

# POSSIBILITY OF REPLACEMENT OF SODIUM CHLORIDE BY POTASSIUM CHLORIDE IN COOKED SAUSAGES - SENSORY CHARACTERISTICS AND HEALTH ASPECTS\*\*

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**Abstract:** Sodium is common cause of human hypertension. Large amount of sodium originate from meat products. Modern trends of nutrition prompt to low amount of sodium in these products. In this paper the possibility of substitution of sodium chloride with potassium chloride in amount of 20%, 40%, 60% and 80% in the model meat products, type of cooked sausages, is investigated. Taste acceptability of products by quantitative-descriptive scale was assessed. The data were analyzed for each product by variance analysis and by comparison of means. Products with 20% and 40% replacement of NaCl with KCl were acceptable, those with 60% were in the limit of acceptability and products with 80% KCl were unacceptable. There is the possibility of replacement sodium chloride by potassium chloride in meat products, but limited by its bitter taste.

**Key words:** sodium chloride, potassium chloride, meat products, taste

## Introduction

Common salt is ingredient that used for meat conservation since ancient time till nowadays. Sodium chloride influence development of desirable sensory and textural characteristics in meat products and also has bacteriostatic effects due to lowering of water activity in product.

Large amount of sodium in human organisms originated from meat products (*Wirth*, 1991), and as it is known, sodium is common cause of hypertension. Even the high intake of sodium is in correlation with mortality and risk of cardiovascular diseases independent of other risk factors, including

hypertension (*Tuomilehto et al.*, 2001). Modern nutrition trends prompt the amount of sodium has to be decreased (*Ruusunen i Puolanne*, 2005; *Desmond*, 2006). The sodium content lowering in meat products can be achieved: (1) by lowering of added sodium chloride; (2) by partial replacement of NaCl by other chloride salts (KCl, CaCl<sub>2</sub> i MgCl<sub>2</sub>); (3) by partial replacement of NaCl by nonchloride salts as phosphates and new process technics and modifications of technological processes, and, (4) by combination of mentioned (*Sofos*, 1983; *Terell*, 1983).

Intake of sodium for basic metabolisms in people is 2000 mg per day. However, daily intake of sodium is 3500-5000 mg that responds to 9-12 g of common salt. American Heart Association proposes that hypertensive persons should not intake more than 1500 mg and people with congestive cardiovascular diseases not more than 1000 mg of sodium per day ([www.intelihealth.com](http://www.intelihealth.com)).

In table 1 is shown recommendations of daily sodium intake.

**Tabela 1. Preporuke dnevnog unosa natrijuma, mg (*Jokić i sar.*, 1999)**

**Table 1. Recommended daily intake of sodium, mg (*Jokic et al.*, 1999)**

<b>Muškarci Men</b>	<b>Žene Women</b>	<b>Starije osobe Eldery persons</b>	<b>Deca Children</b>	<b>Dečaci Boys</b>	<b>Devojčice Girls</b>
Sedeći rad Sedentarily <b>4000-4800</b>	Sedeći rad Sedentarily <b>3000-4000</b>	Prosečno aktivne Medium active <b>3000-4000</b>	1-2 godine 1-2 years <b>300-400</b>	10-12 godina 10-12 years <b>3000-4000</b>	9-11 godina 9-11 years <b>3000-4000</b>
Srednje težak rad Medium hard work <b>5200-6000</b>	Srednje težak rad Medium hard work <b>5000-6000</b>	Koje ulažu osrednji fizički napor Persons with medium physical effort <b>4000-4500</b>	2-4 godine 2-4 years <b>1500-2000</b>	12-15 godina 12-15 years <b>4000-5000</b>	11-13 godina 11-13 years <b>4000-4500</b>
			4-6 godine 4-6 years <b>1600-2400</b>		
Težak rad Hard work <b>6400-8000</b>		Koje se ne kreću Persons who are not moving <b>3000-3500</b>	6-10 godina 6-10 years <b>2500-3000</b>	15-20 godina 15-20 years <b>5000-6000</b>	13-18 godina 13-18 years <b>4500-5000</b>

The aim of this paper was to investigate the possibility of partial replacement of sodium chloride by potassium chloride in the model meat products, type cooked sausage, and to determine the influence of this replacement to taste acceptability.

## Material and method

Six model meat products, type cooked sausages, were made in experiment. In table 2 are shown the composition of model products.

**Tabela 2. Sastav model proizvoda (g)**  
**Table 2. Model products composition (g)**

Grupa Group	Svinjsko meso Pork	Masno tkivo Fat	Led Ice	NaCl NaCl	KCl KCl	Fosfat Phosphate	NaNO <sub>2</sub> NaNO <sub>2</sub>
1	57.00	23.00	17.00	1.73	-	0.29	0.0086
2	57.00	23.00	17.00	1.38	0.35	0.29	0.0086
3	57.00	23.00	17.00	1.04	0.69	0.29	0.0086
4	57.00	23.00	17.00	0.69	1.04	0.29	0.0086
5	57.00	23.00	17.00	0.35	1.38	0.29	0.0086
6	57.00	23.00	17.00	-	1.73	0.29	0.0086

Pork is mixed with NaCl, phosphate, NaNO<sub>2</sub> and ice. After blending fat was added and mass was blended up to homogenate structure. Prepared mass was filled in cans of 150 g that closed and pasteurized at 85°C for 80 minutes. Products were cooled up to 5°C. Model products were evaluated in saltiness and taste acceptability by quantitative-descriptive scale (*Baltić, 1994*) with 9 evaluations: 1 - extremely unacceptable, 2 - very unacceptable, 3 - unacceptable, 4 - slightly unacceptable, 5 - not acceptable nor unacceptable, 6 - slightly acceptable, 7 - acceptable, 8 - very acceptable and 9 - extremely acceptable. Products were assessed by ten selected assessors.

In order to study significant differences the analysis of variance and comparison between mean evaluations were performed whereby the equal means hypothesis was assigned (*Hadživuković, 1991*).

## Results and discussion

In table 3 the results of sensory evaluation of taste acceptability of model products were shown.

**Table 3. Sensory evaluation of taste acceptability****Tabela 3. Senzorna ocena prihvatljivosti ukusa**

Group	n	$\bar{X}$	Sx	Sd	Cv	Iv
1	10	8,20	0,97	0,60	7,32	7,00-9,00
2	10	8,10	0,93	0,54	6,65	7,00-9,00
3	10	7,70	0,82	0,46	5,95	7,00-8,00
4	10	5,50	0,92	0,50	9,09	5,00-6,00
5	10	4,40	0,52	0,49	11,13	4,00-5,00
6	10	3,00	0,36	0,63	21,08	2,00-4,00

Products in first group were evaluated as "very acceptable" and those from fourth group as "not acceptable nor unacceptable". Replacement of NaCl by 20% KCl did not show significant changes in the taste acceptability ( $p>0.05$ ). Also statistical differences between 20% and 40% replacement of NaCl by KCl did not found out. Less differences ( $p<0.05$ ) between the first (without KCl) and the third group (40% KCl) were found. Very significant differences ( $p<0.01$ ) were between the first (without KCl) and fourth group (60% KCl) and between the second (20% KCl) and fourth group.

Assessors found out the decreasing level of saltiness starting from the first to the sixth group according the reducing of NaCl amount in products.

Obtained results are in accordance with results of Askar et al. (1994) and Chavasit that found out that the replacement is possible in these percentages without significant influence on the taste. At 60% of replacement by potassium chloride the bitter taste in products is developed, according to *Desmond* (2006) and *Gelabert et al.* (2003).

Products with 80% of replacement and products made only with KCl were evaluated as "slightly unacceptable" and "unacceptable", respectively. The mean evaluations were statistically different in relation to other groups.

Obtained results showed that the amount of sodium chloride could be decreased for 40% without significant changes in taste acceptability of model products made in this experiment. Products made in this experiment with replacement of sodium chloride by 20% and 40% of potassium chloride can be treated as dietetic products whom did not change the nutritive value (*Chavasit*), sensory characteristics (*Troy*, 2001) and hygienic state (*Gimeno et al.*, 2001; *Gelabert et al.*, 2003) and could be intended in nutrition, particularlyly to sodium-dependent hypertensive persons.

## Conclusion

According to the obtained results it can be concluded:

1. Use of potassium chloride in the meat products is possible, but amount is limited by its bitter taste.
2. Replacement of sodium chloride by potassium chloride in 20% and 40% do not influence significantly to the taste of product, and
3. Due to differences in assessor's taste the products in which NaCl is replaced by 60% KCl are in the limit of acceptability. Products with 80% of replacement and made only with potassium chloride have unacceptable taste.

## Mogućnost zamene natrijumhlorida kalijumhloridom u kuvanim kobasicama – senzorne karakteristike i zdravstveni aspekt

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### Rezime

Natrijum je najčešći uzročnik povišenog pritiska kod ljudi. Velika količina natrijuma potiče iz proizvoda od mesa. Savremeni trendovi ishrane ukazuju na neophodnost smanjenja količine natrijuma u ovim proizvodima. U ovom radu je ispitivana mogućnost zamene natrijumhlorida kalijumhloridom u količini od 20%, 40%, 60% i 80% u proizvodima od mesa tipa kuvane kobasice. Prihvatljivost ukusa je ocenjivana kvantitativno-deskriptivnom skalom. Podaci su analizirani za svaki proizvod korišćenjem analize varijanse i poređenjem srednjih vrednosti. Proizvodi kod kojih je 20% i 40% natrijumhlorida zamenjeno sa KCl su bili prihvatljivi, oni sa 60% su bili unutar granica prihvatljivosti a proizvodi sa 80% KCl su bili neprihvatljivi. Postoji mogućnost zamene natrijumhlorida kalijumhloridom u proizvodima od mesa, ali je ograničena zbog pojave gorkog ukusa.

**Ključne reči:** natrijumhlorid, kalijumhlorid, proizvodi od mesa, ukus

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