MEAT AND MEAT PRODUCTS AS A SOURCE OF FATTY ACID DIETARY INTAKE IN THE DIET OF THE CZECH REPUBLIC POPULATION

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Abstract - Meat and meat products are a traditional part of the Czech population diet. Their consumption amounts about 97 g and 66 g per person of 60 kg/day in the value as purchased. The total dietary fat intake covers about 85 g per person of 60 kg/day in average. Meat and meat products participate in this intake by 12,5 g and 16,7 g per person of 60 kg/day, which is about 35 % of total fat amount. The excessive and incorrect fat selection might have an adverse effect on human health and also might elevate the risk of relevant diseases occurrence. But at the same time, fat is a basic and essential nutrient. The fatty acid (FA) composition fundamentally influences fat quality and its health incidence. New FA diet composition data were not available in the Czech Republic, therefore their surveillance was included into the national dietary intake monitoring, which is carried out on the principles of so-called Total Diet Study. Total of 180 composite food samples after culinary treatment were analyzed for total fat quantity and 37 individual FA. The composition of saturated (SFA), monosaturated (MUFA), polysaturated (PUFA), omega 3 FA and *trans* FA was analyzed for each type of sample. The confrontation of FA concentrations and their dietary intake sources, depending on their consumption, was done. These results show that studied meat and meat products make an important contribution to the SFA dietary intake. The PUFA intake including valuable omega 3 FA from this sort of food is relatively low. In the view of higher unfavorable composition of SFA and *trans* FA, it is necessary to lower beef, pork and its fatter meat products consumption. The skin and dripping elimination in the chicken meat is advisable. From the dietary point of view rabbit meat was optimal.

***Index Terms*— meat, meat products, fat, fatty acid, dietary intake**

I. INTRODUCTION

Meat and meat products, except fish and sea products, make an important part of the Czech Republic population diet. This is caused by tradition, but also current social and economic situation.

In average, meat and meat products consumption amounts to about 97 g and 66 g per person of 60 kg/day in the value as purchased (Ruprich, Dofková, Řehůřková, Slaměníková, Resová, 2006). This fact is related to the relatively extensive dietary fat intake, in average about 85 g per person of 60 kg/day. Meat and meat products are one of dietary fat intake key sources – representing the intake of 12,5 g and 16,7 g per person of 60 kg/day, which is about 35 % of total fat amount. Currently, it is possible to assume that the large part of this animal fat is composed of saturated FA. Their high intake is related to the health risk civilization diseases such as obesity, rectal cancer, hypertension and consequently cardiovascular disease (Jime´nez-Colmenero, 2007). At the same time, fat contained in meat and meat products play a positive role by enhancing its technological and sensory characteristic (Wood, 2008).

To be able to evaluate the fat content ant its health incidence, it is fundamental to know its composition which is determined by FA representation (Schmid, Collomb, Hadorn, 2009). FA are usually classified according to the number of double bonds in carbon chain to the saturated (SFA – double bonds are not present, SFA are unfavorable in the diet because of its cholesterol level elevation and presumption, that they are involved in the coronary and heart diseases formation), monosaturated (MUFA – containing one double bond, are favorable in the organism if replacing SFA), and polysaturated (PUFA – containing two and more double bonds). PUFA have a positive influence on the human body by helping lower the cholesterol level and having the prevention role against cardiovascular diseases, in particularly omega 3 and omega 6 FA. Unsaturated *trans* FA are declared as dangerous, because of their association with cardiovascular diseases, diabetes II., allergies and other problems (Ruprich et al., 2005), (EFSA Journal, 2010).

The optimal diet selection in the view of the FA dietary intake and new national but also multinational nutritional recommendations were released. Contemporary recommendations for EU countries were published by the European Food and Safety Authority (EFSA). For total dietary fat intake, the recommended value is 20-35% of total energy intake. The suggested dietary intake for SFA, *trans* FA and cholesterol is a as low as possible. Exact and evaluated numerical values were declared only for selected PUFA i.e. alfa linoleic acid (ALA), eicosapentaenic acid (EPA) and docosahexaenic acid (DHA) (EFSA Journal, 2010).

So far, there have been no data available which would systematically monitor the FA diet composition in the Czech Republic. In this consequence, since 2004, the fatty acid surveillance has been involved in the national monitoring of the dietary exposure. This monitoring is since 1994 carried out on the principle of co-called Total Diet Study in the Czech Republic (Řehůřková, 2002).

The aim of this study was to (1) define the fat content and its composition in the viewpoint of the FA groups (SFA, MUFA, PUFA, omega 3 FA and *trans* FA) in selected types of culinary treated meat and meat products representing average Czech population diet and to (2) estimate its benefits in the total exposure fat value and FA groups for the average individual in the Czech Republic.

II. MATERIALS AND METHODS

A. Analyzed samples of meat and meat products

The FA content was monitored in selected food samples embedded in the national monitoring dietary exposure program realized as co-called Total Diet Study (Pennington, 1992). Typical national diet is represented by 143 food types which cover more than 95 % of food weight of the average national diet (Ruprich et al., 2006). The category of meat and meat products was represented by 23 food types, which comprise 8 types of meat and offal (chicken, pork, beef, rabbit, hen, turkey, poultry offal and pork liver) and 15 types of meat products (frankfurters, cooked salami, smoked meat, heat-treated dry salami, sausages, poultry specialties, pork ham, head cheese, canned pate, bacon, knackwurst, white and black pudding, fermented dry salami, liver sausage and canned meat). Samples were withdrawn to represent the country and the year seasons. The samples were taken from 12 places within the market network of the Czech Republic, represented by 4 regional areas and 8 sampling terms of two year sampling period (2006/2007). (Ruprich et al. 2008).

B. Pre-analysis food sample preparing

At first, food samples determined for analysis were culinary treated according to the typical procedures used in the Czech Republic. As far as meat and meat products are concerned, the standard culinary treatment is first of all baking, stewing and cooking/heating (Ruprich et al., 1997). Afterwards, culinary treated samples were homogenized. The homogenate contained also treating products, which are generally consumed (e.g. baked sauce and fat, in the chicken samples also skin). To dietary exposure estimation, the weight alteration caused by the culinary treatment was registered (so-called culinary factor).

C. The fatty acid food sample analysis

Samples were analyzed at the National Institute of Public Health (NIPH) in the laboratory which is validated and accredited by the ČSN EN ISO/IEC 17025 method. After the total fat extraction, the triacylglycerol saponification and its subsequence methanol reesterification to the FA methyesters, the individuals of 37 FA (for the specification see standard Supelco 37 Component FAME Mix) were analyzed by the method of gas chromatography (separation on the capillary colony 100m x 0,25mm x 0,2um – Supelco SP^{TM}2560) with flame-ionizing detection (GC-FID; Trace, TemoQuest Italy).

D. Sample processing

At total, 6840 analytical results were gained and processed. The average content value of the total fat content and 37 individual FA in one kg of the sample was calculated. After the concentration correction of the culinary losses (through the culinary factor) the average exposure ratio for the population was enumerated using the data about food consumption (Ruprich et al., 2006). The values for each FA were summarized by the characteristic of its saturation to the groups of SFA (17 individuals), MUFA (9), PUFA (11). Omega 3 FA comprise the sum of 4 FA (18:3N3, 20:3N3, 20:5N3, 22:6N3), and *trans* FA of 2 FA (18:1N9T, 18:2N6T). The data were summarized and compared in graphs showing the concentration value or the contribution to the total average exposure value.

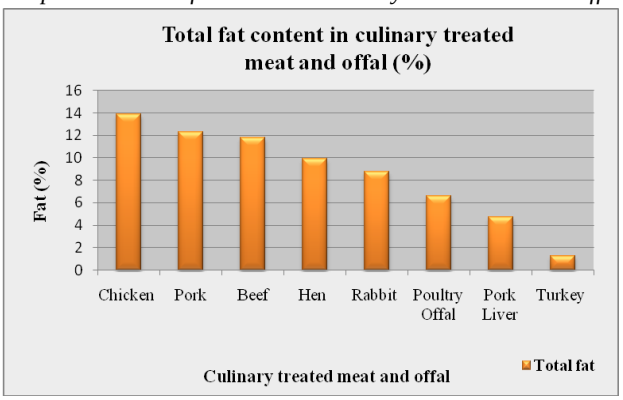
III. RESULTS AND DISCUSSION

The fat content in studied food and its participation on the total dietary intake

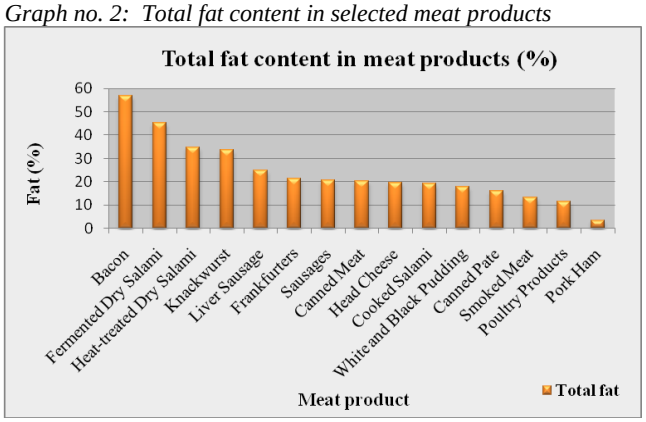
Certain surprising data were found in meat and offal samples analyzed for the total fat content. It was found, that chicken with average content of 13,9 % fat might be a very generous source of fat in the diet. This result is explicable by the truth, that people consume not only the muscle, but also the skin with the subcutaneous fat. For this reason, the measured fat was higher than when consuming other types of culinary treated meat and offal (e.g. pork contained 12,3 % of fat), see graph no. 1.

The bacon (57 % of total fat) and dry fermented salami (45,1 % of total fat) are in the group of meat products dominant (graph no. 2). In spite of a proper food labeling, not all consumers realize how high total fat amount is contained in some popular meat products. Chicken (4,1 g per person of 60 kg/day) and pork with beef (3,6 and 2,2 g per person of 60 kg /day) were the most important of studied meat in the total fat dietary intake of average diet. Frankfurters with 2,3 g per person of 60 kg /day, heat treated dry salami and cooked salami with 2,0 and 1,7 g per person of 60 kg /day were the greatest exposure source of fat in analyzed meat product samples.

Graph no. 1: Total fat content in culinary treated meat and offal



Graph no. 2: Total fat content in selected meat products



The FA group representation in analyzed food samples

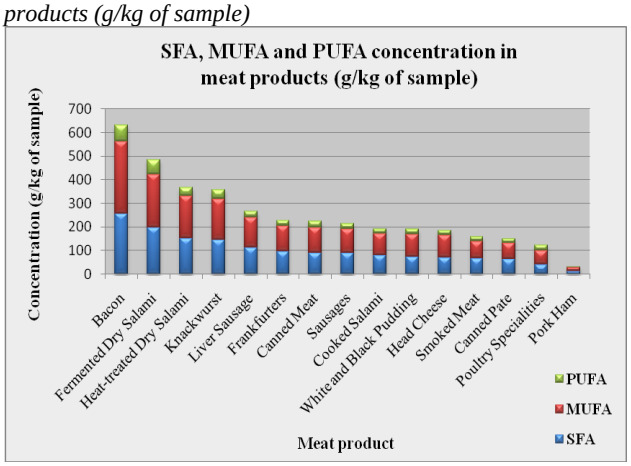
In the view of the health risk evaluation, the FA group representation is a determinant factor of analyzed food samples. The highest amount of unfavorable **SFA**, where palmitic and stearic acids were dominant, was measured in beef (56 g/kg) and the lowest amount in turkey (4 g/kg). Chicken, with regard to its significant consumption (1,2 g per person of 60 kg/day) was the most important studied exposure source of SFA. In the category of meat products, bacon was the greatest source of SFA (257 g/kg) and the lowest amount was measured in pork ham (12,8 g/kg). Frankfurters (1 g per person of 60 kg/day) were the greatest exposure source of SFA dietary intake.

MUFA were mostly represented by oleic and palmitoleic acids. The highest concentration in meat was measured in chicken (73 g/kg), which was also the greatest exposure dietary source (2,2 g per person of 60 kg/day). The MUFA meat product concentration varied from 15 g/kg (pork ham) to 304 g/kg (bacon). Frankfurters (1,2 g for person of 60 kg/day) were the highest dietary exposure source.

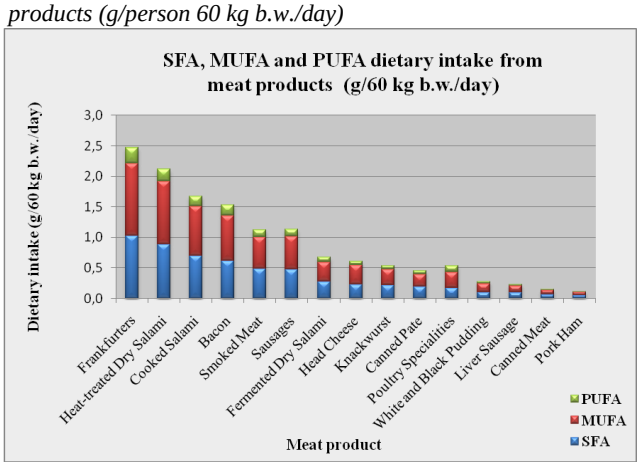
PUFA, furthest represented by linolic and linolenic acids were mostly measured in chicken (34 g/kg), rabbit (26,5 g/kg) and hen (22 g/kg). In the viewpoint of the exposure, chicken was the most important source (1g per person of 60 kg/day). In the category of meat products, the highest content of PUFA was measured in bacon (69 g/kg), fermented dry salami (59 g/kg) and heat treated dry salami (36 g/kg). The most important PUFA dietary exposition was calculated from frankfurters (0,25 g per person of 60 kg/day) and heat treated dry salami (0,2 g per person of 60 kg/day).

In SFA, MUFA and PUFA rate comparison, the major part of 40 – 50 % was represented by MUFA. The dietetically most optimal rate was found in rabbit (40 % SFA, 30 % MUFA, 30 % PUFA) compared to pork liver (56 % SFA, 22 % MUFA, 22% PUFA) and beef (47 % SFA, 50 % MUFA, 3 % PUFA). The rate of 28 % SFA, 49 % MUFA, and 23 % PUFA was measured in chicken. The highest PUFA concentration of 20 % was in the meat product category found in poultry specialties. The SFA, MUFA and PUFA representation in the viewpoint of its exposition and concentration is mentioned in graph no. 3 and 4.

Graph no. 3: SFA, MUFA and PUFA concentration in meat products (g/kg of sample)



Graph no. 4: SFA, MUFA and PUFA dietary intake from meat products (g/person 60 kg b.w./day)



The highest content of omega 3 FA was found in chicken and rabbit (3,3 and 2,5 g/kg), from meat products in bacon and fermented dry salami (3,2 g/kg). From the viewpoint of the exposition, the main source was chicken and pork (0,1 and 0,01 g per person of 60 kg/day) and frankfurters with smoked meat (0,06 and 0,02 g per person of 60 kg/day). The highest *trans* FA content was analyzed in beef and hen (2,1 and 0,5 g/kg) and in bacon (1,5 and 1,4 g/kg). Beef and chicken (0,04 and 0,01 g per person of 60 kg/day) were the most important exposition source of *trans* FA.

IV. CONCLUSION

The knowledge of FA representation in the diet is important with respect to the effect on human health. The excess amount of SFA and *trans* FA might cause many civilizational diseases. In the light of the prevention, higher intake of PUFA is desirable. These results show that studied meat and meat products are an important source of SFA intake in the diet. PUFA dietary intake from these products is relatively low, including valuable omega 3 FA. In the context of higher unfavorable SFA and *trans* FA representation, it is necessary to lower the consumption of beef, pork and its fatter meat products. It is advisable to take away chicken skin and stewing, when consuming. From the dietetic point of view, the most optimal meat is rabbit.

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