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Reducing sodium chloride content in meat burgers by adding potassium chloride and onion

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Abstract

The goal of this paper was to examine the reduction of sodium chloride by partial replacing with potassium chloride and the influence on taste acceptability of meat burgers. Sodium chloride content in burgers produced with 1.5% of salt and half of partial replacement of sodium chloride with potassium chloride in burgers was 0.62-0.67% in fresh and 0.72-0.93% in grilled burgers. The best taste acceptability had burgers with 1.5% of added sodium chloride and burgers with 1.5% salt and 50 g of added onion, in which the partial replacement of sodium chloride with potassium chloride was one half.

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Keywords: meat burgers; sodium chloride; potassium chloride

1. Introduction

Sodium chloride (salt) is traditionally used for preserving meat and has positive effects on the taste, texture, water holding capacity and the reduction of water activity. According to some data, daily requirement in sodium for adults,

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to maintain metabolic processes and needs is below 1500 mg. However, daily intake of sodium is often over 5000 mg. The American Heart Association recommends for persons with hypertension daily intake of not more than 1500 mg, and for persons with congestive heart disorders, daily sodium intake of not more than 1000 mg. Also, excessive sodium intake can lead to: direct risk of heart attack[1]; hypertrophy of the left chamber[2]; sodium retention in extracellular fluid, i.e. water retention and clinical and idiopathic oedema, especially in women[3]; Increased hardness, i.e. decrease of elasticity of blood vessels, especially arteries, independent of the blood pressure[4]; proteinuria, primarily to urinary excretion of albumin, resulting in increased risk of heart and kidney diseases[5]; greater possibility of infection by *Helicobacter pylori* and risk of stomach cancer[6]; increase of urinary excretion of calcium and risk of forming of kidney stones[7]; also risk of reduced bone density, resulting in osteoporosis and compressive bone fractures, especially in case of women in menopause[8]; exacerbations (more intensive and longer) asthmatic seizures[9]; increase of HOMA (homeostasis model assessment) insulin resistance in patients with essential hyper tension, the majority of which have reduced glucose tolerance[10]; and indirect incidence of obesity due to intensive intake of refreshing, non-alcoholic beverages[11]. Potassium chloride is the most common salt replacer, but use of potassium salts has often been disputed because of potential sensibility of one part of the human population, such as persons suffering from diabetes type I, chronic renal insufficiency, last stage of kidney diseases, persons with heart and adrenal insufficiency[12]. US Dietary Guidelines[13] indicate that diets rich in potassium weaken the effects of salt on blood pressure and daily potassium intake of 4.7 g is recommended. Various diet salts as mixtures of sodium chloride and potassium chloride which improve the excretion of sodium from the organism are already on the market[14]. Meat burgers are very popular products in the Balkan region, particularly among young population, and which are consumed often in restaurants, small retail outlets and fast food outlets. Due to that, the goal of this study was to examine the possibility of reduction of sodium chloride by partial replacement with potassium chloride and the influence on taste acceptability of meat burgers.

2. Materials and methods

Six groups of meat burgers were prepared, two control groups and four experimental groups. The composition of burgers is given in Table 1.

Table 1. Composition of burgers.

Group	Beef, g	Pork, g	Water, ml	NaCl, g	KCl, g	Onion, g
C1 (control)	360	90	50	10.00	-	25
C2 (control)	360	90	50	7.50	-	25
E1	360	90	50	5.00	2.50	25
E2	360	90	50	3.75	3.75	25
E3	360	90	50	5.00	2.50	50
E4	360	90	50	3.75	3.75	50

Products from the first control group (C1) were produced with the amount of sodium chloride (NaCl) that is usually used during the burger production in small meat factories and retail outlets. Products from the second control group (C2) contained 25% less sodium chloride than the products from the first control group (C1). Burgers from the first and the third experimental group (E1 and E3) contained 50% less sodium chloride than burgers from the first control group (C1), and this was replaced with the same amount of potassium chloride; burgers from the second and the fourth group (E2 and E4) contained 50% less sodium chloride than burgers from the second control group (C2), and this was replaced with the same amount of potassium chloride. Burgers from groups C1, C2, E1 and E2 contained the same amount of onion (25 g/500 g), while burgers from groups E3 and E4 contained more onion (50 g/500 g).

Sodium chloride content in fresh and grilled burgers was determined according to AOAC[15]. For sensory evaluation of taste acceptability of grilled burgers, a numeric-descriptive scale with 5 points was used (1 – not

acceptable; 5 – very acceptable). Sensory evaluation was carried out by six trained assessors under the same conditions. The obtained results are shown as mean ± SD.

3. Results and discussion

Sodium chloride content in fresh and grilled meat burgers for two control and four experimental groups as well as results from previous study about sodium chloride content in burgers from retail[16] are shown in Table 2.

Table 2. Sodium chloride content in fresh and grilled burgers, %.

	Fresh burgers	Grilled burgers
Burgers from retail[16]	1.80 ± 0.22	2.22 ± 0.25
C1 (control)	1.92 ± 0.04	2.51 ± 0.14
C2 (control)	1.53 ± 0.03	1.85 ± 0.02
E1	0.92 ± 0.01	1.15 ± 0.04
E2	0.62 ± 0.04	0.93 ± 0.02
E3	0.91 ± 0.03	1.13 ± 0.01
E4	0.67 ± 0.01	0.72 ± 0.02

The average sodium chloride content in the first control group (C1) and burgers from retail was 1.92% and 1.80% in fresh burgers, and 2.51% and 2.22% in grilled burgers, respectively. Consequently to partial replacement, the sodium chloride content was less in burgers from experimental groups. The sodium chloride content averaged 0.92% and 0.91% in fresh burgers with one third of sodium chloride replaced with potassium chloride and 1.13% and 1.15% in grilled burgers, respectively. The minimum content of sodium chloride was measured in burgers from E2 and E4 groups in which half the sodium chloride was replaced with potassium chloride and it was 0.62% and 0.67% in fresh burgers and 0.72% and 0.93% in grilled burgers, respectively. Salt content in meat products is relatively high[17, 18] and it is estimated that approximately 20% originated from meat products[19]. Because of that, it is necessary to decrease the sodium content in each group of meat products, whereas potassium chloride is most common replacer of sodium chloride[14], but its use is limited by bitter taste and pH of medium[20].

Results of sensory evaluation of taste acceptability are shown in Fig. 1.

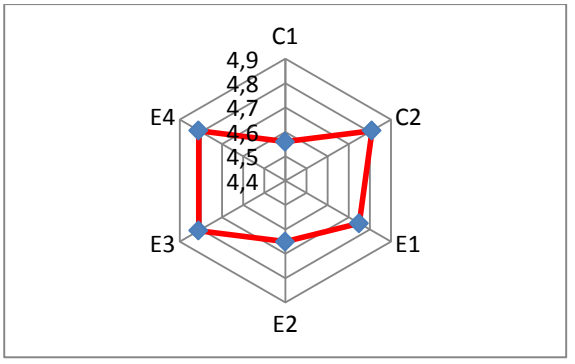

Fig. 1. Sensory evaluation of taste acceptability.

The lowest evaluation of taste acceptability was assigned to burgers from the first control group C1 (4.56 ± 0.39) and the highest evaluation was awarded to burgers from the second control group (C2) and experimental groups E3 and E4 (4.81 ± 0.24). Burgers with the smaller amount of added onion were also very acceptable, but were evaluated as being slightly less desirable (4.75 ± 0.25 and 4.65 ± 0.24, respectively). Even though the bitter taste of potassium chloride is a limiting factor for replacing sodium chloride with potassium chloride; this work shows it is possible to

reduce the sodium content in meat burgers by using a suitable combination of raw materials and different amounts of onion.

4. Conclusion

The average sodium chloride content was 0.92% and 0.91% in fresh burgers with one third of sodium chloride replaced with potassium chloride and 1.13% and 1.15% in grilled burgers, respectively. The minimum content of sodium chloride was determined in burgers from E2 and E4 groups in which half the sodium chloride was replaced with potassium chloride and it was 0.62% and 0.67% in fresh burgers and 0.72% and 0.93% in grilled burgers, respectively. The lowest evaluation of sensory acceptability was awarded to burgers from the first control group C1 (4.56 ± 0.39) and the highest evaluations were scored by burgers from the second control group (C2) and experimental groups E3 and E4 (4.81 ± 0.24). Burgers with the lower amount of added onion were also very acceptable, but evaluated slightly lower (4.75 ± 0.25 and 4.65 ± 0.24, respectively). It is possible to reduce the sodium chloride content by replacing half of it with potassium chloride in meat burgers without negative influence on sensory acceptability of these products, particularly when a larger amount of onion (50 g/500 g) is added to the product.

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