JAP&T
TPA-Timişoara

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

Journal of Agroalimentary Processes and Technologies 2020, *26*(4), 330-334

Journal of Agroalimentary Processes and Technologies

Chemical, physicochemical, and nutritional characteristics of some sausage types

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Abstract

Sausages are a meat product usually made from ground meat, often pork, beef or poultry, along with salt, spices and other flavors. Other ingredients, such as breadcrumbs or grains, may be included as fillers or extenders.

Our research consists in developing an innovative meat product by using blueberry (*Vaccinium myrtillus L.*) and sea buckthorn (*Hippophae rhamnoides* L.) fruit rich in bioactive compounds. Our work has focused on evaluation of the biochemical, and nutritional characteristics some type of sausage with fruit adding (blueberry and sea buckthorn). These fruits have 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 physico-chemical features observed in the sample of sausage (simple sausage and sausages prepared with added cranberries) were: the content of humidity (%), ash (%), sodium chloride (%), 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.

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

Keywords: sausages, blueberry, sea buckthorn, pork, nutritional characteristics

1. Introduction

Sausages are considered to be one of the oldest forms of meat processing. Although it is not known exactly when the first sausage was made, there is evidence that it existed for at least several thousand years. The origins of sausage making probably began when people found out that salt is an effective preservative.

Naturally fermented dried sausages have been produced in many European countries [1,2]. They are a significant source of protein. In addition, the quality of the meat combined with traditional production technology ensures their unique sensory properties [3,4].

Today's consumers are becoming increasingly aware of these products for their unique sensory properties and specific health benefits [5,6].

Fermented sausages usually consist of pork, beef, fat, salt and spices. In Romania, there are many different types of dry fermented natural sausages. They are poorly investigated insofar their qualities vary greatly, depending on the ingredients used in their formulation and the processing conditions. Their quality is heterogeneous due to the fact that they are non-standard products in small-scale facilities.

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The production of non-industrial sausages is driven by cultural practices related to the seasonality of production, the region of production, unregulated and variable production conditions, the seasonality of production and its small scale [4].

The present study was conducted on utilization of dry fruit in the development of a new pork sausages prototype - enriched in bioactive compounds (in antioxidant capacity). A study was designed to evaluate the effect of different 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. Materials and methods

Ingredients and preparation of the experimental batches

In home-making conditions, we have prepared several experimental batches of dried sausages with different addition dry fruits (3 batches for each experiment). The sausage composition was prepared with well chosen pork meat (< 10% fat), hard lard, garlic, salt and spices.

Sausages were made in an Oltenia in household according to a traditional recipe from Gorj county.

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

The meat was bought from the stores from Galaţi and the used ingredients were those commonly used for the prepared of traditionally sausage

Condiment used was garlic. The external covering of all were peeled off and cut into pieces. In the sausage the spice used were thyme, black pepper, coriander and allspice. The spice mix formula used for preparation of the pork sausages contained black pepper *(Piper nigrum)* -29%, coriander *(Coriandrum sativum)* -14%, thyme *(Satureja hortensis)* - 43%, allspice *(Pimenta dioica,* also called *Myrthus pimento)* -14%. 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 3 ÷ 5 cm cubes; mincing the meat with an electric mincing machine (with a sieve which has 3 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 tied in pairs and 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 respective methods recommended by the International Organization for Standardization, ISO 1442:1997 [7].

The ash content was established according to ISO 936:1998 [8] by virtue of burning the samples in a furnace at 505±5°C (P320 Nobertherm, Germany).

The NaCl content was determined trough the Mohr method according to the Romanian Standard STAS 9065-5/73 [9].

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 [10]. Samples containing extracted fats were weighed and noted. The crude protein content was determined by Kjeldahl method (the FOSS 8400-8420 apparatus) were following the manufacturer's application notes. The Kjeldahl method makes it possible to determine the crude protein content of the samples on the basis of the nitrogen content. 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 analyzer 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 Atwater energy conversion factors based on the following equation: energy (kJ) = 37 × (g lipid) + 17 × (g protein + g carbohydrate). We transformed energy values from kJ in kcal, by using international system of measurements (1 *kcal* = 4.185 *kJ*).

All determinations were performed in triplicate, calculating their arithmetic mean of three separate determinations. The data were statistically analyzed using the program Microsoft Excel.

3. Results and Discussion

Basic nutritional properties. Chemical characterization of sausage sample

The results of ***water content*** (moisture) of saples are shown in figure1. The result was the arithmetic mean of the three parallel determinations (for each sample), which do not differ by more than 0.5 g of water per 100 g of sample to be analyzed.

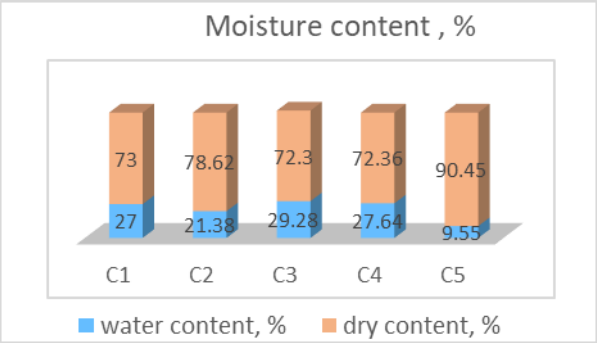

Figure 1. Water content moisture and dry mater in sausage sample

Notations used: C1 - sausages with sea buckthorn dried in hot air; C2 - sausages with blueberries dried in hot air, C3 - sausages with sea buckthorn - dried by smoking, C4 - sausages with blueberries - dried by smoking, C5 - control sausage (dried in warm air)

From the experimental data presented above we can see that the highest content water was found in sample C3, and the lowest in C5 sample. Regarding dry content, the highest value was found in C5 sample. Samples C1 and C3, were obtained by adding dried sea buckthorn, instead samples C2 to C4 have the addition of dried blueberries. The drying mode is different for samples C1 and C3, respectively for samples C2 and C4 (see above).

It can also be seen that the samples of smoked sausages have a higher water content than those dried in hot air.

The determination of the total fat content is performed by several methods based on organic solvent extraction. In fig.3 is showed total fat content from the sausage samples. In the graph, the value of arithmetic means of the three parallel determinations are placed.

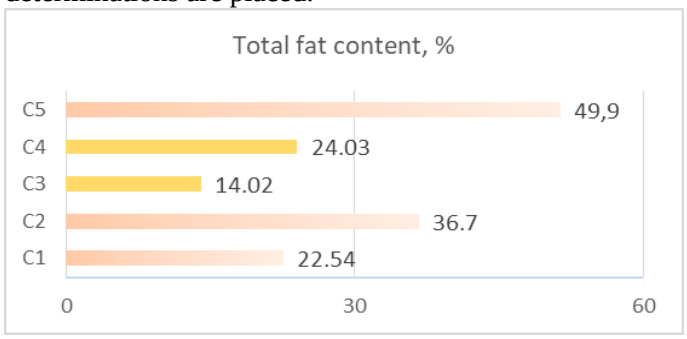

Figure 3. Total fat content in sausage samples

Fat content of the analysed sausage samples registered values below the limit of admissibility (38%) in all sausages sample with dry fruit in composition [9]. The lowest value for this parameter was determined in case of sample C3 (14.02%) and the highest value in case of control (blank test) sample, C5 (48.91%).

The crude protein content of the samples were determinate by Kjeldahl method. All determinations were performed in triplicate, calculating their arithmetic mean. Determination of total crude protein content in samples are presented in Fig.4.

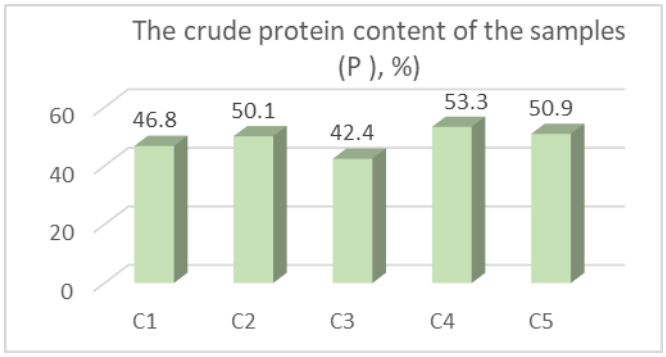

Figure 4. The crude protein content of the sausage samples

Salt content of the analyzed sausage samples ranged below the maximum limits of 3% for this parameter. The percentage of salt in the analysed samples showed values between 2,1% and 2.6% (fig. 5).

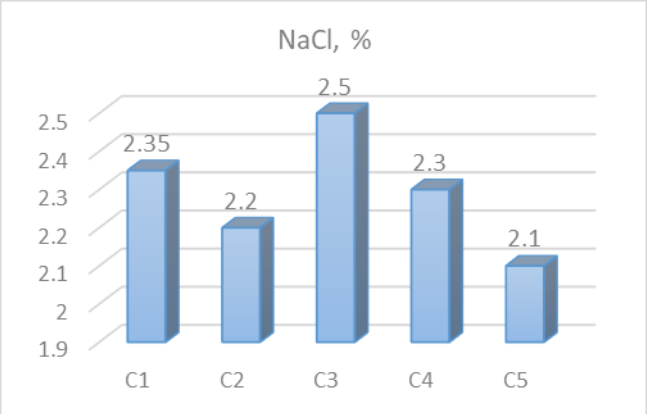

Figure 5. Salt content of analysed samples

The lower content in salt (NaCl,%) is for C5, control sample.

The energy sausages value was calculated. The data regarding this value it is shown in fig. 6.

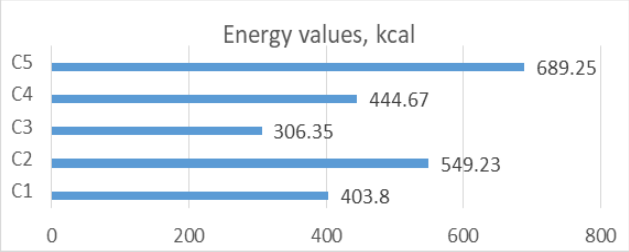

Figure 6. Caloric content of sausage sample

The highest caloric content is for simple sausages (C5), control samples, sample without dry fruit in composition. The sausages with dry blueberry have a lower caloric content (C3, C4). In conclusion, the replacement of pork fat with dry fruit were reduced the fat content of sausages (see fig.3). The caloric content (the energy value) of sample with dry fruit was decrease.

4. Conclusions

Our results indicate some different between the sausage with dry fruit in the composition and without added dry fruit (ie: betwwen martor sample and other). Also, different dry fruit in sausages samples determinated different behhevior of sample.

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

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

Regarding salt and fat content of the analyzed sausage samples, the obtained values were below

the maximum admitted limits.

These fruits have 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.

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.

Their nutritive and phytomedical potentials of sausages with dry fruit are increased due to the high content of bioactive substances in fruit.

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

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

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

References

1. Comi G.; Urso, R.; Iacumin, L.; Rantsiou, K.; Canttaneo, P.; Cantoni, C.; Cocolin, L., Characterisation of naturally fermented sausages produced in the North East of Italy. *Meat Sci*., **2005**, *69*, 381–392.
2. Demeyer, D.; Raemaekers, M.; Rizzo, A.; Holck, A.; De Smedr, A.; ten Brink, B.; Hagen, B.; Montel, C.; Zanardi, E.; Murbrekk, E.; et al. Control of bioflavour and safety in fermented sausages: First results of a European project. *Food Res. Int*., **2000**, *33*, 171–180.
3. Elias, M.; Carrascosa, A.V., Characterisation of the Paio do Alentejo, a traditional Portuguese Iberian sausage, in respect to its safety. *Food Control*, **2010**, *21*, 97–102.
4. Laranjo, M.; Gomes, A.; Agulheiro-Santos, A.C.; Potes, M.E.; Cabrita, M.J.; Garcia, R.; Rocha, J.M.; Roseiro, L.C.; Fernandes, M.J.; Fernandes, M.H.; et al. Characterisation of Catalao" and „Salsichao" Portuguese traditional sausages with salt reduction. *Meat Sci.*, **2016**, *116*, 34–42.

5. Adewumi, G.A. *Health-Promoting Fermented Foods*, *Encyclopedia of Food Chemistry*, L. Melton, F. Shahidi, P. Varelis, Editors. **2019**, Academic Press: Oxford 399-418.
6. Marco M.L. Heeney, D., Binda, S. et al., Health benefits of fermented foods: microbiota and beyond, Curr. Opin. Biotechnol., **2017**, *44*, 94-102. doi: 10.1016/j.copbio.2016.11.010.
7. ISO Standard ISO 1442:1997. Meat and meat products - Determination of moisture content. International Organization for Standardization. Genève, Switzerland.
8. ISO Standard ISO 936:1998. Meat and meat products - Determination of total ash. International Organization for
9. Standard STAS 9065-5/73.
10. AOAC, Official Methods of Analysis, AOAC, Washington, DC,USA, 17th edition, **2000**.