Salt and sodium content in dry fermented sausages and dried meat in Serbia

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ABSTRACT

Salt is main ingredient in meat products which desirably impact on technological properties, textural and sensory characteristics of product. Even it is GRAS substance (Generally recognized as safe), salt (sodium) is one of the main cause of essential hypertension. Daily salt intake in human nutrition is excessive, especially by processed food. The object of this study was to determine salt and sodium content in dry fermented sausages and dried meat from Serbian market. Sodium chloride content was determined by standard volumetric AOAC method and sodium content was calculated from the ratio of sodium and chlorine in the salt. Salt content in dry fermented sausages was 2.61-4.05% (average 3.17%) and in dried meat 5.09-9.58% (average 7.13%), while sodium content was 1031-1594 mg/100 g (average 1247 mg/100 g) in dry fermented sausages and 2003-3770 mg/100 g (average 2805 mg/100 g) in dried meat. Daily sodium intake for metabolic needs should not exceed 1500 mg as well as for the people with congestive heart diseases according to American Heart Association. Due to high salt/sodium content, general health recommendation is to reduce salt/sodium content during meat processing.

Keywords: **meat products, salt**

I. INTRODUCTION

History of salt is ancient as the history of human population. Discovery and use of salt have made the food sustainable for longer period, available regardless of the season of the year and enabled its transport over long distances. It was one of the first categories of commercial exchange; also it has been subject of fees, taxes, caused wares and brought colonial power. Salt in meat products causes the salinity [1] and together with fats contributes to numerous sensory properties. Increase of salinity is more distinct in products with increased amount of fat, and in products with higher protein content, the sense of salinity is lower. One of the major functions of salt in meat products is solubilisation of functional myofibril proteins, which activates the proteins to increase the hydration and water holding capacity (WHC) and, accordingly, improves the texture of product. Increase of WHC in meat reduces cooking loss and increases the tenderness and softness of meat products. There are two hypotheses on role of salt in meat WHC [1]. According to Hamm [2], chlorine ions have the tendency to penetrate myofilaments causing their dissolution, whereas Offer and Trinick [3] claim that sodium ions form ion "clod" around filaments. They base their hypothesis on selective bonding of chlorine ions to myofibrillar proteins. Dissolved myofibrillar proteins form sticky exudates on the surface of meat pieces which are subsequently binding in this way during the heat treatment of the product. Matrix of proteins coagulated by heat tie in "trap" the free water. In emulsified meat products such as cooked sausages, dissolved proteins in form of continuous phase, represent the film around fat and water drops. Inhibitory effect of salt on bacteria is based on lowering of the activity of water. Content of salt in meat products depends, primarily, on technologically justified amounts, and, of course, on the influence of salt on the salinity flavour.

There are numerous studies on content of salt in different meat products. In one study, Vranic et al. [4] which examined meat products from Serbian markets, cite that the lowest content of salt is in the cooked sausages and meat cans. In cooked sausages, content of salt ranges from 1.28 to 2.03 g/100 g, in average 1.66 g/100 g, whereas in meat cans it ranges from 1.35 to 1.84 g/100 g, in average 1.67 g/100 g. In smoked meat products the content of salt is slightly higher and it ranges from 1.66 to 3.11 g/100 g, i.e. in average 2.19 g/100 g. In dry fermented sausages, technologically justified amount of salt is considerably higher and therefore 2.5-3.0% is added, since these products are not subject to heat treatment, and salt serves for maintaining of the microbiological stability of the products. Content of salt in these sausages is 2.08-3.98 g/100 g, i.e. in average 2.61 g/100 g. The dry meat products have the highest content of salt. Due to long production process, i.e. curing, these products are salted or cured using 5-

10% of salt or brine salt, in order to reduce, by action of the salt, the water activity in order to prevent growth of undesirable microorganisms. Content of salt in dry meat is in the range from 3.78 to 7.35 g/100 g, in average 5.09 g/100 g.

The aim of this paper was to investigate the salt content in meat products that are produced with the largest amount of salt and that are not thermal treated during the processing, dry fermented sausages and dry meat products.

II. MATERIAL AND METHODS

Samples of meat products were taken from different Serbian markets. Totally 33 samples of dry fermented sausages were taken and 27 dry meat products produced by different producers. Salt (NaCl) content was determined by volumetric method (AOAC, 1984) and sodium content was calculated from the ratio between sodium and chlorine in sodium chloride determined in sample. The results of examination were statistically analysed calculating the average value, standard error, standard deviation, variation coefficient and range.

III. RESULTS

It was total 33 dry fermented sausages and 27 dried meat products examined. Results are presented in Table 1. Salt (NaCl) content was in the range of 2.61-4.05%, average 3.17 ± 0.52% in dry fermented sausages and in range 5.09-9.58%, average 7.13 ± 1.64% in dried meat products. Calculated sodium content was 1247 mg/100 g of dry fermented sausages and it was in range 1031-1594 mg/100 g. Average sodium content was higher in dried meat and it was in the range 2003-3770 mg/100 g, average 2805 mg/100 g.

Table 1 Salt and sodium content in dry fermented sausages and dried meat

	n	$\bar{X}$	Se	CV	Min.	Max.
Dry fermented sausages						
Salt content, %	33	3.17 ± 0.52	0.35	16.48	2.61	4,05
Sodium content, mg/100 g		1247			1031	1594
Dried meat						
Salt content, %	27	7.13 ± 1.64	0.81	23.05	5.09	9,58
Sodium content, mg/100 g		2805			2003	3770

IV. DISCUSSION

For several millions of years, the prehistoric men consumed less than 0.5 g of salt daily [5]. Intentional adding of salt to food started around 5000-10000 years ago, at the beginning of the agricultural development and daily intake of salt reached average value of 10 g, which is in evolutionary sense relatively recent. Intake of salt is caused not only by physiological needs (athletes), but also habits which are acquired in the early childhood, as well as tradition in nutrition (region, i.e. climatic conditions, preparation of food, livestock resources, etc.). Of total daily amount of salt introduced into organism by common amounts of food (dishes prepared in the household, bread, bakery products, cheese, etc.), approx. 20% derives from meat products [6].

Sodium from salt is mainly located in the extracellular fluid in the organism and it influences the maintaining of the water balance, nerve function, acid-base balance and muscle contractions. Although even unexpected, reduced intake of sodium can lead to muscle contractions, nausea, vomiting, anorexia and coma. Because of this important role of sodium in the organism, requirements of humans in salt are often expressed as sodium requirements. According to some data, daily requirement in sodium for adults, to maintain metabolic processes and needs, is below 1500 mg. In case of athletes, requirements are higher, and even exceed 10000 mg per day, when large amount of sodium is lost through intensive sweating. However, daily intake of sodium is often over 5000 mg [7]. American Heart Association recommends for persons with hyper tension daily intake of not more than 1500 mg, and for persons with congestive heart disorders, daily sodium intake of not more than 1000 mg.

Present trends in nutrition to reduce the content of sodium in meat products, as reported by Ruusunen et Puolanne [1] and Desmond [8]., can be achieved in the following way: (1) by reducing the amount of sodium chloride added [9, 10]; (2) by substituting part of NaCl with other salts [9, 11, 12, 13]; (3) by using flavour/aroma enhancers and masking agents [8]; (4) by combination of mentioned procedures [9, 11]; (5) adding of spice herbs and spice extracts to meat products [14]; (6) by optimisation of the physical form of salt [15]; and (7) by alternative process techniques [16]

Several studies have shown that reduced intake of salt in population is economically justified [17]. So, Murray et al. [18] have shown that health interventions, including government actions to stimulate the reduction of content of salt in food products were economically justified in sense of decrease of the incidence of cardio vascular diseases. One of the studies showed that reduced intake of salt to 6 g per day in Norwegian population had lead to drop in systolic blood pressure by 2 mm Hg and reduced cost by 4.7 million dollars annually [19]. Study carried out in Canada showed that reduction of salt intake to 4.6 g daily can save approximately 430 million dollars annually in treatment costs, visits to doctors and laboratory testing of the causes of hyper tension [20].

In their study, Asaria et al. [17] have evaluated the effects and costs of the strategy to reduce the salt intake and tobacco control for 23 less developed and developing countries, and have proven that with the reduction of salt by 15% in the period 2006 to 2015, the death of 8.5 million people suffering from cardio vascular diseases could be avoided/prevented, and by reduction of smoking by 20% death of 3.1 million people. Moderate salt reduction could be achieved by reduction of salt content in food by producers, as well as through continuous media campaign. Cost of implementation of such programs of salt reduction is estimated at the amount of 0.09 dollars *per capita* annually. Cost of tobacco control including free measures and cost amount to 0.26 dollars *per capita* annually. These data clearly indicate that the reduction in salt intake is more or at least to the same extent economically justified compared to tobacco control in reduction of prevalence of cardio vascular diseases.

WHO initiated the reduction strategy through regional directorates and 11 EU countries have agreed to and signed the program of salt content reduction of 16% in the next 4 years.

Because of the importance of this topic, many producers initiate salt reduction programs in their production and starting with reformulation of their products. If very salty food is consumed consistently, receptors become used to salinity and demand for salty food increases. However, some of the snacks producing companies in the world are also part of companies manufacturing such beverages; therefore it is understandable that they do not want to participate in programs for reduction of salt in food.

V. CONCLUSIONS

Salt content in dry fermented sausages from Serbian markets examined in this study was in the range 2.61-4.05%, in average 3.17%; and in dried meat in the range 5.09-9.58%, in average 7.13%.

Sodium content in dry fermented sausages was in the range 1031-1594 mg/100 g, in average 1247 mg/100 g; and in dried meat in the range 2003-3770 mg/100 g, in average 2805 mg/100 g.

Both salt and sodium content exceed nutritional need for humans. Only 100 g of dry fermented sausages meets recommended daily amount of sodium. In the combination with other food that is consummated during one day, it is clear that modern man has excessive intake of salt/sodium.

The goal of meat industry is to find possibilities to produce meat products with less salt/sodium content without repercussions on technological properties of salt.

ACKNOWLEDGEMENTS

This paper is part of scientific project “Reduction of sodium content in meat products – technological possibilities, quality characteristics and health aspects” (TR 031083) funded by Ministry of Education and Science, Republic of Serbia.

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