Partly processed meat products prepared for grilling as a source of protein

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Abstract. In the period January 2018 to December 2018, the levels of protein were measured in 864 samples of partly processed meat products prepared for grilling, from the Serbian market. Just 2.89% of these partly processed meat products contained protein content less than 14 g/100g, and so did not meet the requirement laid down in the national regulation. By groups, 97.89% of minced shaped meat, 98.71% of minced unshaped meat and 93.62% of fresh sausages met the requirement of national regulation. The meat product group with the biggest percentage of non-compliant meat products was the fresh sausages group – 6.38% of these contained less than the required protein content. All in all, most of the partly processed meat products met the national regulation regarding protein content. With average 16.23±1.82 g/100g of protein in raw, pre-thermal treatment samples, this group of meat products would be a good source of protein in human nutrition. Nonetheless, those meat products that did not meet national regulation requirements show that regular and periodic control of partly processed meat products is necessary and one of the most important steps in ensuring safe and quality meat products for consumers.

1. Introduction

Protein is an indispensable nutrient that plays many critical roles in the human body including building muscles, tissue cells, making hormones and antibodies, transporting substances into and out of cells, controlling chemical reactions, transmitting messages from one part of the body to another, and much more.

A protein molecule is made of a long chain of amino acids. There are 20 types of amino acids in proteins, each with different chemical properties [1]. Meat and meat products are one of the most important sources of essential amino acids in human nutrition and provide protein of high biological value. Conventional animal-based protein sources such as meat (beef, pork, lamb, poultry, etc.), fish, eggs, and dairy are generally considered high-quality sources of dietary protein because they meet all of the indispensable amino acid requirements for humans and are highly digestible [2]. Beside this, red meat is the best source of iron, unlike pork and chicken, which contain moderate amounts of iron. That is why vegetarians have a higher risk of developing iron deficiency, as iron obtained from plants has a lower bioavailability, so they often have to take supplements in order to compensate for the lack of iron and essential amino acids. Nevertheless, human population studies show that red and processed meats are associated with an increased risk of colorectal cancer, while white meat has no impact on this type of disease. The evidence is not yet conclusive, but consuming a lot of preserved meat probably increases the risk of colorectal cancer [3,4,5]. Some studies showed this risk can be lowered...
with addition of fiber from different sources [6,7]. Back to the protein, the current international recommended dietary allowance (RDA) for protein is 0.8 g per kg of body weight, regardless of age [8,9]. According to the FAO, human requirements for protein are currently estimated to be 55 g per day for adult men and 45 g for women, although there is a higher requirement in various disease states and conditions of stress. These amounts refer to protein of what is termed “good quality” and highly digestible, otherwise the amount ingested has to be increased proportionally to compensate for lower quality and lower digestibility [10]. In Serbia, national regulation [11] states that 50 g of protein per day is the recommended amount for adults. Another national regulation [12] requires that samples from partly processed meat products group must contain at least 14 g of protein per 100 g of meat product. “Pljeskavica” (Serbian-style meat patties of various types) and “ćevapčići” (grill kebabs), must contain a minimum 14% of meat protein. On the other hand, all other products (e.g. hamburger, burger, ćevapi, etc.) can contain, beside the already present meat protein, other sources of substitute protein, i.e. soya and other. The total protein content in this case also has to be at least 14 g per 100 g sample.

Meat composition, as well as its physicochemical properties, undergoes significant changes during heat treatment. It is well known that meat composition, especially its fat content combined with the specific cooking methodology, is among the factors that most affect the final quality of meat products [13]. This also stands for other macronutrients, including protein, and after water loss during thermal treatment, protein concentration in product raises. However, this will not be part of this scientific paper, as testing was conducted just in raw samples, before thermal treatment.

The aim of this study was to determine levels of protein in retail partly processed meat products, before thermal treatment, commonly consumed in Serbia.

2.  Materials and Methods

2.1. Partly processed meat products

In the period January 2018 to December 2018, 864 samples of different types of partly processed meat products prepared for grilling (521 shaped minced meat, 155 unshaped minced meat and 188 fresh sausages) were tested for protein content. Samples were from the Serbian market and were produced by local producers. Testing was conducted in raw samples, before thermal treatment.

2.2. Method of chemical testing

The protein content was determined according to the standard procedure [14], expressed as percentage (g/100g), and measured by FOSS Kjeltec™ 8400 Analyzer. All chemicals used for testing the protein content in the partly processed meat products prepared for grilling were of analytical grade and were used as received without any further purification.

2.3. Statistical analysis

The results analysis and graphical presentation of their distribution was performed using Microsoft Office Excel 2016.

3.  Results and Discussion

Protein contents of the grouped meat products are shown in Table 1. The distributions of the results, in accordance with the national regulation [12] and its requirement for minimum protein content (14.00%), are graphically presented in Figure 1 for all samples.

| Type of product | $n^a$ | $n^a$ (%) | Min | Max | $Xs^b \pm S_0^c$ | CV$^d$ (%) | $n^e$ | $n^e$ (%) | $n^f$ | $n^f$ (%) |
|-----------------|-------|-----------|-----|-----|-----------------|-----------|-------|-----------|-------|-----------|

Table 1. Protein content in samples of partly processed meat products prepared for grilling, for the period January 2018 – December 2018
Minced shaped meat & 521 & 60.30 & 9.17 & 21.83 & 16.33±1.76 & 10.78 & 11 & 2.11 & 346 & 66.41 \\
Minced unshaped meat & 155 & 17.94 & 10.09 & 21.35 & 16.33±1.62 & 9.92 & 2 & 1.29 & 60 & 38.71 \\
Sausages & 188 & 21.76 & 8.86 & 22.34 & 15.89±2.09 & 13.15 & 12 & 6.38 & 120 & 63.83 \\
All samples & 864 & 100.00 & 8.86 & 22.34 & 16.23±1.82 & 11.21 & 25 & 2.89 & 526 & 60.88 \\
a number or percentage of samples; b average value; c standard deviation; d coefficient of variation; e number or percentage of non-compliant samples; f number or percentage of samples which contain just meat protein

Figure 1. Percentage of all tested samples in accordance with the national regulation [12] regarding protein content

Most of the tested meat samples, 97.11% of them, met the national regulation [12] regarding the minimum content of protein. The minimum (8.86%) and maximum (22.34%) concentrations of protein were determined in the group of fresh sausages. This group of meats had the smallest average protein content (15.89%), and the highest percentage (6.38%) of tested samples that did not meet the national regulation [12] requirement of minimum 14% protein content. Minced unshaped meat had the lowest percentage of samples that did not meet the same requirement, 1.29% of them. The maximum average protein content (16.33%) was determined as the same in both groups of minced meats (shaped and unshaped) but there was no big difference between the average protein contents of any of the different tested groups. Minced shaped meats produced the highest percentage of samples containing just meat protein (66.41%), and minced unshaped meats produced the lowest, just 38.71% of samples from this group. The most common meat product type sampled for this study was the group of minced shaped meats (n=521, or 60.30% of all meats sampled).

4. Conclusion
The majority of raw meat products tested in this research, 97.11% of them, across the selected meat product groups, met the national regulation [12] requirement for minimum protein content. Over 60% of samples contained only meat protein, without any protein substitutes, i.e. soya or other protein. Requirements [8,9,10,11] for protein intake are around 50 g/day, and the average content of protein in the tested raw meat products was 16.23 g/100g, but after thermal treatment of raw product, the concentration of protein should be higher because of water content loss. According to these results, it is clear that partly processed meat products prepared for grilling are a good source of protein in human nutrition.

Aside from protein content, in the meat products tested, we also determined the content of other quality parameters, i.e. collagen, but this is not reported here. The small number of partly processed meat products that did not meet the national regulation [12] requirement leads us to conclude that periodic and regular control by the responsible authority is a necessary step in ensuring quality and safety of meat products and food in general.
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