

# Dietary salt/sodium intake through consumption of animal origin foodstuffs available on the Serbian market

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**A b s t r a c t:** Salt (sodium chloride) was the first and the best recognised food preservative, particularly for meat. The World Health Organization strongly recommends a reduction in sodium intake in adults to less than 2 g/day sodium (5 g/day salt) to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart disease, as well a reduction in sodium intake in children to control blood pressure. The goal of this paper was to investigate the salt content as labelled on foods of animal origin from the Serbian retail market. The study reviewed a total of 395 foods, of which 16 were meat preparations, 13 were fresh sausages, 31 were finely minced cooked sausages, 16 were coarsely minced cooked sausages, 39 were patés, 21 were canned meats (luncheon meat type), 10 were pasteurised ham, 26 were pasteurised smoked meat products, 20 were bacon, 8 were semi-dry fermented sausages, 57 were dry fermented sausages, 28 were dry meat, 15 were prepared meat meals, 18 were soft cheese, 36 were semi-hard cheese, 6 were meat soups, 17 were smoked salmon and 18 were sandwiches. The highest declared salt contents are labelled on thermally untreated meat products, i.e. dry meat, bacon, dry and semi-dry fermented sausages and smoked salmon. Pasteurised and sterilised meat products have lower salt contents declared on labels. It was concluded that meat products examined in this study are important sources of dietary salt, and that consumption of 100 g of these products can largely meet daily dietary requirements for salt/sodium. Due to that, it is necessary to reduce salt/sodium content in these foods by decreasing amounts of salt used during production and by using salt substitutes, such as salt with potassium.

**Keywords:** salt, sodium, meat products, daily requirements.

## Introduction

Salt's history is important to the history of the human population. Salt (sodium chloride) was the first and the best recognised food preservative, particularly for meat. The discovery of salt had great importance and its use in food was very practical due to it making food more shelf stable and available independently of annual season. Also, it ensured food could be transported for long distances. Salt was one of the first categories of trade and was the subject of taxes, salaries and colonial power. One kilogram of salt was sometimes equal to one kilogram of gold, especially in sub-Saharan Africa. Salt consumption achieved a maximum level during the first years of the 20<sup>th</sup> century, but salt use has continued to grow along with industrial food production.

Salt is the prototypical stimulus for salty taste (Dotsch *et al.*, 2009) and it improves the sensory properties of food by increasing saltiness, decreasing bitterness and increasing sweetness and other congruent flavour effects (Keast and Breslin, 2003).

However, nowadays, excessive dietary sodium intake from salt is recognised as a main cause of essential hypertension. Besides that, excessive sodium intake can lead to: direct risk of heart attack (Perry and Beevers, 1992), hypertrophy of the left heart chamber (Schmieder and Messerli, 2000), sodium retention in extracellular fluid (MacGregor and de Wardener, 1997), greater possibility of infection by *Helicobacter pylori* and risk of gastric cancer (Tsugane *et al.*, 2004), increase of urinary excretion of calcium and risk of forming of kidney calculi (Cappuccio *et al.*, 2000), risk of reduced bone density (Devine *et al.*, 1995), exacerbations of asthmatic seizures (Mickleborough *et al.*, 2005) and increase of HOMA (homeostasis model assessment) insulin resistance in patients with essential hypertension (Kuroda *et al.*, 1999).

The World Health Organization (WHO) strongly recommends sodium intake in adults is reduced to less than 2 g/day sodium (5 g/day salt) to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart disease, and sodium

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intake in children is reduced to control blood pressure. The recommended level is based on the energy requirements of children relative to those of adults. There is high-quality evidence that decreasing sodium is beneficial for blood pressure in adults and children, while it has no harmful effect on blood lipids, catecholamine levels, renal function or any minor side effects (e.g. headache and dizziness) in adults or children. Moderate-quality evidence is that reduced sodium is consistent with a benefit to renal function in adults; that reduced sodium is beneficial for reducing risk of cardiovascular disease, stroke and coronary heart disease, because of the well-established relationship between blood pressure and cardiovascular disease outcomes, and; that reduced sodium is beneficial for controlling blood pressure in children (*WHO Guideline*, 2012).

According to European Commission data (*European Commission*, 2013), the highest daily salt intake is in Czech Republic (13.6 g) and similar levels are consumed in Slovenia, Hungary and Portugal (12.7, 12.5 and 12.3 g, respectively). Lower daily consumption levels were established in Poland, Romania, Belgium, Estonia, Norway and Spain (11.5, 11.1, 10.5, 10.0, 10.0 and 10.0 g, respectively). Under 10.0 g/day salt is consumed in Italy, Lithuania, Switzerland, the Netherlands, Denmark, France, Austria, Finland, UK, Sweden, Slovakia, Latvia, Bulgaria, Cyprus and Germany (9.6, 9.0, 9.0, 8.7, 8.6, 8.6, 8.5, 8.1, 8.1, 8.0, 7.6, 7.3, 7.1, 6.5 and 6.3 g/day, respectively) (*European Commission*, 2013).

In most European countries, the greatest salt intake originates from bread, cereals, and bakery products, followed by meat products, cheese and dairy products (*Anderson et al.*, 2010; *Guallar-Castillón et al.*, 2013). There is no adopted international standard for sodium versus salt labelling. The term salt is more common in the European Union, and because of that term, salt instead of sodium should be used on food labels to ensure consumer understanding, according to Regulation (EU) No 1169/2011 (*European Commission*, 2011). Front-of-package labelling used in Serbia provides information about the energy value of food, and fat, saturated fat, carbohydrate, sugar, protein and salt contents in 100 g or 100 ml of food. This information can also be presented as the percentage of an adult's guideline daily amount met by one serving or 100 g or 100 ml of food.

The goal of this paper was to investigate the salt content as labelled on foods of animal origin from the Serbian retail market.

## Materials and Methods

The study involved checking the labelled sodium chloride content on the nutrition declarations of a total of 395 foods, of which 16 were meat preparations, 13 were fresh sausages, 31 were finely minced cooked sausages, 16 were coarsely minced cooked sausages, 39 were pâtés, 21 were canned meats (luncheon meat type), 10 were pasteurised ham, 26 were pasteurised smoked meat products, 20 were bacon, 8 were semi-dry fermented sausages, 57 were dry fermented sausages, 28 were dry meat, 15 were prepared meals were meat, 18 were soft cheese, 36 were semi-hard cheese, 6 were meat soups, 17 were smoked salmon and 18 were sandwiches. Sodium content was calculated by dividing the salt content by 2.5.

The results obtained were statistically evaluated using Microsoft Excel 2010 and are presented as mean  $\pm$  SD.

## Results and discussion

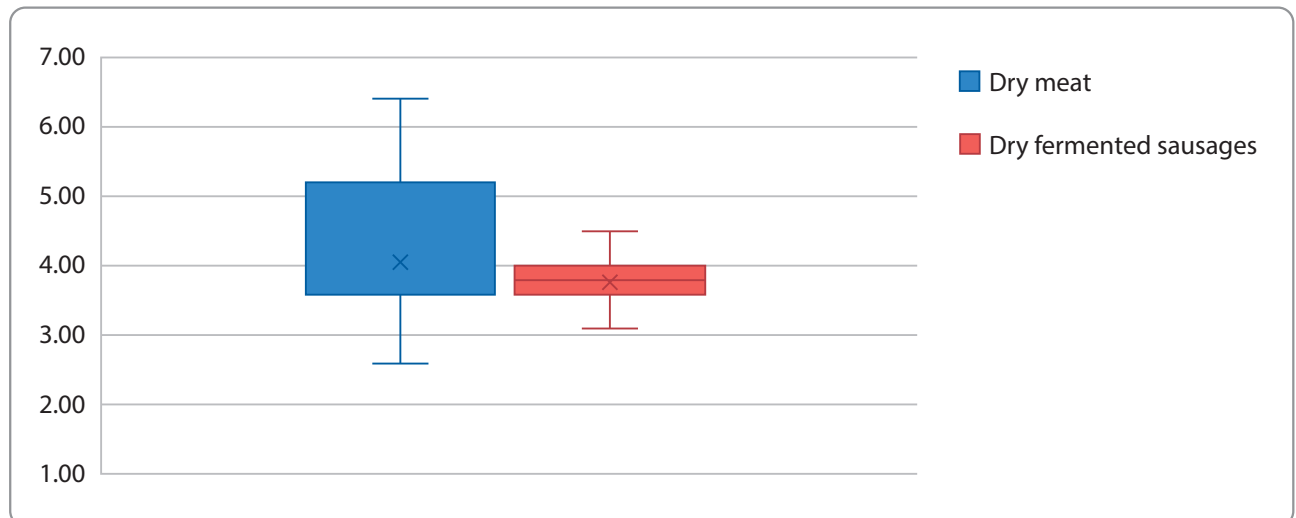
The declared salt content of the foods is presented in Figures 1–6. The highest labelled salt content in this study (Figure 1) was in the range from 2.60 to 6.40 g/100 g (average  $4.10 \pm 1.21$  g/100 g), as labelled on dry meat, then dry fermented sausages in the range from 3.10–4.50 g/100 g (average  $3.80 \pm 0.36$  g/100 g). Lower salt content (Figure 2) was declared on semi-dry fermented sausages, bacon, smoked salmon and pasteurised smoked meat products (3.10–4.50 g/100 g, average  $2.80 \pm 0.51$ ; 2.00–5.10 g/100 g, average  $2.80 \pm 0.81$ ; 1.20–3.50 g/100 g, average  $2.50 \pm 0.61$  g/100 g and 1.70–3.30 g/100 g, average  $2.70 \pm 0.56$  g/100 g, respectively). Salt content in food depends on many factors such as type of food, consumer habits and geographical area, but primarily on the production process. A high salt content in these products is expected because they are not produced under high temperature treatments, their production cycle lasts a long time, and salt and low temperature are the main hygienic factors. In thermally untreated food, smoking can also be an important preservation technique. The salt content is very variable, depending primarily on the amount of salt used at the start of production, then on the size of meat (ham, smaller pieces of meat) and consumer consumption habits.

Foods with a salt content around 2 g/100 g were mostly meat products and products using meat as an ingredient. Meat preparations had a declared on-label salt content of 1.40–2.50 g/100, average  $1.88 \pm 0.41$ , fresh

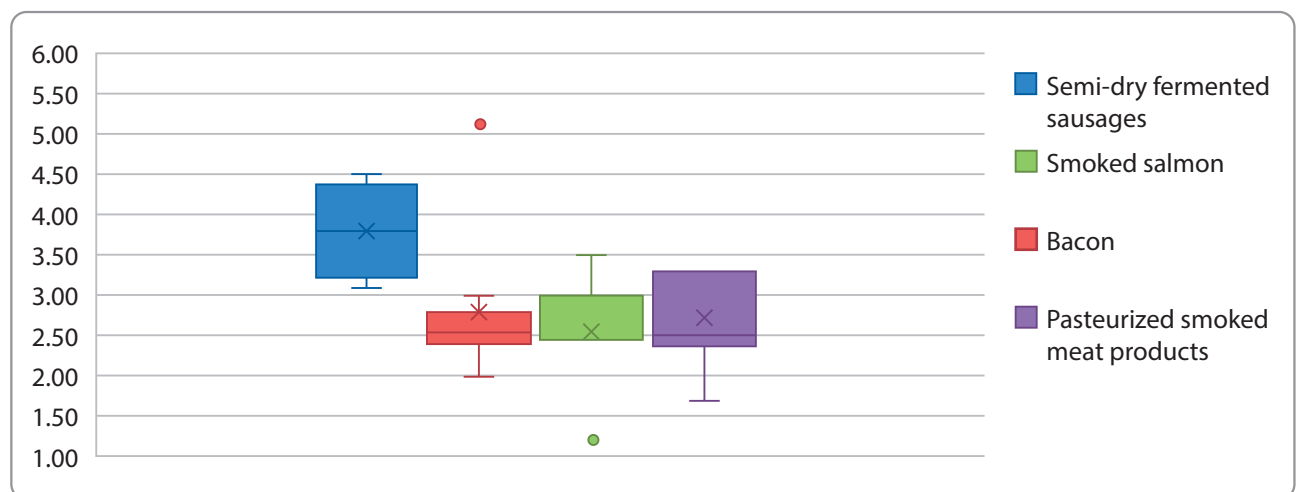
sausages 1.65–2.50 g/100 g, average  $2.10 \pm 0.37$  g/100 g, finely minced cooked sausages 1.40–2.50 g/100 g, average  $1.80 \pm 0.33$  g/100 g, coarsely minced cooked sausages 1.70–2.90 g/100 g, average  $2.23 \pm 0.33$  g/100 g, pasteurised ham 1.60–2.50 g/100 g, average  $2.00 \pm 0.31$  g/100 g, sandwiches 1.70–2.20 g/100 g, average  $1.97 \pm 0.21$  g/100 g, prepared meals of meat 1.10–1.80 g/100 g, average  $1.52 \pm 0.18$  g/100 g (Figure 3 and 4), canned meats (luncheon meat type) 1.40–1.80 g/100 g, average  $1.64 \pm 0.11$  g/100 g, meat soup 1.30–1.60, average  $1.43 \pm 0.09$  and pâté 1.10–1.30 g/100 g, average  $1.20 \pm 0.06$  g/100 g (Figure 5). This salt content is primarily the result of the nature of these products, and each product's expected saltiness characteristics, as well as of salt's technological aspects, such as its contribution to consistency and textural characteristics of the products.

Soft cheese had a slightly lower salt content (1.35–2.00 g/100 g, average  $1.61 \pm 0.22$  g/100 g). Although semi-hard cheese had a lower average salt content ( $1.10 \pm 0.83$  g/100 g), individual cheeses in this group sometimes had significantly higher salt contents, 0.50–4.00 g/100 g (Figure 6).

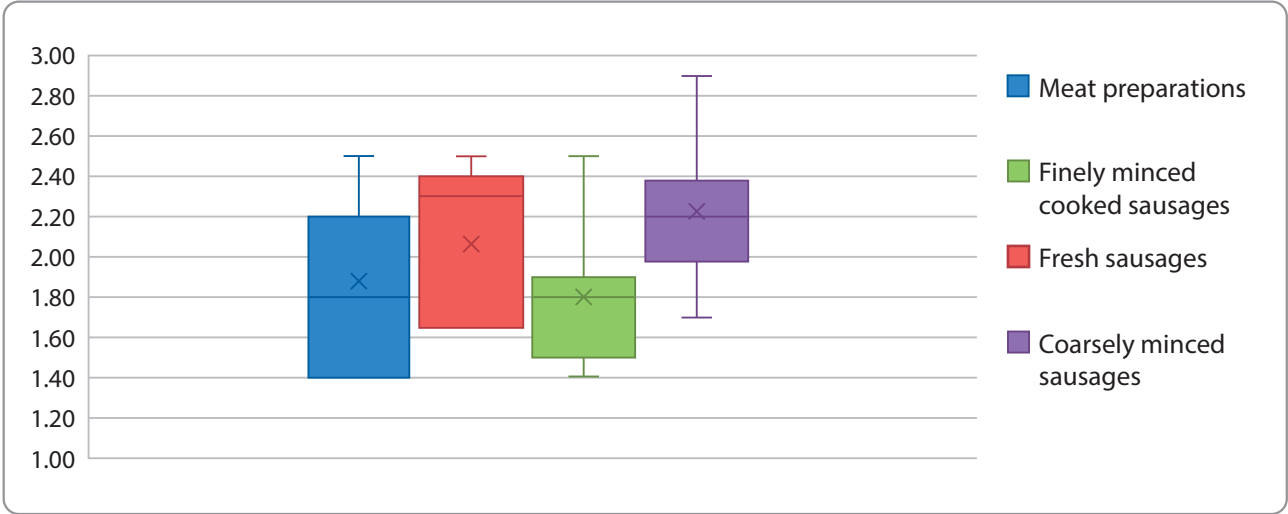
Data on the declared sodium contents in the foods are presented in Table 1, and they were in direct correlation with declared salt contents. From the human health aspect, the most interesting data are the percentages of the daily recommended intake of salt/sodium that consumption of 100 g of food meets (Table 2). Up to 100% and sometimes more of daily sodium requirements can be met by consumption of 100 g of some foods: dry meat (52–128%), bacon (40–102%), dry and semi-dry fermented sausages (62–90%), semi-hard cheese (10–80%) and smoked salmon (24–70%). About



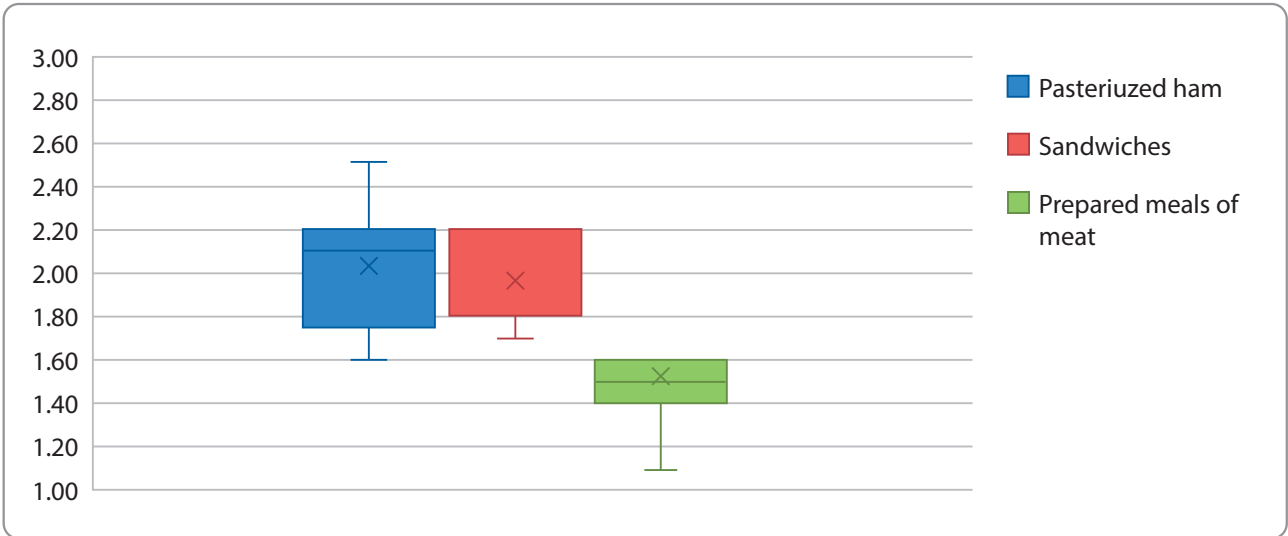
**Figure 1.** Salt content in dry meat and dry fermented sausages, g/100 g



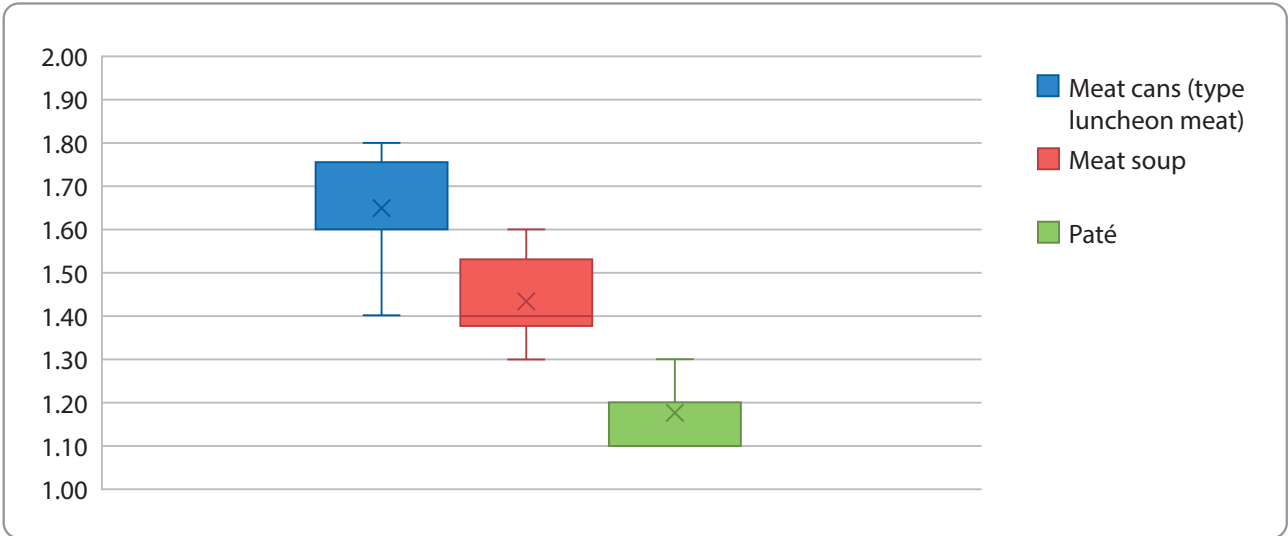
**Figure 2.** Salt content in semi-dry fermented sausages, bacon, pasteurised smoked meat products and smoked salmon, g/100 g



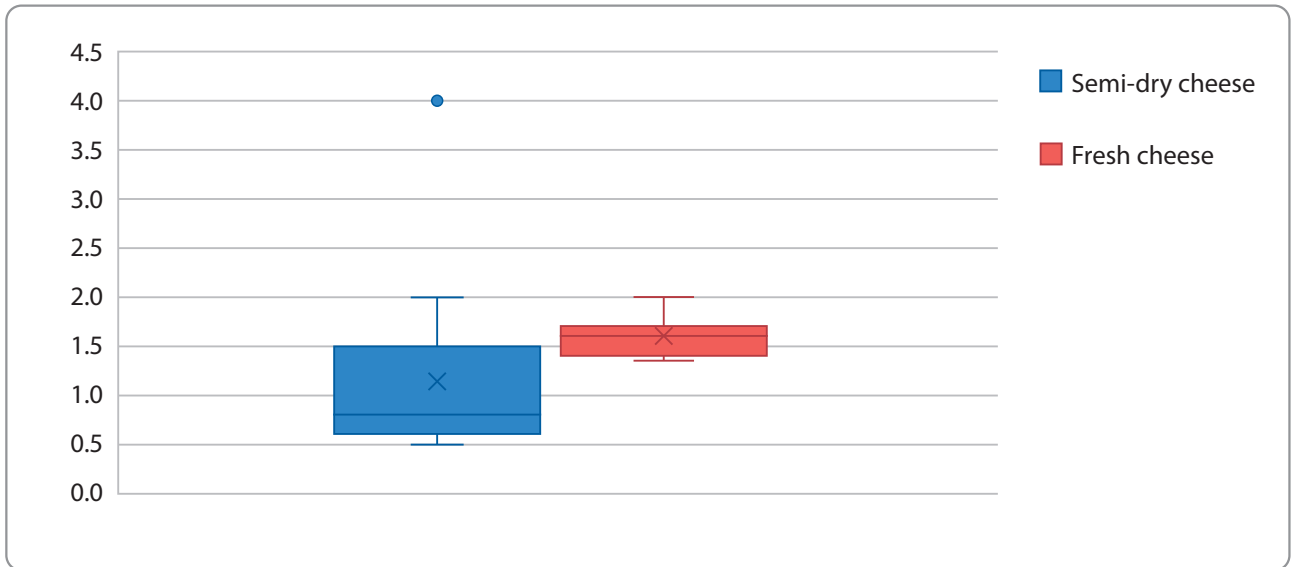
**Figure 3.** Salt content in meat preparations, fresh sausages, finely and coarsely minces sausages, g/100 g



**Figure 4.** Salt content in pasteurised ham, sandwiches and prepared meals of meat, g/100 g



**Figure 5.** Salt content in canned meats (luncheon meat type), meat soup and paté, g/100 g



**Figure 6.** Salt content in semi-dry and fresh cheese, g/100 g

half of daily sodium requirements can be met by consumption of 100 g of some foods: meat preparations (28–50%), fresh sausages (33–50%), finely and coarsely minced cooked sausages (28–50% and 34–58%, respectively), pasteurised smoked meat products (34–66%), pasteurised ham (32–50%) and sandwiches (34–44%).

It can be concluded that meat products, especially thermally untreated meat products, are one of the main dietary sources of sodium. Although other meat products are preserved with high temperature (pasteurisation or sterilisation), they are also important sources of sodium due to salt imparting a desirable taste, and to consumer consumption habits.

**Table 1.** Sodium content (mean values and ranges) declared on food labels, mg/100 g

	n	Sodium (mean $\pm$ SD)	Range
Meat preparations	16	752.50 $\pm$ 162.62	560–1000
Fresh sausages	13	826.15 $\pm$ 149.33	660–1000
Cooked sausages, finely minced	31	720.00 $\pm$ 130.11	560–1000
Cooked sausages, coarsely minced	16	890.00 $\pm$ 132.29	680–1160
Paté	39	468.72 $\pm$ 25.54	440–520
Canned meat (luncheon meat type)	21	657.14 $\pm$ 45.48	560–720
Pasteurised ham	10	808.00 $\pm$ 122.38	640–1000
Pasteurised, smoked meat products	26	1086.15 $\pm$ 224.55	680–1320
Bacon	20	1120.00 $\pm$ 324.47	800–2040
Semi-dry fermented sausages	8	1520.00 $\pm$ 205.91	1240–1800
Dry fermented sausages	57	1504.56 $\pm$ 144.47	1240–1800
Dry meat	28	1620.00 $\pm$ 483.62	1040–2560
Prepared meat meals	15	608.00 $\pm$ 73.32	440–720
Soft cheese	18	643.33 $\pm$ 88.25	540–800
Semi-hard cheese	36	453.33 $\pm$ 330.12	200–1600
Meat soup	6	573.33 $\pm$ 37.71	520–640
Smoked salmon	17	1023.53 $\pm$ 242.82	480–1400
Sandwiches	18	786.67 $\pm$ 84.33	680–880

**Table 2. Percentage of sodium chloride (NaCl) and sodium (Na) (mean values and ranges) in recommended daily requirements (*WHO Guideline, 2012*) met by consumption of 100 g of food**

	n	NaCl (mean)	NaCl (range)	Na (mean)	Na (range)
Meat preparations	16	31.33	23.33–41.67	37.63	28.00–50.00
Fresh sausages	13	35.00	27.50–41.67	41.30	33.00–50.00
Cooked sausages, finely minced	31	30.00	23.33–41.66	36.00	28.00–50.00
Cooked sausages, coarsely minced	16	37.17	28.33–48.33	44.50	34.00–58.00
Paté	39	20.00	18.33–21.67	23.44	22.00–26.00
Canned meat (luncheon meat type)	21	27.33	23.33–30.00	32.86	28.00–36.00
Pasteurised ham	10	33.33	26.67–41.67	40.40	32.00–50.00
Pasteurised, smoked meat products	26	45.00	28.33–55.00	54.31	34.00–66.00
Bacon	20	46.67	33.33–85.00	56.00	40.00–102.00
Semi-dry fermented sausages	8	46.67	51.67–75.00	76.00	62.00–90.00
Dry fermented sausages	57	63.33	51.67–74.00	75.23	62.00–90.00
Dry meat	28	68.33	43.33–106.67	81.00	52.00–128.00
Prepared meals of meat	15	25.33	18.33–30.00	30.40	22.00–36.00
Soft cheese	18	26.83	22.50–23.33	32.17	27.00–40.00
Semi-hard cheese	36	18.33	8.33–66.67	22.67	10.00–80.00
Meat soup	6	23.83	21.67–26.67	28.67	26.00–32.00
Smoked salmon	17	41.67	20.00–58.33	51.18	24.00–70.00
Sandwiches	18	32.83	28.33–36.67	39.33	34.00–44.00

**Conclusion**

The main retail food products with high salt/sodium contents declared on labels are thermally untreated meat products, i.e. dry meat, bacon, smoked salmon and dry and semi-dry fermented sausages. Lower amounts of salt are declared on other meat products. In general, 100 g of the examined foods mostly met half or 100% of the daily recommended

requirements for salt and sodium. Due to that, it is necessary to reduce the salt/sodium content in these foods by decreasing the amount of salt used during production and by using salt substitutes, such as salt with potassium. Also, foods with large amounts of salt should be combined with other kinds of foods, such as vegetable and fruit rich in potassium, to achieve WHO recommendations for salt intake.



# Unos soli/natrijuma hranom animalnog porekla sa tržišta Srbije

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**A p s t r a k t:** So (natrijum hlorid) je prvi konzervans za hranu, posebno za meso. Svetska zdravstvena organizacija donela je stroge preporuke za smanjenje unosa natrijuma u cilju snižavanja krvnog pritiska i rizika od pojave kardiovaskularnih oboljenja, moždanog i srčanog udara, na manje od 2 g natrijuma dnevno (5 g soli dnevno), kako kod odraslih, tako i kod dece. Cilj rada bio je da se istraži sadržaj soli deklarisan na proizvodima animalnog porekla sa tržišta Srbije. Ogled je obuhvatio pregled deklaracija ukupno 395 uzoraka hrane, od toga 16 uzoraka poluproizvoda od mesa, 13 uzoraka svežih kobasica, 31 uzorak fino usitnjenih barenih kobasica, 16 uzoraka grubo usitnjenih barenih kobasica, 39 uzoraka pašteta, 21 uzorak konzervi od usitnjenog mesa, 10 uzoraka pasterizovane šunke, 26 uzoraka dimljenih proizvoda od mesa, 20 uzoraka slanina, 8 uzoraka fermentisanih polusuvih kobasica, 57 uzoraka fermentisanih suvih kobasica, 28 uzoraka suvog mesa, 15 uzoraka pripremljenih jela od mesa, 18 uzoraka mekog sira, 36 uzoraka polutvrdog sira, 6 uzoraka mesnih supa, 17 uzoraka dimljenog lososa i 18 uzoraka sendviča. Najveći sadržaj soli deklarisan je na termički netretiranim proizvodima od mesa, kao što su suvo meso, slanina, fermentisane polusuve i suve kobasice i dimljenom lososu. Nešto manji sadržaj soli deklarisan je na pasterizovanim i sterilizovanim proizvodima od mesa. Može da se zaključi da proizvodi od mesa predstavljaju značajan izvor soli i, da se konzumiranjem 100 g ovih proizvoda, može da se zadovolji celokupna dnevna potreba u soli, odnosno natrijumu. Zbog toga, neophodno je smanjiti sadržaj soli, odnosno natrijuma u hrani, smanjivanjem dodate soli u proizvodnji, kao i korišćenjem supstituenata soli, u prvom redu solima kalijuma.

**Cljučne reči:** so, natrijum, proizvodi od mesa, dnevne potrebe.

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