Corresponding author:

Phone: +381 214853827

E-mail address: tatjana.peulic@fins.uns.ac.rs

SODIUM CHLORIDE AND NITRITE CONTENTS IN CANNED MEAT IN PIECES FROM THE SERBIAN MARKET

Tatjana A. Peulić*, Predrag M. Ikonić1, Marija R. Jokanović2, Jovana D. Delić1, Jasmina M. Gubić1, Snežana B. Škaljac2, Jasna S. Mastilović1

1University of Novi Sad, Institute of Food Technology, 21000 Novi Sad, Bulevar cara Lazara 1, Serbia
2University of Novi Sad, Faculty of Technology Novi Sad, 21000 Novi Sad, Bulevar cara Lazara 1, Serbia

Abstract: Canned meat in pieces (CM) is a group of meat products widely consumed by children and consumers with special diet regimes, due to high protein and low fat content. In this study safety of these products regarding sodium chloride and nitrite contents was examined in total of 19 meat samples produced by 14 most represented meat processors on Serbian market. The statement about high protein and low fat content in CM for products from the Serbian market was confirmed. The products made from chicken meat (“Pileća prsa”, protein 12.4 to 17.4 g/100 g; fat 0.92 to 3.84 g/100 g) had higher protein and lower fat content that the products made from pork (“Pizza šunka”, protein 11.5 to 14.3 g/100 g; fat 4.61 to 14.4 g/100 g). In the group “Pileća prsa” 90.91% of samples had sodium chloride content below 1.5 g/100 g, while in the group “Pizza šunka” 75% of samples had sodium chloride content lower than 1.5 g/100g. Residual nitrite content in product “Pileća prsa” ranged from 0.62 to 20.7 mg/kg and in product “Pizza šunka” this content ranged from 3.27 to 19.2 mg/kg. These results indicate that all analysed samples were below the required limits of nitrite content. According to the results obtained in this study, children and consumers with special diet regimes are free to consume Serbian meat products in the type of CM considering the contents of protein and fat, as well as sodium chloride and nitrite residue.

Key words: meat products, pork, chicken, protein content, fat content, safety, Serbian meat product market

INTRODUCTION

Meat and meat products are widely consumed in Serbia. The main reason for meat consumption is high quality proteins with high content of essential amino acids. Moreover, meat is a valuable source of vitamin B12, zinc, phosphorous and iron, but low in carbohydrates (Rede & Petrovic, 1997; Lawrie & Ledward, 2006; Godfray et al., 2018). On the other hand, high content of fat, rich in saturated fatty acids in some meat and meat products, can be a problem for consumers suffering from cardiovascular diseases and other illnesses. Thus canned meat in pieces (CM) is widely consumed by children and consumers with special diet regimes, due to high protein and low fat content. But, the question is how high is the content of sodium chloride and nitrite in this type of product? Sodium chloride is a widely
used preservative in meat processing industry, since it has influence on safety and quality parameters of meat products. It plays a great role in microbial stability by controlling the growth of foodborne pathogens and spoilage microorganisms. Also, sodium chloride improves the sensory properties by enhancing the perception of meat flavour, textural properties and colour (Desmond, 2006; Vuković, 2012; Wu et al., 2015; Pretorius and Schönfeldt, 2018; Silva Haddada et al., 2018). Apart from important role in meat products safety and quality, sodium chloride plays an important role in the human body. But, the excessive intake of sodium contribute to high blood pressure and increase the risk of heart disease and stroke, as well as other health problems such as stomach cancer and renal diseases (Doyle & Glass, 2010; WHO, 2010; Haizhou et al., 2015; WHO, 2016). Therefore, many countries try to regulate total sodium chloride intake through national strategies (Aaslyng et al., 2014; Inguglia et al., 2017). Food Standards Agency (FSA), World Health Organization (WHO), European Food Safety Authority (EFSA) and other regulatory authorities recommend a daily average consumption of ≤5–6 g of NaCl or < 2.4 g of Na (Matthews and Strong, 2005; Desmond, 2006; EFSA, 2009; WHO, 2012). Since meat products are generally recognized as the most responsible for sodium chloride intake it would be desirable to consider all the possibilities for sodium chloride reduction in these products, going toward recommendations of health authorities (Kamenik et al., 2017).

Nitrite is also widely used in meat processing industry as an additive due to its inhibitory role in the growth of foodborne pathogenes and spoilage microorganisms, as well as due to its antioxidant action against lipid oxidation (Barbieri, Bergamaschi, Barbieri, & Franceschini, 2012; Vuković, 2012; Sebranek, 2009). Like sodium chloride, nitrite also improves the sensory properties of meat products by forming the unique pink colour, flavour and aroma (Honikel, 2008; Parthasarathy & Bryan, 2012; Vuković). The content of added nitrite for meat products is defined by the Commission Regulation (EU) No. 1129/2011 and the Serbian Regulation (Serbian Regulation, 94/15, 104/15 and 19/17). Total of 19 meat samples produced by 14 most represented meat processors (P1-P14) were collected from the Serbian retail market during the year 2018. The collected samples belonged to CM group of meat products as defined by the Serbian Regulations 94/15, 104/15 and 19/17. Eleven samples (n=11) were made from chicken meat („Pileca prsa“) and eight samples (n=8) were made from pork („Pizza šunka“). After collection, the samples were homogenized and stored at -18 °C until analysis. All determinations were conducted in triplicate.

**MATERIALS AND METHODS**

**Meat product samples**

Total of 19 meat samples produced by 14 most represented meat processors (P1-P14) were collected from the Serbian retail market during the year 2018. The collected samples belonged to CM group of meat products as defined by the Serbian Regulations 94/15, 104/15 and 19/17. Eleven samples (n=11) were made from chicken meat („Pileca prsa“) and eight samples (n=8) were made from pork („Pizza šunka“). After collection, the samples were homogenized and stored at -18 °C until analysis. All determinations were conducted in triplicate.

**Determination of protein and fat content**

Protein content in samples was determined according to the international standards ISO 937:1978 and expressed as g protein/100 g sample.

Fat content in samples was determined according to the international standards ISO 1443:1973 and expressed as g fat/100 g sample.

**Determination of sodium chloride and nitrite content**

Sodium content in the samples was determined according to the international standards ISO 6869:2000. Sodium chloride content was estimated from the content of sodium according to the Serbian Regulation (Serbian Regulation, 19/2017 and 16/2018) and expressed as g sodium chloride/100 g sample.

Residual nitrite content in samples was determined according to the international standards ISO 2918:1975 and expressed as mg nitrite/kg sample.

Results shown in the tables represent mean values of three measurements ± standard deviation.
RESULTS AND DISCUSSION

Protein and fat content (g/100g) in CM from the Serbian market are shown in Table 1. The protein content in the product type “Pileća prsa” ranged from 12.4 to 17.4 g/100g and in the product type “Pizza šunka” ranged from 11.5 to 14.3 g/100g. The legal limit of protein content according to the Serbian regulation (2015) for this type of products type is minimum 12%. Only one sample from the total of 19 samples did not fulfill the legal requirements, while 74% of samples had protein content 20% higher than the legal minimum, 10% of samples had protein content in the range from 20% to 40% higher than the legal minimum and 11% of samples had 40-60% higher proteins than the legal minimum which was reported earlier by Delić et al. (2019). The fat content in the “Pileća prsa” product type ranged from 0.92 to 3.84 g/100 g whereas in the product “Pizza šunka” ranged from 4.61 to 14.4 g/100g. The statement about high protein and low fat contents in CM mentioned above has been confirmed for these products from the Serbian market, even though products made from chicken meat (“Pileća prsa”) had higher protein and lower fat content than products made from pork meat (“Pizza šunka”). Sodium chloride (g/100 g) and residual nitrite (mg/kg) contents in the CM samples collected from the Serbian market are shown in Table 2. Sodium chloride content lower than 1.5 g/100g, i.e. only one sample (9.09%) had sodium chloride content higher than 1.5 g/100g. For “Pizza šunka” 75% of samples had sodium chloride content below 1.5 g/100g. The results obtained in this study were in accordance with the results of Parpia et al., (2018) for sodium chloride-reduced products and were lower than results obtained by Kamenik et al. (2017) and Pretorius & Schönfeldt (2018) for similar products. According to literature data, the sodium chloride content can be reduced to 1.5–1.7% without changing the sensory and technological properties of the product (Kamenik et al., 2017). Furthermore, according to Honikel (2008) 1.5% is sufficient for increasing water binding capacity of proteins, while Feiner (2006) recommends minimal amount of 1.2 % of sodium chloride is meat products needed to the effective activation of proteins. To improve the taste of meat products, 1% of sodium chloride content is sufficient (Honikel, 2008). In their work, Kamenik et al. (2017) concluded that relationship of sodium chloride content and analysed instrumental and sensory characteristics was not strong; supporting indicates that it is possible to reduce sodium chloride content in meat products without changing the sensory or textural properties. Even though, the analysed CM samples from the Serbian market had relatively low content of sodium chloride, compared to similar products from the literature, all possibilities for further sodium chloride reduction should be considered. These intentions are firstly guided by the statements of the European Society of Cardiology saying that Serbia is a high risk country with cardio-

Table 1.

| Product | „Pileća prsa“ | „Pizza šunka“ |
|---------|-------------|--------------|
| Sample | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 |
| Protein content | 14.2 ±0.01 | 13.4 ±0.01 | 12.4 ±0.07 | 14.2 ±0.10 | 15.0 ±0.02 | 12.7 ±0.07 | 13.8 ±0.03 | 15.6 ±0.05 | 17.2 ±0.14 | 17.4 ±0.08 | 14.3 ±0.02 |
| Fat content | 1.89 ±0.01 | 1.95 ±0.02 | 3.84 ±0.03 | 0.98 ±0.00 | 1.79 ±0.02 | 2.19 ±0.03 | 3.72 ±0.01 | 1.10 ±0.00 | 0.92 ±0.00 | 1.04 ±0.00 | 1.3 ±0.01 |
| Protein content | 13.3 ±0.10 | 13.2 ±0.08 | 14.3 ±0.01 | 11.5 ±0.04 | 13.0 ±0.02 | 12.2 ±0.00 | 12.7 ±0.03 | 14.0 ±0.05 |
| Fat content | 6.12 ±0.02 | 6.19 ±0.02 | 6.78 ±0.10 | 2.17 ±0.10 | 5.07 ±0.06 | 4.61 ±0.04 | 8.57 ±0.04 | 9.52 ±0.04 |

Results are given as mean ± standard deviation (n = 3)
vascular diseases being the leading causes of mortality (Giga et al., 2017).

Residual nitrite content in the samples of “Pileća prsa” ranged from 0.62 to 20.7 mg/kg whereas in “Pizza šunka” ranged from 3.27 to 19.2 mg/kg. Currently, the legal limit for added nitrite according to the Serbian Regulation (53/2018) for this product type is maximum 150 mg/kg. According to the literature data (Honikel, 2008), after thermal treatment of meat products content of added nitrite decreases and around 35% remain as residual, what indicated that producers did not use a maximum allowed concentration of nitrates during processing. The average nitrite value for the examined samples was 9.54 mg/kg which is in accordance with literature data for similar meat products (Bajčić et al., 2018; Hamid et al., 2020).

CONCLUSIONS

The analysed samples of CM collected from the Serbian retail market, produced by 14 most abundant meat processors, contained high protein and low fat contents. The products made from chicken meat (“Pileća prsa”) had higher protein and lower fat content than the products made from pork meat (“Pizza šunka”).

Even though the examined samples had relatively low content of sodium chloride (84% of samples were below 1.5 g/100 g) all possibilities for further sodium chloride reduction should be considered, since Serbia is a country with high prevalence of cardiovascular diseases. Also, the residual nitrite content was in the range from 0.62 to 20.7 mg/kg, which means that all samples were below the required limits. According to the results obtained in this study, children and consumers on special dietary regimes are free to consume Serbian meat products in the type of CM considering the content of protein and fat, as well as from sodium chloride and nitrite content. All examined quality issues were in accordance with the legal requirements, and low sodium chloride content was in accordance with WHO recommendation for a daily average consumption of <5–6 g of NaCl or <2–2.4 g of Na.

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| Product | Sample | “Pileća prsa” | | “Pizza šunka” | |
|---------|--------|--------------|---------|----------------|---|
| Sodium  | Sample | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | |
| content | 1.45 | 1.21 | 1.45 | 1.96 | 1.30 | 1.40 | 1.35 | 1.31 | 1.18 | 1.17 | 1.09 |
| ±0.05 | ±0.02 | ±0.05 | ±0.03 | ±0.03 | ±0.03 | ±0.05 | ±0.04 | ±0.07 | ±0.03 | ±0.04 |
| Nitrite | 6.60 | 7.74 | 6.51 | 13.51 | 7.74 | 20.7 | 8.43 | 9.00 | 13.9 | 0.62 | 7.28 |
| ±0.07 | ±0.10 | ±0.04 | ±0.09 | ±0.02 | ±0.06 | ±0.10 | ±0.06 | ±0.05 | ±0.03 | ±0.07 |

Results are given as mean ± standard deviation (n = 3)
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САДРЖАЈ НАТРИЈУМ ХЛОРИДА И НИТРИТА У КОНЗЕРВАМА ОД МЕСА У КОМАДИМА НА ТРЖИШТУ РЕПУБЛИКЕ СРБИЈЕ

Татјана А. Пеулић*, Предраг М. Иконић1, Марија Р. Јокановић2, Јована Д. Делић1, Јасмина М. Губић1, Снежана Б. Шкаљац1, Јасна С. Мастиловић1

1Универзитет у Новом Саду, Научни институт за прехранбене технологије у Новом Саду, 21000 Нови Сад, Булевар цара Лазара бр. 1, Србија
2Универзитет у Новом Саду, Технолошки факултет, 21000 Нови Сад, Булевар цара Лазара бр. 1, Србија

Сажетак: Конзерве од меса у комадима су производи од меса које у највећој мери конзумирају деца и потрошачи са специјалним захтевима у исхрани, због високог садржаја протеина и ниског садржаја масти. Стога је циљ овог рада био да се у овој групи производа од меса испита садржај натријума хлорида и нитрита у укупно 19 узорака прикупљених од 14 најзаступљенијих производа на тржишту Републике Србије. Чињеница да конзерве од меса у комадима имају висок садржај протеина и низак садржај масти, потврђена је у овим истраживањима. Садржај протеина у узорцима Пилећих прса кретао се у интервалу од 12,4 до 17,4 г/100 г, а масти од 0,92 до 3,84 г/100 г док се у узорцима Пица шунке садржај протеина кретао у интервалу од 11,5 до 14,3 г/100 г, а масти од 4,61 до 14,4 г/100 г. У 90,91% узорака „Пилећих прса“ садржај натријума хлорида био је ниже од 1,5%, док је исти резултат добијен за 75% узорака Пица шунке. Резидуални садржај нитрита се у узорцима Пилећих прса кретао у интервалу од 0,62 до 20,7 мг/кг, док се у узорцима Пица шунке кретао у интервалу од 3,27 до 19,2 мг/кг. Утврђене вредности нитрита у свим узорцима су испод прописаних граница. На основу свих резултата добијених у овом истраживању може се закључити да производе декларисане као конзерва од меса у комадима слободно могу конзумирати све групе потрошача, како са аспекта саржаја протеина и масти, тако и са аспекта садржаја натријума хлорида и натријума нитрита.

Кључне речи: производи од меса, пилеће месо, свињско месо, садржај протеина, садржај масти, безбедност, тржиште производа од меса Србије

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