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Review paper

Meat in Human Nutrition

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Abstract: This paper analyzes the role of meat in human nutrition. Meat and meat products have been one of the main foodstuffs in human nutrition worldwide for centuries. Type and quantity of consumed meat were influenced by different factors (religion, social status, and offer) in the past. Meat and meat products are the foodstuffs, which are the most important for its composition and nutritive value. People who consume meat are provided with proteins which have balanced ratio of essential amino acids, B complex vitamins, micro elements (iron, zinc, copper) and energy. On the other hand, meat contains significant quantity of fats in which dominate saturated fatty acids and cholesterol. During technological process table salt is added to meat, thereby high concentrations of sodium enter the body.

Researches in the last 30 years pay more and more attention to the impact that certain type of meats in human nutrition have on heart diseases and cardiovascular diseases, appearance of high blood pressure, stroke and colon cancer and to possibility if processing procedure would be changed, fats content, cholesterol and sodium would decrease, thus lowering the risk of mentioned diseases. The aim of this paper is to review existing literature for both the risks and benefits of meat consumption, focusing on case-control and prospective studies. Researches in the science of meat and meat technology gave results and meat products are obtained with lower sodium content, lower content of saturated fatty acids and higher content of poly-unsaturated fatty acids. Thus, meat and meat products will stay the most important foodstuffs in future centuries due to its nutritive, culinary and sensory traits.

Key words: Meat, Human nutrition, Nutrition value of meat, Health protection

Introduction

Meat and meat products were one of the main foodstuffs in human nutrition worldwide for centuries. Type and quantity of consumed meat were influenced by different factors (religion, social status, and offer) in the past. In literature (Borowski, 2007) are mentioned several key phases in human civilization development, that had impact on people's commitment to eat meat. Primitive people, who lived nomadically, moved searching for food and ate foodstuff of plant origin. Among plant origin foodstuff, that *Homo sapiens* collected, were roots, seeds and fruits and among the animal origin foodstuffs were insects, caterpillars, bird eggs and later pieces of raw meat, which were preys' leftovers. Next important phase was discovery of arms, when a man became a hunter and could provide for himself meat as a food. With fire discovery, a man began to heat-treat and smoke meat. Thus, meat was conserved and could be kept for a while, while product itself after heat treatment became tastier and more digestive.

For the 19th and 20th century are related the most significant discoveries in technique and thus in meat technology and food science in general. In the beginning of the 19th century the first meat can was made and the end of the 19th century is the period when artificial cold was introduced which preconditioned meat storage in the chilled state for considerable time (Rede, Petrovic 1997; Vukovic, 1992). In the first half of the 20th century with meat consumption people tried to provide nutritive valuable ingredients (proteins, essential amino acids, B complex vitamins, iron, zinc, copper and other minerals) (Grujic, 2000; Grujic and Miletic, 2006). In the end of the 20th and beginning of the 21st century people started to concern about their health due to consumption of high quantities of cholesterol, fats, saturated fatty acids and sodium in meat and meat products. Intake of these ingredients from meat are related

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to appearance of heart disease, cardiovascular disease, colon cancer and high blood pressure (WHO, 2003; Kontogianni et all, 2008; McAfee et all, 2010). The science of meat and meat technology took part in solving these problems and efforts have been already visible.

Nutritive Value of Meat

Due to composition and characteristics, meat from slaughtered animals is divided on red meat (beef, pork, and sheep) and white meat (chicken, turkey, duck, and dove) (FAO, 1992; McAfee et all, 2010). Red meat is long established as an important dietary source of protein and essential nutrients including iron, zinc and B12 vitamin, yet recent reports that its consumption may increase the risk of cardiovascular disease (CVD) and colon cancer have led to a negative perception of the role of red meat in health (McAfee et all, 2010).

Meat is consisted of muscle tissue, connective tissue, fats, bones and around 75% of water. Ratio of the mentioned tissues depends on type, age, plane of animal nutrition, etc. Content of water in meat is between 65,0% and 75,0% and for the average content is taken the data of 73,0%. Average content of proteins in meat is 18,0% (16,0-20,0) and of fats 5,0% (3,0-30,0). Content of minerals is around 1%. Among carbohydrates in the blood in very small quantities are present monosaccharide's glucose and glycogen in meat. In time post mortem content of carbohydrates from 1% in the beginning decreases and falls to zero few days after an animal bleeds out (Vukovic, 1992; Grujic and ass, 2007).

The most important ingredient of meat are proteins, which, according to function they perform in a body and place they are, can be myofibrillar, sarcoplasmic and connective tissue (Rede, Petrovic; 1997). It is known that meat proteins belong to the most valuable sources of essential amino acids, due to the content of all essential amino acids and their interrelation.

The quality of proteins in food is a measure of its capability to meet human needs for amino acids. It can be measured differently; however, the basis of all measurements is to establish ratio of type and quantity of amino acids which are available in food and type and quantity of amino acids body needs. If this ratio is 1.0 (100 percents) it means that observed amino acid is available in proteins which are consumed in quantity sufficient for meeting human needs; ratio 0,5 means that the essential amino acids is present in quantity representing only the half of the required need. In literature (FAO, 1992) is stated that according to the quality, animal origin proteins are superior over the plant origin ones. It is true that most of animal origin proteins have higher level of utilization (Net Protein Utilisation, NPU), which is higher over 0,75; while many proteins of plant origin have NPU in the range 0,5-0,6. Most of people consume different sources of proteins, so lack of one of the essential amino acids can be compensated with other source, so called complementary proteins. Due to possibility to supplement essential amino acids with different sources, the proteins' quality, measured as NPU, in one meal (even in developing countries) is not below 0.7 (70%). In developed countries average NPU value is around 0.8 (80%). Value of meat in this regard is that meat is a concentrated source of high quality proteins (NPU 0,75-0,80) and high digestibility (around 0,95) and the best source of lysine's amino acids. While meat is heat-treated in processing and utilization, the proteins' structure is changing and it influences meat traits and its nutritive value. Besides, meat proteins react with other ingredients, causing new compounds important for forming meat color, aroma and taste.

Fats are meat ingredient and their share is the most changing. Lean meat consists 5% fats, medium-fatty meat consists 10-15%, while fatty meat consists over 25% of total fat (In meat are present "true" fats (triglycerides) and intramuscular fats (phospholipids, cerebrosides, cholesterol). Within the fat of animal origin are the most common saturated fatty acids (SFA), less mono-unsaturated (MUFA), while content of poly-unsaturated fatty acids (PUFA) is very low. According to the FAO data (FAO, 1992) average content of SFA, MUFA and PUFA

in fat beef, fat mutton and fat pork is the following: 48%, 43% and 4%; 50%, 39% and 5%; 37%, 41% and 15%, respectively. The highest PUFA content is in chicken meat (19%) and in the liver intestines (26%). For determining nutritive value of meat very important data is cholesterol content in meat. Cholesterol content in red meat and poultry meat is between 60mg/100g, 120mg/100g. Cholesterol content in some internal organs is higher: heart (140-260mg/100g), liver (300-350mg/100g) and brain (2000-3000mg/100g). From nutritive and culinary aspect it is very important to know disposition of fat layers in meat. In general, fats are disposed in three places of animals' trunk and according to that they are divided on: subcutaneous fatty tissue, internal fatty tissue and intramuscularly tissue (Rede, Petrovic, 1997). In meat processing and meal preparing subcutaneous and internal fatty tissue can be removed and thus decrease intake of undesirable fat, cholesterol and excess energy in the body. Intramuscular fatty tissue is disposed within muscles, between muscle fibers and contributes significantly to forming sensor traits of meat

Meat is foodstuff that provides consumers with different minerals and vitamins. It is necessary to emphasize that certain minerals in meat are in the most easily adoptable form, what enables their best utilization in human body. Content of the most significant mineral elements (Na, K, Ca, Mg, P, Fe, Cu and Zn) is the following: in beef (61, 350, 7, 20, 180, 2.1, 0.14, 4.3), mutton (21, 8.8, 88, 350, 7, 24, 190, 1.6, 0.17, 4.0) and pork meat (20.7, 7.1, 76, 370, 8, 22, 200, 0.9, 0.15, 2.4). Content is shown as mg/100 g of meat (FAO, 1992).

Meat is exquisite source of some minerals, such as iron, copper, zinc and manganese, and has an important role in prevention of zinc deficiency, and especially in prevention of iron deficiency. Iron is vital for many cellular processes in the body and, as a component of hemoglobin, is essential for maintaining adequate transport of oxygen in the blood. Half of iron in meat is in form of hem iron (hemoglobin). Hem iron is well absorbed, around 15-35% (absorption of iron from animal origin foodstuff is around 1-10%; or total meal average 10%). Hem iron found in meat is more bio-available than non-hem iron found in plant sources and, for this reason, meat consumers maintain better iron status than vegetarians and vegans (Cosgrove, Flynn, & Kiely, 2005; Grujić, 2000; Grujic and Miletic, 2006). Red meat in particular is recognized as a significant source of hem iron compared to poultry and fish.

Zinc is present in all body tissues; it is a part of more of fifty enzymes. Meat is the richest source of zinc in nutrition (1/3 to ½ of total Zn intake during nutrition). According to Zn content, beef and mutton meat (4.1mg and 3.3mg /100g) (Cann et al., 1996) are classified as important Zn sources.

Meat is an important source of B complex vitamins and some vitamins which are soluble in fats. According to the FAO data (1992) content of thiamin, riboflavin, nicotine, folic acids, vitamin E is in beef (0.07 mg/100g, 0.24 mg/100g, 5.2 mg/100g, 0.32 mg/100g, 2 μg/100g, 10 μg/100g, 0.19 mg/100g), mutton (0.14 mg/100g, 0.78 mg/100g, 6.0 mg/100g, 0.25 mg/100g, 2 μg/100g, 5 μg/100g, 0.10 mg/100g) and pork meat (0.89 mg/100g, 0.25 mg/100g, 6.2 mg/100g, 0.45 mg/100g, 3 μg/100g, 5 μg/100g, 0.10 mg/100g) (FAO, 1992). Poultry meat, especially broiler meat is a rich source of B12 vitamin (12 μg/100g).

Internal organs are rich source of some minerals and vitamins, thus in literature (FAO, 1992) it is stated that liver is an important source of iron, vitamins A, B1, B2, B6, B12, niacin, pantothenic acid; kidneys are source of B1, B2, B12 vitamins, pancreas of vitamins B1, B2, C.

Red meat (meat of cattle, pigs, and sheep) is part of usual balanced nutrition of most of adult population living in Europe. During years, people adjusted to consumption of higher quantities of lean red and processed red meat. Researches conducted during last years link consumption of red and processed meat with development of two the most often chronic diseases in western world (cardiovascular diseases and colon cancer (Kontogianni et all., 2008; McAfee et al., 2010). Ingredients of red meat considered to be responsible for the mentioned problems are fatty acids which are natural elements of fat and cancer

compounds, such as amines heterocyclic (HCAs) which can be formed in meat heat-treated in high temperatures (Bingham, Hughes & Cross, 2002).

Meat consumption in the world

Meat consumption is based on availability, price and tradition; it is difficult to give precise comparison of meat consumption between different countries, as different methods are being used for consumption estimation (data on the wholesale level or consumption data on the household level – there are missing data on meat consumption and meat products outside household and on the level of meat import-export) (FAO, 2010).

Meat consumption depends on individual/household incomes. In rich countries part of home budget spent on food is decreasing, while in underdeveloped countries it is increasing. Meat quantity consumed in different countries significantly depends on social, economic and political influence, religious affiliation and local differences.

In the Great Britain men and women in average consume in total 108g of meat and 72g per diem and in the Ireland 168g and 107g respectively. Total daily consumption of meat in Germany is 154g (men) and 84g (women), while share of red meat is 52g (men) and 28,6g (women). The highest daily consumption of meat in Europe is in Spain: 170g (men) and 99g (women) of which the share of red meat is 74g (men) and 38g (women). The lowest consumption of meat in Europe is in Greece: 79g (men) and 47g (women); share of red meat is 45g (men) and 25g (women). The Greeks consume the lowest quantity of meat products (10g – men and 6g – women), which compared to consumption of meat products in Germany (83g – men and 41g – women) is much smaller quantity. Uruguay, Argentina, Australia and the New Zealand are countries with significantly higher meat consumption (300g per capita per diem). In underdeveloped countries the total quantity of meat consumed by average consumer per diem is very small. Therefore, meat consumption in India, Indonesia and Sri Lanka is only 10g per capita per diem (Linseisen et al. (2002); Cosgrove, Flynn & Kiely, 2005).

Meat consummation and people's concern for preserving the health

The World Health Organization (WHO, 2003) has conducted a research on nutrition influence on different non-infectious diseases among population of different countries. The World Health Organization estimates that within the next few years non-communicable diseases (NCDs) will become the most important global cause of morbidity and mortality (WHO, 2003). The role of diet in the etiology of most NCDs is extremely important. The shift towards refined foods and meat and dairy products (what has been termed the "nutrition transition") is increasingly occurring in middle and lower income countries with resultant rises in obesity and NCDs.

There is a clear need for political commitment in developing adequate nutrition policies. Part of this political action should include the translation of nutrient population goals into foodbased dietary guidelines (FBDG) at the national level. In this analysis is given an overview of recommendations on foodstuff quantities recommended for daily consumption given by authorized ministries of the European countries. It is interesting that in great number of countries there are no FBDG or that for some foodstuff groups' recommendations are not given. In the table below are the data on recommendations given for meat consumption in several European countries.

Earlier UK guidelines set recommended that intakes of red and processed meat should not rise and that individuals with higher intakes (140 g/d) ought to consider a reduction. The World Cancer Research Fund (WCRF) 1997 report recommended that red meat intakes should be no more than 80 g/d, of which very

little should be processed. After 10 years however, the most recent report lowered this limit to 71 g/d or 500 g red meat per week and further emphasized that intakes of processed meat should be avoided completely (WCRF, 2007; McAfee et al., 2010).

Fats in meat are the cause of coronary and heart diseases. The most important risk factor of coronary diseases in highly developed countries is the presence of saturated fatty acids in nutrition. Around ¼ of saturated fats in human nutrition comes from meat, thus meat consumption became problematic. (The first phase of disease development is narrowing of the coronary arteries of fatty complex deposition on the walls – this process is called **atherosclerosis**. The fatal phase is the creation of blood clots blocking the narrowed arteries – **thrombosis**. Even if thrombosis did not cause reduction of blood flow to the heart muscle, it deprives heart of oxygen and may cause great damages – myocardial stroke).

For reducing CVD risk is given the following recommendation: decrease share of energy from total fats and saturated fatty acids (SFA) and reduce intake of trans-fatty acids. Red meat which is produced today is leaner and contains less fats then meat produced ten years ago. This is a consequence of combined activities of more factors: changes in animal production, planes of nutrition, and meat processing technology (Williamson and ass., 2005). In the newest works (Li, Siriamornpun, Wahlqvist, Mann and Sinclair, 2005, Williams, 2007; Nikolic and ass., 2009) lean red meat is described as a foodstuff which contains low share of total fats and SFA.

Cholesterol in meat and appearance of coronary and heart diseases With meat consumption in western diets body takes around 1/3 of the total cholesterol (the rest is taken with eggs and diary products). These foodstuffs are sources of other important ingredients, and limitation of its intake would be risk in nutrition. It se determined that changing nutrition planes of cattle (Garcia et al., 2009) and fish (Spiric et al., 2009) would be possible to change fatty acid system of animal fatty tissue and decrease cholesterol content in tissues.

Trans-fatty acids, appeared in heat-treatment of meat products with high content of unsaturated fats, represent another risk for people's health. Trans-unsaturated fatty acids are considered to be a factor with capability for increasing cholesterol concentration in blood. Trans-fatty acids in red meat are probably a risk factor for CVD. However, low concentrations of total trans-fatty acids, consumed during a usual European diet, should not be a reason for concern (Hulshof et al, 1999; Murtaugh, 2004; Wagemakers et al., 2009).

Vranic et al., (2009) researched content of sodium chloride in some meat products on the market in Serbia. They determined that different groups of meat products in average contain different quantity of sodium chloride: the lowest average content is measured in canned meals (0,94%), somewhat higher is in samples of cooked sausages (1,15%), samples of boiled sausages with meat pieces (161-1,67%). The highest content of salt is measured in smoked products (2,19%), dry fermented sausages (2,61%) and delicatessens (5,09%). As meat products are important source of sodium, the authors conclude that some meat products may have higher risk for people's health, especially for hypertensive people, people with cardiovascular diseases and people who are "sensitive on sodium".

Considering the proven impact on emergence of more diseases (hypertension, stroke, diabetes, some forms of cancer) in all guidelines for nutrition are given recommendations for decrease of fat quantity, especially saturated fats taken in nutrition meals.

Most of guidelines recommend that total fats should be decreased to 20-30% of total energetic intake, total saturated fats to 10%, mono-unsaturated fats to 10-15% and poly-unsaturated fatty acids to 3% and more. Quantity of cholesterol is limited to 300mg/per diem and less.In some nutrition guidelines are given recommendations for replacing meat rich with fats with other foodstuff. The following recommendations are given by WHO 2004

1. Instead of red meat use poultry meat. When hide and subcutaneous fat is removed from the poultry meat, the fat content is decreased to only 5%.
2. Chicken meat has lower content of saturated fatty acids (33% of total content) and higher

content of poly-unsaturated fatty acids (14%) from lean red meat (45% and 4%, respectively).

3. Duck meat contains high percentage of fats: 45% with hide and 10% without hide; 27% fats are saturated.
4. Meat of wild feathered animals (grouse, partridge, pheasant and pigeon) contains 5, 7, 9, 13% fats of which 1/3 is saturated.

Toxics emerged in meat preparation and heat treatment. The aim of heat treatment of meat besides destruction of harmful microorganisms is improvement of meat taste. Fat oxidation on temperatures of heat treatment leads to emergence of compounds with unwanted taste (aldehydes, esters, alcohols, fatty acids with short chains, etc.). On these changes are particularly sensitive unsaturated fats, easily oxidized under present hem and non-hem iron (Grujic and Miletic, 2006, Grujic and Grujic, 2009). Pork meat (with higher PUFA concentration – 3,6g/100g of meat) while fried is the most sensitive on fat oxidation. Duck meat (3,5g PUFA/100g meat) and chicken meat (2,5g PUFA/100g meat) are rather resistant to oxidation (FAO, 1992). Negative impact of oxidation on nutrition quality, in recent times is connected with appearance of compound which is cancerous or is involved in aging process.

Cancer genes. Numerous epidemiological researches point to link between intake of animal original proteins and predisposition to cancer of pancreas, breast, colon, prostate, etc.). Products of organics pyrolysis (product overheating and burning) are polycyclic hydrocarbons. It is believed they are cancerous. Best researched is cancerous activity of 3,4-benzpiren, which is formed on the surface of meat treated on barbeque (embers) and delicatessen (including fish). Prevention in this case is not to impose meat directly to fire influence (especially one caused by coal combustion).

Nitrosamines. Nitrites in salt brine may react with amines from meat thus creating nitrosamines. Nitrosamines are cancerous for all researched animals. In some cases nitrites are registered in peoples' stomach although they haven't eaten delicatessen (They have probably emerged in reaction of nitrites with other types of food with amines). Prevention measures suggested by different authors in this case are to add salt ascorbic acid in meat together with salt brine, which will increase nitrite utilization level and provide reduce of total quantity of nitrites / nitrites added to brine mixture.

Improvement of meat processing with aim to lower the risk from present fats and sodium

Decrease content of Na/salt in products. Researches conducted in the last forty years confirm that salt quantity in meat products can be reduced (Verkleij et al., 2009; Cofrades et al., 2009). However, consumption of sodium chlorides in meat industry is increased (wish to increase consumers' safety and to extend deadline of products sustainability). Na content in products reached the level where appears concern for people's health. Decrease of Na intake in food is a question all manufacturers of processed food should answer.

Today exist proofs that lower intake of sodium favorably influences on decrease of the ill from high blood pressure, cardiovascular diseases and stroke (Penner, 2007; Verkleij et al., 2009). Link between sodium quantity in body and level of blood pressure is linear. For example, yearly in the USA can be avoided 150000 death cases due to lower intake of sodium (Dickinson and Havas, 2007).

Meat processing industry has a task to lower quantity of added salt into meat products, but decrease of salt quantity added to meat during processing may cause problems related to product structure, dates of products' expiry, income and taste of products (Verkleij, 2009). Problem size depends on meat type and type of meat products. Most of researches lead toward replacing part of sodium chloride with potassium or calcium salts (Stopfort et al., 2009; Vranic et al., 2009). In this case products that were made have unacceptable income, insufficiently good structure or taste.

Table 1. Recommended meat quantities for daily consumption – overview of guidelines in some countries in Europe (WHO, 2003)

Country	Recommendation on lean meat, poultry and fish
Denmark	Fish: 1-2 servings/d (or 200-300g/week)
Sweden	Not specified
Norway	Yes but not quantified
Austria	1 – 2 portions (150 g)/weekly of fish, not more than 2 – 3 times per week meat (150 g/ portion max.) and sausages (50 g/portion max), 3 eggs/week max.
France	No FBDG
Germany	<300-600g of meat/week, max 3 eggs/week, 1portion of seafood/week
Switzerland	Lean meat and fish, not quantified
Italy	1-2 portions/d FBDG in preparation or waiting for official endorsement
Malta	Not quantified but guidelines advise consumption of lean meat, fish & poultry
Bulgaria	Meat quantified in grams/d
Czech Rep	1-3 servings/d (1 serving= 80g)
Poland	1-2 portions/d
Lithuania	Use poultry, fish and beans instead of fatty meat
Albania	No FBDG
Bosnia & Herzegovina	No FBDG Bosnia and Herzegovina use the former Yugoslavian recommended nutrient reference values from 1979.
Croatia	Yes, not quantified Use the US RDA from 1989
Slovenia	Replace fatty meat and meat products with beans, legumes, lentils, fish, poultry or lean meat. FBDG in preparation
Former Yugoslav Rep. of Former Yugoslav Republic of Macedonia	Max. 100g meat/d
Georgia	Meat: 29-33 g/d beef, 32.9 g/d pork, 13.7 g/d mutton, 32.9 g/d poultry, 12.8-15 g/d fish; Legumes: 32.9 g/d lablab
Ukraine	10g/d poultry, 20g/d fish, 20g/d lean meat (rabbit, beef), 5g/d legumes

Increase of PUFA content in meat. Researches that are being carried out lead to manufacturing meat products supplemented with vegetable oil or algae oil with aim to increase total nutritive product value. Vegetable oils are rich with mono and poly-unsaturated fatty acids. Sea algae contain different bioactive materials with potentially positive impact on people's health and possibility to place them in different meat products. Fats from algae (1-3%) contain high percentage of n-3 PUFA and compounds with anti-oxidative influence. Adding raw materials of vegetable origin enriched with poly-unsaturated fatty acids provided manufacturing of meat products with functional traits, meat products with low content of fat and salt, products enriched with MUFA and n-3 PUFA fatty acids and products with balanced n-6/n-3 ratio. Campo et al., (2009) heat-treated mutton meat in water where was added small quantity of olive oil to the final temperature in the piece middle of 75ºC. As a result of this experiment was a product with

increased quantity of n-6 PUFA, better ratio n-6/n-3 PUFA and better ratio PUFA/SFA compared to other procedures of heat treatment (roasting and grilling). Cofrades et all (2009) researched impact of adding olive oil and algae oil on production of frankfurter with functional activity, while simultaneously reducing salt content in sausages. Thereupon they got a product with lower fat content and lower sodium content, with increased content of MUFA and n-3 PUFA and well balanced ratio n-6/n-3. Olive oil and algae oil, author concluded, could well replace a part of animal origin fats in sausages. Additional utility was a product with well balanced Na/K and product containing other elements that have positive influence on health (such as, fibers).

Manufacture of meat products with functional elements. Adding probiotics and prebiotics Zlender et all (2009) made fermented sausages with better nutritive and sensor traits. Thereupon they used the following layers of microorganisms: (1) commercial starter cultures: Bactoferm SM 181, *Lactobacillus sake* HJ-7, *Staphilococcus xylosus* DD-34, (2) probiotic cultures: *L.paracasei subsp. Paracasei* and (3) prebiotic Inulin. Similar results got Vasilev et al., (2009), Petkovski et al., (2009) and Vukovic et al., (2009).

Conclusion

People change habits in consuming meat and meat products. People's wish from 50 years ago to get valuable ingredients with meat (essential amino acids, iron, zinc, B complex vitamins) in the end of the last and beginning of this century became a concern while consuming meat not to take excess cholesterol and saturated fatty acids which are associated with heart diseases and colon cancer or to bring high sodium quantities into body, which are risky for health as it influences higher blood pressure. Science on meat and meat technology responded to this challenge. In the last several years it is intensively worked on change of meat composition and meat products in several production phases: selection and animals' plane of nutrition, processing meat with adding vegetable oils and algae oil into meat products or replacing sodium chloride in products with salt of other metals.

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