

The need for enrichment of meat products with micronutrients

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Abstract. The article discusses the chemical composition of meat according to the main qualitative characteristics to identify the least nutritious product for its subsequent enrichment with various micronutrients. The introduction of dishes and products with an adjusted composition of vitamins, macro- and microelements into the existing diet of an average person is a serious intervention in the traditionally established structure of human nutrition. The need for such an intervention is determined by objective environmental factors associated with changes in the composition and nutritional value of the products that are used in daily nutrition, as well as changes in our lifestyle, with a decrease in physical activity and energy consumption. For these reasons, this intervention should only be carried out in accordance with scientifically sound and proven principles. The choice of micronutrients is quite diverse and, depending on the task of enriching meat products, it is possible to satisfy various physiological needs of the population.

1 Introduction

The need to improve the nutritional properties of food products is becoming increasingly important in the world. According to the annual studies of the United Nations (UN) [1]: the number of people suffering from hunger is growing, and the problem of malnutrition remains relevant in all countries of the world, regardless of the income level of the population and the level of economic development of countries.

There is a problem of food consumption in the world depending on climate change. The importance of reducing consumption of animal products has increased [2]. The official food-based dietary guidelines (FBDG), which consider health and sustainability, are promoting more plant-based diets. Such sustainable national FBDGs have been implemented in several countries such as Brazil, Denmark, Germany, Italy, the Netherlands, Poland, Qatar, Sweden, the UK, etc. [3].

According to the World Health Organization, from 1975 to 2016, the number of overweight people in the world is increasing. Most of them are obese [2]. More than 1.9 billion adults aged 18 and over were overweight in 2016, and 650 million were obese. Statistics show that during this period there was an increase in weight in 39 % of aged people, including 39 % of men and 40 % of women, but obesity is expressed in 13 % of adults.

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Among them, 11 % are men and 15 % are women. Over the period 1975-2016, the number of cases of obesity was three times higher than in previous years.

Along with adults, children also suffer from obesity. In 2016, there were over 41 million children under the age of 5. This figure differs from the previously obtained data for 1975, when only 19 % were obese between the ages of 5 and 19, the number of overweight adolescents reached to 124 million, 8 % of boys and 6 % of girls.

The BBC NEWS website [4] provides data confirming the importance of rational nutrition for the harmonious development of the individual. Violation of the recommended diet and food quality annually leads to the death of eleven million people.

Based on the analysis of the results of studies in the Russian Federation, which are mentioned in the article [5], it was concluded that there are no threats of poor-quality nutrition in the country today. However, we noted the presence of risk factors for the growth of non-communicable diseases associated with metabolic disorders and obesity.

For normal growth and development of the body, it is necessary to consume high-quality meat dishes, since the importance of meat for human health is very high. It supplies the body with a protein that is indispensable for maintaining life processes in the construction of cells and tissues in the body. The content of iron, which is well absorbed by the body, is important. Meat perfectly satisfies hunger and is rich in minerals and vitamins. However, it is not balanced for all nutrients.

Based on scientific data on established physiological norms, we analyzed the need to enrich meat with various micronutrients in order to improve the nutritional properties and quality characteristics of meat products. The article also presents calculations of the percentage of the content of essential nutrients and energy from the average daily norm in the meat selected for enrichment.

2 Materials and methods

The norms of the average daily physiological need, necessary for the analysis and calculation, were selected from several sources (Figure 1). Category 2 beef was selected as a sample (Figure 2).

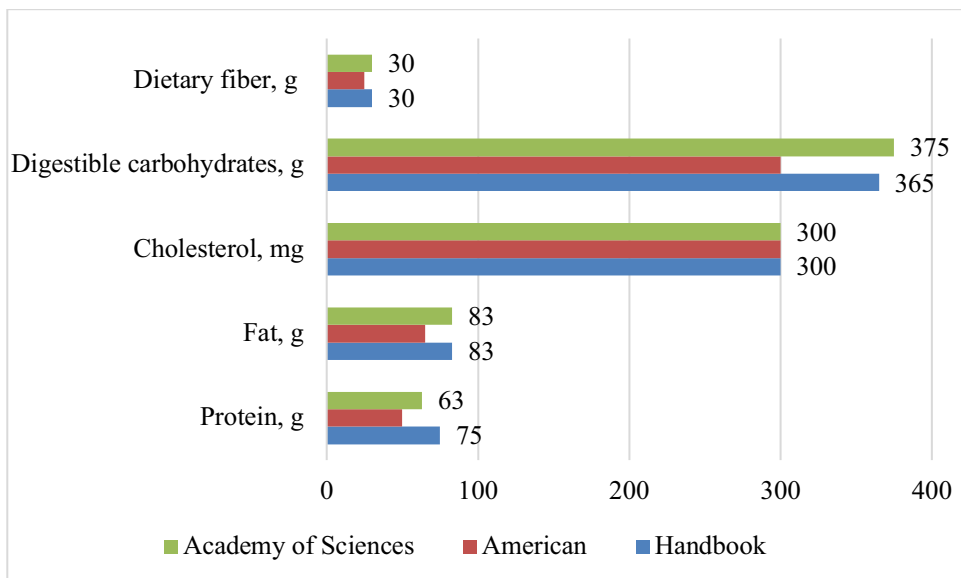


Fig. 1. – Recommended nutrient intake for humans [6, 7]

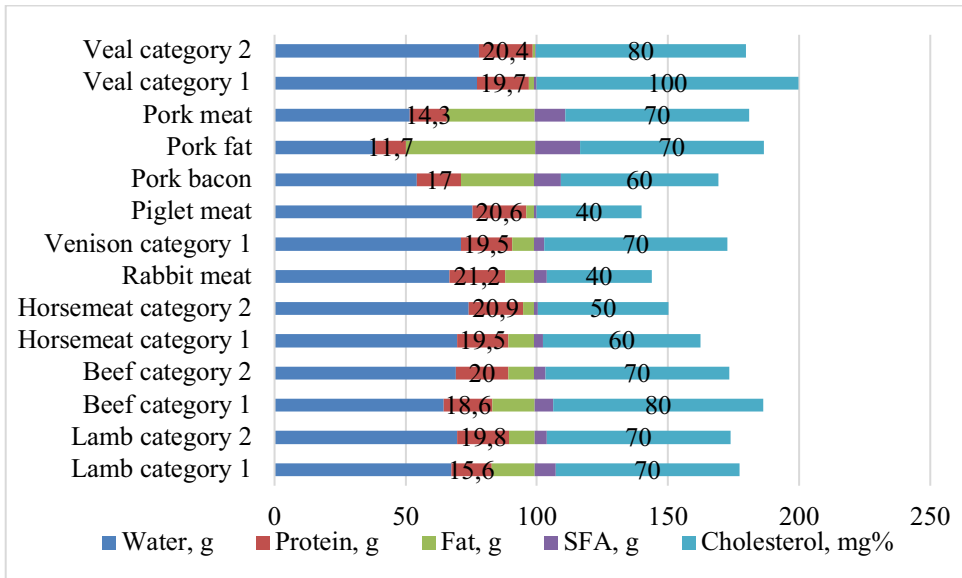


Fig. 2. – Chemical composition of meat products [7]

3 Results and discussion

Meat products occupies one of the leading places in the modern rating. The most abundant macronutrient in these foods is protein, which accounts for over 50% of the macronutrient content of mycoprotein-based foods, wheat foods, and most soy protein-based foods. Macronutrient content is significantly different ($p \leq 0.05$) when comparing all food groups separated by different food types and protein sources. The average energy value ranges from 412 to 963kJ/100g of product, the lowest energy value in products based on mycoproteins, where the protein content is from 6.6g/100g in meat cuts based on combined soy and pea protein, up to 33 g /100 g in wheat protein based on seitan [15]. In general, there is no significant difference between products of the same protein source group, with the exception of products based on soy protein. Between chopped products and sausages, the protein content significantly differs ($p \leq 0.05$). Carbohydrates are the second most abundant macronutrient, ranging from 0.6g/100g in soy-based tofu to 17.5g/100g in wheat protein-based cold cuts. The content of dietary fiber ranges from 0.8 to 12g/100g, which is the highest in ground soy-based products. In addition, products based on soy and mycoproteins have a high content of dietary fiber, about 6g/100g [10-12].

Each of us needs a certain amount of energy, proteins, fats, carbohydrates, mineral salts, trace elements, vitamins and amino acids, including those that are not produced by the body itself. An adult should receive from 1 to 1.2g of protein per 1 kg of body weight with food; including 20 amino acids, 8 of which are essential. It should be noted that meat proteins contain all the essential amino acids in optimal proportions for pregnant women, they are closest to the "ideal" animal proteins. The norms of meat consumption by people recommended by the Ministry of Health of the Russian Federation are on average 85kg per year or 232g per day.

In Russia, indicators of satisfaction in nutrients and energy are most fully covered. The reference data of the American Academy of Sciences and the Codex Alimentarius are very limited and partially characterize only the main nutrients. It should be noted that in terms of calorie content in foreign reference books, gratification is higher and is 1.9-4.9 % higher than in Russia.

The degree of gratification in proteins due to the consumption of beef also exceeds Russian indicators by 5.4-13.7 %. However, gratification with the use of animal beef fats in Russia is 2.43-5.7 % higher.

In foreign norms, a slight increase in the gratification of thiamine norms was noted -0.33 - +0.3 %; in riboflavin 0.6-1.25 %; in niacin – 2.8 %. No data are available for other water- and fat-soluble vitamins.

In Russia, the degree of satisfaction due to the consumption of category 2 beef is also not high. Low rates of vitamins B1, B9, E and H intake were noted. They make up 2.0-10.0 %. Gratification of the daily requirement for minerals when eating beef is also low. The reference indicators in the Codex Alimentarius for calcium and magnesium differ slightly. They range from 0.25 % to 2.0 %.

Only the use of high-quality beef will satisfy the need for iron, which is very important for the human body. The indicators noted in the Codex Alimentarius exceed the Russian ones by 4.6 %.

Analysis of literature data showed that meat products usually make up a significant part of the diet in Western countries. According to dietary data in Denmark, the Czech Republic, Italy and France, on average, people consume meat (including poultry) from 100 to 125g per 2000 kcal [9]. Men on average consume from 113 to 175g per 2500 kcal, women – from 85 to 122g per 2000 kcal [9]. In the diets of residents of Denmark, the Czech Republic and Italy [10], animal protein makes up more than 60 % of the total amount of protein consumed.

Vegetable protein has been a major part of the diet for centuries in some regions of the world, such as in soy and wheat-based products in China [11]. In the UK, vegetarians have been a significant part of the population for decades. According to the Euromonitor study, this is about 7 % of the population [12, 13]. Vegetarian dishes instead of meat have been introduced in the UK since the 1960s, and the number of imitation meat products has also recently increased in other countries, such as Denmark [11, 14].

Plant-based protein products are an alternative to meat and may also be referred to as "meat analogs", "meat substitutes" or "meat substitutes containing protein derived from soy, peas or wheat". It is possible to get the protein for these foods from non-vegetable sources such as mushrooms and egg whites. In this regard, the number of flexitarians, the so-called group of consumers who eat vegetarian food several days a week, is increasing [15].

On the basis of the conducted studies, it has been established that for the production of functional meat products that satisfy the daily need for nutrients and energy by 15 %, it is necessary to enrich beef of the 2nd category with cereals, legumes, vegetables and herbs, eggs, and, if possible, combine it with high-grade fish and milk proteins.

4 Conclusion

The authors compared the content of basic nutrients and energy in category 2 beef with the norms of the average daily physiological need. An insufficient content of essential vitamins and micronutrients in the analyzed meat relative to the average daily requirement was revealed. Some of the plant-based protein foods analyzed in this study showed nutritional value that could be described as "high in fiber, water-soluble vitamins and minerals", while some, such as soy, pea, cereal, vegetable based products with greens contain a significant amount of Ca, I, Fe, Se and Zn.

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