality of the meat and traditional production technology ensures their unique sensory properties [1, 2]. Dried sausages have been produced in many European countries [3, 4].

In last years, production of functional and healthier meat products is one of the most important purpose of meat product processors. It is important to find techniques for improving the quality of these products [1, 5, 6, 7, 8].

Previous studies have shown that a diet with high animal fats may increase the risk of many diseases, such as colon cancer, cardiovascular disease, and obesity [9].

Sausages usually consist of pork, beef, fat, salt, and spices. In our country there are many different types of dry natural sausages. There is poorly research to show to what extent the qualities of sausages vary, depending on the ingredients used in their formulation and the processing conditions.

The present study was conducted to develop a new prototype of pork sausages, which is based on the use of dried fruits. This prototype of homemade sausages is rich in bioactive compounds and has lower content in fat. The study was designed to evaluate the effect of dry fruit on physico-chemical properties and sensory profile of pork sausages. This study aimed to improve the nutritional quality of dry sausages using dry fruit rich in bioactive compounds.

2. Material and Methods

The samples that were taken in the analysis were homemade dry sausages prepared by us and other two dry pork sausages samples purchased on the Romanian supermarket.

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Notations used: sausages from different industrial manufacturers purchased on the Romanian supermarket (CS1, CS2, and CS3) and homemade sausages dried by smoking (CHM4 - sausages with blueberries, CHM5 - control sausage). We also analysed the two types of pork sausages purchased on the Romanian market.

Ingredients and preparation of the experimental batches

In home-making conditions, we have prepared experimental batches of dried sausages with dry fruit addition and without addition of fruit (3 batches for each experiment). The sausage composition was prepared by mixed of well-chosen pork meat (< 10% fat), hard lard, garlic, salt and spices. Sausages were made according to a traditional recipe from Gorj county (in an Oltenia household).

The sausages were prepared according to the traditional recipe from Oltenia Region. In the case of sausages with dried fruit, we used the same recipe, but we added blueberries dried fruits. The fruit ratio: (meat + meat and fat) was 1:25.

The meat and the ingredients were bought from the stores from Gorj and commonly used for the prepared of traditionally sausage. It was used garlic and the spices: thyme, black pepper, coriander and allspice. For preparation of the pork sausages we used the following spice mixture content: coriander *(Coriandrum sativum)* -13%, allspice *(Pimenta dioica*, also called *Myrthus pimento)* -15%, black pepper *(Piper nigrum)* -29%, thyme *(Satureja hortensis)* - 43%. Dry fruits were procured from local market.

The manufactured of sausages requires the following steps: choosing of the connective tissue (lean meat) and fat meat, cutting the meat and the hard lard into 5 ÷ 7 cm cubes; obtaining minced meat with an electric mincing machine (with a sieve which has 6 mm holes); measuring the ingredients; adding them to the meat and lard mix and homogenizing the composition.

The meat paste was stuffed into pork intestines. The sausages were subjected to the drying process. The ripening process lasted for 30 days until the desired sensorial, physical and (bio)chemical and microbial characteristics of the products were achieved.

Physicochemical analysis and nutritional characteristics

All chemicals used for analyses were of an analytical grade. All samples were analysed for physicochemical parameters within the next 48 hours upon arrival into the Laboratory.

The moisture content in sausages samples were determined gravimetrically at 103°C in an oven (according to ISO 1442:1997) [10].

The NaCl content was determined through the Mohr method according to STAS 9065-5/73 [11].

The amount of crude protein and ***fat*** in the samples was determined on the dry sample. Fat content was estimated by Soxhlet extraction by using petroleum ether [12]. The Kjeldahl method was used to determine the crude protein content (the FOSS 8400-8420 apparatus) were following the manufacturer's application notes. This method is based on determined of the nitrogen content from the samples. The test sample (1 ± 0.2 g) is mineralized with 98% sulfuric acid in the presence of a catalyst and boiled at 450°C for 45 minutes. The nitrogen captured is multiplied by the conversion factor - 6.25 - and expressed in crude protein equivalent (using the formula: % Protein = % Nitrogen x 6.25). The analyser is an automatic device that, by entering the data and the weight of the sample, generates the automatic result, expressed in% of crude protein.

Total carbohydrates were calculated by difference. ***The energy value*** was calculated by using the following equation: energy (kcal) = 9 × (g lipid) + 4 × (g protein + g carbohydrate).

All determinations were performed in duplicate, calculating the arithmetic mean of the two separate determinations. The data were statistically analysed using the program Microsoft Excel.

3. Results and Discussion

Basic nutritional properties. Chemical characterization of sausage sample

The results of *water content* of samples are shown in Figure 1. The result was the arithmetic mean of the two parallel determinations (for each sample), which do not differ by more than 0.5 g of water per 100 g of sample to be analysed.

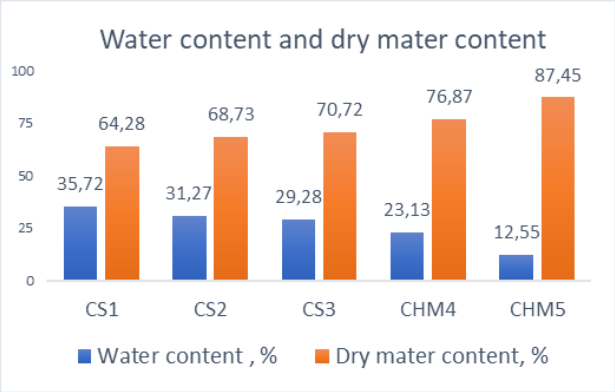

Figure 1. Water content and dry mater in sausage sample

From the experimental data presented in Figure 1 it can be observed that the highest content water was found in sample CS1 and the lowest in CHM5 sample. Regarding dry content, the lowest value was found in CS1 sample. Samples CHM4 was obtained by adding dried sea buckthorn. The drying mode is same for homemade prepared samples (CHM4 and CHM5). The samples CHM4 and CHM5 were been drying in a special room where it was introduced smoke warm. About CS1, CS2 and CS3, pork sausages samples purchased on the Romanian market, it was no information about drying process. It can also be seen that the homemade samples of smoked sausages have a higher dried mater content.

The salt content of the sausage samples varied below the maximum limit of 3%. The percentage of salt in samples showed values between 1.2% and 2.3% (Figure 2).

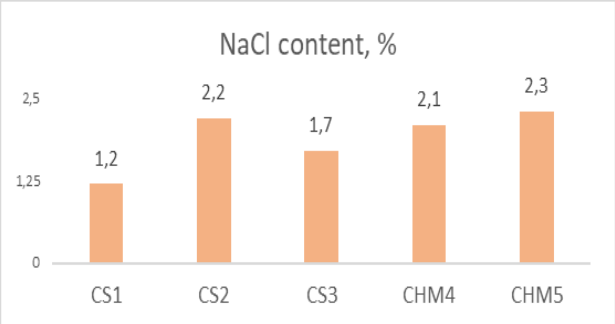

Figure 2. Salt content of analysed samples

The lower content in salt (NaCl, %) is for CS1. This sample had the highest water content.

The determination of the content carbohydrates is performed by difference. In Figure 3 is showed total carbohydrates content from the sausage samples. The highest carbohydrate content was found in the homemade sample (CHM4) in which was added dried fruit.

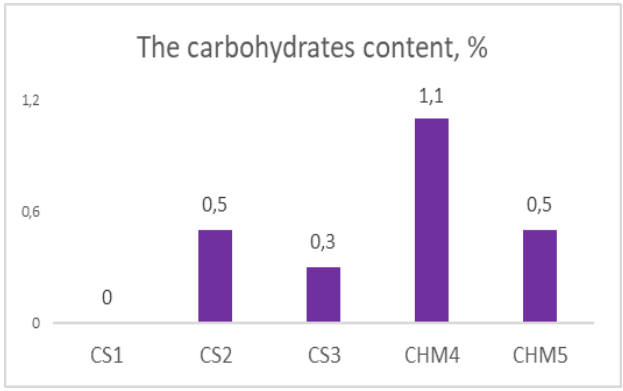

Figure 3. Carbohydrates content in sausage

The determination of the total fat content can be done by several methods, which are based on the extraction in different organic solvents. Total fat content from the sausage samples is showed in Figure 4, where is placed the value of arithmetic means of the two parallel determinations for each sample

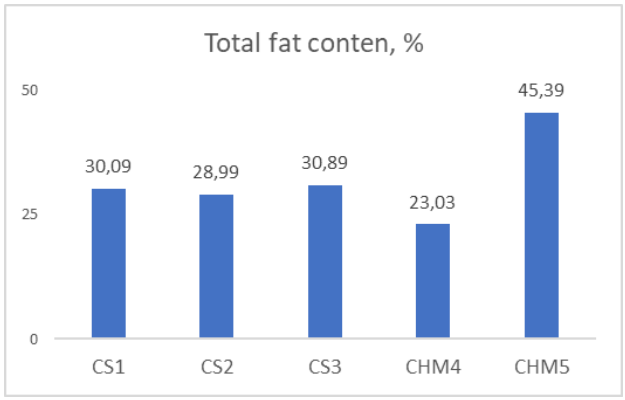

Figure 4. Total fat content in sausage samples

Fat content of the analysed sausage sample registered different values for our samples. Fat content of the sample of sausage with dry fruit in composition registered had value below the limit of admissibility in sausage sample. The fat content in our sample was between 23.03% and 45.39 %. The highest content (45.39%) was found in homemade sausage sample (CHM5), in case of control sample, this sample have the lowest content of water. The lowest content of fat was found in sample of homemade sausage with dry fruit in composition. This can be explained by replacing a portion of fat with dried fruit.

The crude protein content of the samples was determinate by Kjeldahl method. All determinations were performed in duplicate, calculating their arithmetic mean. Total crude protein content from samples are presented in Figure 5.

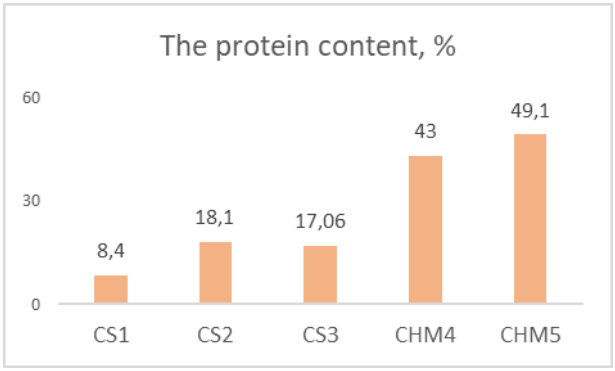

Figure 5. The crude protein content of the sausage samples

The data regarding the energy sausages value is shown in Figure 6. The energy sausages value was calculated.

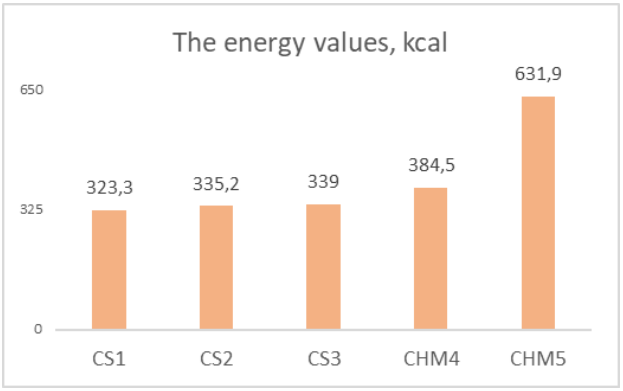

Figure 6. Caloric content of sausage sample

The highest caloric content is for simple homemade sausages (CHM5), control samples, sample without dry fruit in composition. This sample have a highest content of dry mater, and the lowest content of water. The sausages with dry blueberry have a low caloric content (384.5 kcal). In conclusion, the replacement of pork fat with dry fruit were reduced the fat content of sausages (see figure 4). The caloric content (the energy value) of sample with dry fruit was decrease.

Conclusions

Our results indicate some different between the sausage with dry fruit in the composition and without added dry fruit (witness sample and purchased sausages).

Our research consists in developing an innovative meat product by using blueberry (*Vaccinium myrtillus L.*) fruit rich in bioactive compounds.

The salt and fat content of the analysed sausage samples had values below the maximum permissible limits.

The replacement of pork fat with dry fruit were reduced the fat content of sausages and consequently the caloric content of sample with dry fruit was decrease.

These fruits have high content of antioxidants. The addition of antioxidants to meat products is done to prevent lipid oxidation, delay the flavours development and improve colour stability.

Following the undertaken research in this work, the obtained product (sausages with fruit) can be included in the category of safe products for consumers.

Due to the high content of bioactive substances in dry fruit it was increased the nutritive and phytomedical potentials of homemade sausages with dry fruit.

In conclusion, this sausage prototype can be considered a food variant due to its high nutritious properties and to its distinguished taste.

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.

Acknowledgments.This work was performed with the help of the equipment from the "***Food Science***" Research Center, Faculty of Food Engineering, Banat's University of Agricultural Sciences and Veterinary Medicine "*King Michael I of Romania*" from Timişoara

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