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Reducing the sodium chloride content in chicken pate by using potassium and ammonium chloride

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Abstract

The aim of this research was to investigate possibility of chicken pate production with reduced sodium chloride content, as well as to establish changes in sensory characteristics. In the study, six experimental groups of chicken pate were produced with the same basic ingredients, but different amounts of added salts. Sensory evaluation was performed in order to determine general taste acceptability, and of the sodium and potassium levels in the chicken pate. The pate from EI and EII groups in which the amount of added sodium chloride was reduced and/or partially substituted with ammonium chloride had a most acceptable taste.

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Key words: chicken pate; sodium chloride; reducing of the content

1. Introduction

Salt is of great importance for humans. Given that food is our main source of salt today, it is not surprising there is a close connection of food consumption with normal functioning of the body, primarily in terms of reducing the

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content of salt, but also sugar and fat. Table salt, or sodium chloride in food products is main source of sodium. Increased sodium intake expresses a negative impact on health, because excessive sodium intake is directly correlated with increased blood pressure[12]. Besides hypertension[10], an excessive sodium intake leads to other negative health impacts, including a direct risk of heart attack[11,13], left ventricular hypertrophy[15], the proteinuria[5], developing kidney stones risk[1], reduction bone density risk[4]. Of the total daily amount of salt consumed through food, 20% comes from meat products[17]. The average salt content in boiled sausages ranges from 1.6% to 2.4%, 3.5% to 5.0% in dry fermented sausages, and in smoked products ranges from 3% to 4%, while the highest content is in dried meat products, from 4% to 7%[2]. Adding salt to meat products has an effect on salinity[14], which is more pronounced in meat products with more fat than in products with more protein. Sodium chloride leads not only to the feeling of salinity, but in many categories of food plays other roles, including product strength perception, enhancing sweet taste, masking metallic and off tastes, rounding the overall taste (flavour), and so contributing to food flavour intensity[7].

The most common methods to reduce sodium intake are by reducing the added sodium chloride[14], substituting part of the sodium chloride with other salts[8,9,14,15], the use of flavorings and taste enhancers and the use of masking agents[3].

The most common substitute for sodium chloride is potassium chloride, but its main deficiency is amplification of bitter taste and reducing salinity[7], if it is used as a 50% replacement. Use of potassium chloride is often challenged from the health aspect since it leads to sensitivity of one part of population, such as people suffering from diabetes type I, or chronic renal insufficiency[6].

The aim of this study was to examine the possibility of reducing the sodium chloride content in cooked sausages, produced as a type of chicken pate, and to evaluate changes in the sensory properties, primarily changes in general taste acceptability.

2. Materials and methods

The main ingredient used was chicken meat (thighs and drumsticks) and broth; both were later added when creating pates. Soy isolate, onions and sodium nitrite were additives used. Six groups of chicken pate, one control group and five experimental groups were prepared, and the amount of salt differed between groups. The composition of pate in the six groups is given in Table 1.

Table 1.Composition of chicken pate.

Group	Chicken meat, g	Sunfloweroil, ml	Broth, ml	Soy isolate, g	Onion, g	Na-nitrite, mg	Na-chloride, g	K-chloride,g	NH_4 chloride, g
C (control)	182.5	150	150	10.00	20.00	16.25	5.00	-	-
E I	182.5	150	150	10.00	20.00	16.25	3.25	-	-
E II	182.5	150	150	10.00	20.00	16.25	3.25	-	1.75
E III	182.5	150	150	10.00	20.00	16.25	2.17	1.10	-
E IV	182.5	150	150	10.00	20.00	16.25	2.17	1.10	1.75
E V	182.5	150	150	10.00	20.00	16.25	-	3.25	1.75

The first group (control) contained 1% added sodium chloride, which is usual for this type of product. The second group, EI, contained 3.25 g of added sodium chloride, which was 65% of the usual amount. The third group, EII, contained 3.25 g of added sodium chloride and 1.75 g of added ammonium chloride. The fourth group, EIII, contained 2.17 g of added sodium chloride and 1.10 g of added potassium chloride. The fifth group, EIV, contained 2.17 g of sodium chloride, 1.10 g potassium chloride and 1.75 g of ammonium chloride all added, while the sixth group, EV, did not contain any sodium chloride or potassium chloride, but did contain3.25 g of added ammonium chloride. After cooking the chicken meat, salts, soy isolate, onion, broth and sunflower oil was mixed into the filling. The filling was prepared by grinding these ingredients in a mixer to a homogeneous, smooth texture. This prepared filling was dispensed in cans with net weight of 150 g, which were then closed and sterilized in an

autoclave until the temperature reached 121°C. For sensory evaluation of taste acceptability, a numeric-descriptive 5-point scale (1 – not acceptable; 5 – very acceptable) was used. Sensory evaluation was carried out by six trained assessors under the same conditions. The concentrations of sodium (^{23}Na) and potassium (^{39}K) in the cooked chicken pate were measured using an inductively coupled plasma mass spectrometer (ICP-MS) iCap Q (Thermo Scientific, Bremen, Germany), equipped with collision cell and operating in kinetic energy discrimination (KED) mode. The quality of the analytical process was confirmed by the analysis of the standard reference materials SRM 1577c and SRM 2384 (Gaithersburg, MD, USA) and were within the range of the certified values. Statistical analysis of the sensory evaluation data was conducted using the software GraphPad Prism version 5.00 for Windows (GraphPad Software, San Diego, California USA, www.graphpad.com).

3. Results and discussion

Results of sensory evaluation of the general taste acceptability of chicken pate are shown in Fig.1.

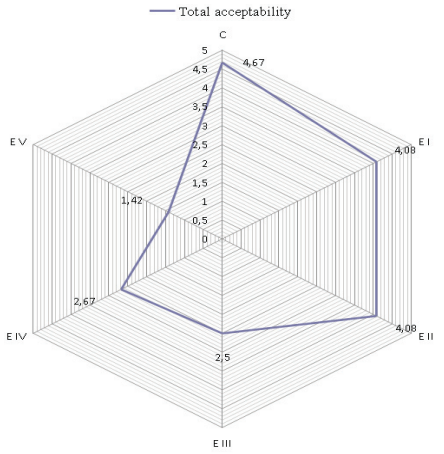

Fig. 1. Sensory evaluation of the general acceptability of the taste of chicken pate.

The normal content of sodium chloride in cooked sausages ranges from 1.09 g to 1.20 g/100g[16]. In this study, in addition to reduced amounts of added sodium chloride, the pates also contained added ammonium and potassium chloride as partial substitutes for sodium chloride. Looking at the results in Fig. 1, all panelists found that general acceptability of taste declined from control to last experimental group, which was consistent with the amount of added sodium chloride. The control group pate contained the most sodium chloride, but the amount was usual for this type of product, while in the last (EV) group, sodium chloride was completely replaced with ammonium and potassium chloride; this resulted in a pate of unacceptable flavour, because it was dominated by a bitter taste. Pate in groups EI, with smaller amount of sodium chloride and (EII),with partly substituted with ammonium chloride, were acceptable, and were not significantly different from the control pate ($p > 0.05$).In pate from EIII and EIV groups, in which a part of the sodium chloride was substituted with potassium and ammonium chloride, panellists detected a partly bitter taste which is characteristic of potassium chloride. The sodium content was highest in pate from control group (3.39 mg/kg), while it was the lowest content in pate from EV group (1.92 mg/kg). It should be taken into account that sodium in such products, besides being added in the form of salts (sodium chloride and sodium nitrite), also originates from the meat. This could account for the sodium content in EV group pate, in which the sodium chloride was completely substituted with potassium and ammonium chloride. The potassium content was highest in pate from EV group (1.68 mg/kg). The potassium content gradually decreased depending on the content of added potassium chloride, although we did find that pate in the control and EI groups contained 0.70 mg/kg, or 0.75 mg/kg

potassium chloride, respectively. Results of the determination of sodium and potassium in the chicken pates are shown in Table 2.

Table 2.The content of sodium and potassium in chicken pate.

Group	Content of sodium g/kg	Content of potassium g/kg
C	3.39	0.70
E I	2.76	0.75
E II	2.49	0.92
E III	2.02	1.70
E IV	1.92	1.68
E V	0.37	3.62

4. Conclusion

Both groups of pate in which the amount of added sodium chloride was reduced and/or partially substituted with ammonium chloride did not have significantly changed general taste acceptability; this is because, according to the literature, sodium chloride has salinity index 1, and ammonium chloride has salinity index 4. Also, the taste acceptabilities of these two pate groups were not significantly different to control pate ($p > 0.05$). In contrast, the pate of EV group, in which sodium chloride was partially substituted with potassium chloride and ammonium chloride, was unacceptable in terms of general taste acceptability, which can be explained by the characteristic bitter taste of potassium.

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