RESEARCH ON THE SODIUM CHLORIDE CONTENT IN VARIOS MARKETED MEAT PRODUCTS

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Abstract

In the meat industry, salting is used to preserve, increase the hydration capacity and to influence the taste of the obtained preparations. On the other hand, the high salt content is linked to the deterioration of the consumer's health. For this reason, the amount of salt added in the manufacturing process of meat products must be maintained within the limits imposed by the in-force legislation.

Nine products belonging in three food categories (bacon, baloney, and pork pastrami products) have been investigated in laboratory via Mohr method to identify and quantify the usage of sodium chloride. The inclusion level of sodium chloride in the first group (bacon) was between 2.2 g and 2.4 g, less than the maximum admitted inclusion level (AIL) (3g /100g product). The concentration detected in the baloney products was between 2.0 g and 2.7 g, lower than the AIL for this food category (3g /100 g). The inclusion level of sodium chloride in the third group of meat products (pork pastrami) was between 2.7 g and 2.8 g, less than the maximum admitted inclusion level (AIL) (3g /100g product). From the data obtained, it can be seen that in some of the foods analyzed, the amount of added sodium chloride was close to the maximum level of inclusion, specified by the legislation.

Key words: sodium chloride, inclusion level, bacon, baloney, pork pastrami

INTRODUCTION

In developed countries, the recommendations and suggestions for salt intake via food consumption are based on scientific research results [4]. Various scientific studies have shown that salt is an essential ingredient in food; however, reduced salt intake is also recommended. High salt intake is known to increase the risk of chronic diseases, including stroke, hypertension, and cardiovascular diseases [8]. However, salt is a vital component for maintaining human life as it helps to maintain adequate water balance in the body [22]. Therefore, consuming an appropriate amount of salt is essential for the maintenance of good health [20].

The World Health Organization recommends a daily intake of sodium chloride of less than 5 g for adults (i.e., < 2 g of sodium) [11], but this amount is exceeded in some European and Asian countries by more than twice [7].

In meat products, sodium is principally incorporated through the addition of sodium chloride (NaCl), and to a lesser extent through some other additives such as sodium nitrate and nitrite (widely used as preservatives in meat products) [9], sodium lactate (principally added as an emulsifier or flavour enhancer)[5], sodium ascorbate (used as an antioxidant) [21], monosodium glutamate (flavour and taste enhancer) [15, 19]. Thus, although the quantity of sodium in fresh meat is low (48−80 mg/100 g sample) [24], meat products contribute 20–30 % of the total amount of salt ingested in the diet [6]. Fermented and dry-cured meat products, such as sausages, hams, or loins, have the greatest amounts of salt, which is related to the dehydration that occurs during processing [23].

The role of salt in food processing is important. In fact, salt plays a central role in enhancing food properties and for food preservation [2]. Salt is well known to be important for meat processing. Salt role in meat

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processing is to form the desired texture by extracting myofibrillar proteins. Myofibrillar proteins contribute to the water holding capacity (WHC) and emulsion stability [12, 13]. Thus, the addition of salt is an important process when manufacturing meat products to sufficiently elute the salt soluble myofibrillar proteins. Another role of salt in meat products is to enhance flavor and juiciness. Salt also inhibits the growth of microorganisms during storage. The antimicrobial effect of salt is well known and has an important impact on the role of salt in various foods [25]. In addition, the flavor of meat products can be enhanced by the addition of salt ingredients. Related with aforementioned role of salt in meat products, attractive textural properties, juiciness, flavor, and safety shelf-life of meat products could be achieved [10]. Although salt is the most important additive in the manufacturing of meat products, meat industry has tried to reduce or replace salt in meat products [16] with salt reduction targeting campaign [4]. As a result, there are obvious limitations in processing meat products without the addition of salt but also new methods to prolong products shelf life and to reduce at the most extent the risks for consumers' health, such as packaging in modified atmosphere [14], usage of high pressure [18] and power ultra sounds [1].

MATERIAL AND METHOD

There have been studied three groups of meat food, in whose composition the usage of sodium chloride (NaCl) is allowed maximum inclusion level at 3 g/100 g edible portion. Three brands from each meat product have been investigated (coded bacon K1, bacon K2, bacon K3, pork pastrami P1, pork pastrami P2, pork pastrami P3, baloney B1, baloney B2, baloney B3).

Salt content was determined in accordance with the AOAC method (2005 reference 969.23) [17]. Firstly, the extracts were prepared from 10 *g* of minced samples added to 40 % (150 mL) ethanol and heated (50 °C, 1 h) in order to extract the chloride ions. The mixture was filtered into a 250 mL volumetric flask, mixed with Carrez I and II (5 mL of each solution), topped up with 40 % ethanol, shaken, and left to stand in the dark for 10 min. Then, the content was centrifuged (3000 rpm, 10 min), filtered, heated to evaporate down to 100 mL, followed by the addition of distilled water until reaching 200 mL.

Once the extract had been prepared, it was titrated. To do that, the extract (10 mL), silver nitrate 0.1 mol/L (10 mL), nitric acid (1 mL), ammonium ferric sulfate 4 % (1 mL), and distilled water (50 mL) were mixed, shaken, and left to stand in the dark for 10 min. In this way, the chlorides of the extract react with part of the silver nitrate, resulting in silver chloride and the 0.1 mol/L silver nitrate remaining. Then, nitrobenzene (1 mL) was added to coagulate the precipitate. Finally, the titration of the remaining 0.1 mol/L silver nitrate was done with 0.1 mol/L of potassium sulfocyanide. Simultaneously, a blank was run with 10 mL of water instead of the extract.

The results were expressed as g NaCl/100 g samples, based on the equivalence between NaCl and the remaining 0.1 mol/L of silver nitrate and considering the exact weight of the sample. Each sample was analyzed fully (extract preparation and titration) in triplicate.

The acquired data have been statistically interpreted, computing the main statistical descriptors (mean). The means have been compared with the maximum tolerated limits of NaCl inclusion in food and relative differences were also calculated.

RESULTS AND DISCUSSIONS

Table 1 shows the salt content results for samples K1, K2 and K3. K1 samples had values between 2 and 2.3 g and the average was 2.2 g NaCl/100 g product

Table 1 Sodium chloride (NaCl) contents in the food products from "bacon" category

Sample code	NaCl g/100 g product	average NaCl content g/100 g product
K 1.1	2.276	2.188
K 1.2	2.274	
K 1.3	2.013	
K 2.1	2.370	2.338
K 2.2	2.312	
K 2.3	2.333	
K 3.1	2.427	2.439
K 3.2	2.384	
K 3.3	2.505	

K2 samples had values between 2.3 and 2.4 g and the average was 2.3 g NaCl/100 g product; K3 samples had values between 2.4 g and 2.5 g, and the average was 2.4 g NaCl/100 g product.

Figure 1 shows the values of the NaCl content on the label of kaizer products from the three producers, compared to the values obtained from our analyzes and to the maximum inclusion amount allowed by the current legislation.

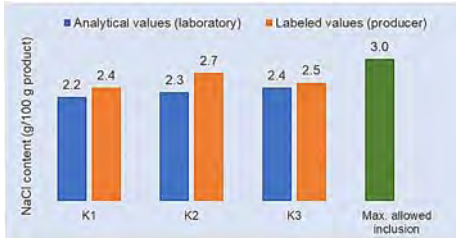

Fig. 1 Average values of the sodium chloride (NaCl) contents in the "bacon" products category

For sample K1, the average amount of salt was 2.2 g/100g product, while value specified on the label was 0.2 g higher. In the case of K2 sample, the average identified salt content was 2.3 g, while the value specified on the label was 0.4 higher. In K3 sample, the determined average was 2.3 g NaCl/100 g, while the labeled value was 2.4 g.

The analytical findings in the bacon - Kaizer category were below the maximum permissible limit (3 g NaCl/100 g product) [10].

The results for the salt content for chicken meat products from the three producers: B1, B2 and B3 are shown in Table 2. The samples analyzed from producer B1 had values between 2.2 g and 2.3 g, and the average obtained was 2.3 g NaCl/100 g product.

In the case of samples from producer B2, the salt content values were lower, between 1.95 and 2.04 g NaCl/100 g product, with an average value of 1.99 g/100 g product. The highest values of salt content were identified in chicken baloney products from producer B3 (2.7 g - 2.8 g NaCl/100 g product).

Figure 2 shows the values of NaCl content on the label of chicken baloney products from three producers on the Romanian market, compared to the values obtained from our analyzes and to the maximum allowed amount to be included in these products, according to legislation in force.

Table 2 Sodium chloride (NaCl) contents in the food products from "baloney" category

Sample code	NaCl g/100 g product	average NaCl content g/100 g product
B 1.1	2.333	2.298
B 1.2	2.234	
B 1.3	2.328	
B 2.1	2.043	1.989
B 2.2	1.971	
B 2.3	1.953	
B 3.1	2.799	2.733
B 3.2	2.708	
B 3.3	2.692	

For sample B1, the average amount of salt reached 2.3 g/100g product, while the value specified on the label was 0.2g lower.

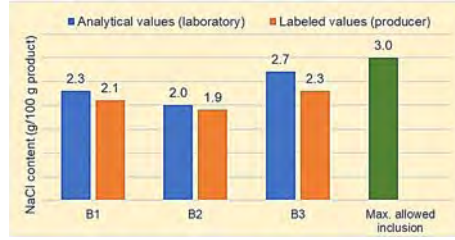

Fig. 2 Average values of the sodium chloride (NaCl) contents in the "baloney" products category

In the case of the B2 samples, the analytical values gave an average of 2.0 g NaCl/100 g product, close to the labeled value, that was 0.1 g lower. In B3 samples the analysis revealed an average value of 2.7 g/100 g, in comparison with the 2.3 g NaCl/100 g, printed on the package. It can be seen that, in all samples of chicken baloney, the analytical values were higher than the labeled ones. However, the amount of salt in the three commercial products was below the maximum allowed inclusion level (3 g/100 g of product) [10].

The third meat product studied in terms of the amount of salt included was pork pastrami. As for the other meat products, 3 producers

were chosen, namely: P1, P2, P3 and the results obtained from the chemical analyzes are shown in Table 3. The P1 samples P1 had values between 2.7 and 2.9 g NaCl/100 g, and the average obtained was 2.8 g salt/100 g product. In the case of samples processed from producer P2, the values of salt content were similar to those obtained from samples analyzed from producer P1. The lowest values of salt content were identified in P3 samples (1.65 - 1.73 g NaCl / 100 g product).

Table 3 Sodium chloride (NaCl) contents in the food products from "pork pastrami" category

Sample code	NaCl g/100 g product	average NaCl content g/100 g product
P 1.1	2.727	2.793
P 1.2	2.796	
P 1.3	2.855	
P 2.1	2.794	2.794
P 2.2	2.802	
P 2.3	2.788	
P 3.1	1.651	1.701
P 3.2	1.729	
P 3.3	1.722	

Figure 3 shows the values of NaCl content on the label of pig pastrami products from three producers, compared to the analytical values and to the maximum recommended amount to be included in these products, according to the legislation in force. In the case of the samples analyzed from the first pork pastrami product (P1), the average amount of salt determined was 2.8 g/100 g while the value specified on the label was 0.3 g lower. For the second product (P2), the average salt content resulting from the analysis was 2.8 g while the value specified on the label was almost 1g lower.

In the P3 samples we have assessed an average value of 1.7g salt/100 g, while the value specified by the manufacturer was 2.1 g NaCl/100 g product. It can be seen that in the case of samples analyzed from producers P1 and P2, the values of the determined amount of salt were very close to the maximum recommended dose to be included (3 g/100 g of product) and the values of salt content on the label were lower than those obtained from chemical analyses. Only the P3 samples had a salt content below 2 g/100 g product.

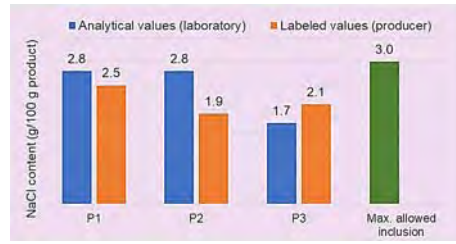

Fig. 3 – Average values of the sodium chloride (NaCl) contents in the "pork pastrami" products category

It can be observed that the level of inclusion of salt differed in accordance with the type of product and with each producer. There is a tendency to set the inclusion rate close to the maximum allowed limit. If an adult consumer intakes 100 g of any of the 3 meat preparations analyzed (kaizer-bacon, chicken baloney, pork pastrami) it would be covered more than 50% of the daily maximum allowed dietary salt. It is known that NaCl is added when home cooking, it is present in many culinary raw matters, spices mixtures, snacks or in many other processed foods, hence the caution in preventing a cumulative effect for the consumer.

CONCLUSIONS

Assessment of chloride content in certain meat products (bacon, baloney and pork pastrami), issued from different processing companies, revealed that the values were found below the maximal admitted threshold (3 g NaCl added per 100 g product), while most of the samples contained more than 2 g NaCl per 100 g product.

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