A STUDY OF FATTY ACID COMPOSITIONS IN PORK MEAT AND FAT UNDER THE ASPECT OF A HEALTHY HUMAN DIET

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ABSTRACT
Mangalita is a rustic pork breed which is mainly grown for meat and lard. Its history starts in the beginning of the 19th century, when Mangalita populations appeared and spread in various European Countries as Slovakia, Hungary, Romania and also Austria and Germany. Unfortunately, the breed suffered a rapid decline by the end of World War II, becoming close to extinction in the 1970's. In the past 20 years conservation programs were started in countries like Hungary and Germany, and recently Romania, which resulted in a numeric rise of the Mangalita populations. The purpose of the present paper is to analyse and compare various studies made on the quality of meat and lard coming from this breed, under the aspect of the fatty acid composition, respectively the proportion of unsaturated fatty acids versus saturated fatty acids. The paper also aims to emphasize the importance of the Mangalita breed conservation, not only in the context of ecological breeding, biodiversity and gene pool conservation, but also as a key breed in a healthier nutrition plan, as it is the only red meat that contains a high proportion of unsaturated fatty acids like Omega 3 and Omega 6, which are essential in human nutrition and help prevent a series of diseases, among which heart diseases and autoimmune disorders.

Keywords : Mangalita, conservation, unsaturated fatty acids, health, nutrition

INTRODUCTION

Mangalita is a rustic pork breed which is mainly grown for meat and lard. Its history starts in the beginning of the 19th century, when Mangalita populations appeared and spread in various European Countries as Slovakia, Hungary, Romania and afterwards Austria and Germany (HOGBERG, 2005). There are various hypothesis surrounding its origin, one of them stating that the breed originated from the *Sus Mediteraneus* wild pig, which was infused with asian swine breeds. The Mangalita populations suffered a rapid decline by the end of World War II, becoming close to extinction in the 1970's. In the past 20 years conservation programs were started in countries like Hungary and Germany, and recently Romania, which resulted in a numeric rise of the Mangalita populations.

Mangalita's features differ radically from other breeds and should be maintained in the future. The animals are calm and have a good accomodation capacity. They manifest a high indurance to stress and are resistant to diseases. Mangalita is well adapted for breeding in an extensive system because they act well in extreme climate conditions and can be held outside during winter. Their capacity to produce lard is excellent. The largest part of their body weight is represented by lard and fat.They transform nutrients with a minimum loss of energy. There are five color varietes:baris, blonde,red, black and swallow-belly. According to DNA testing the three varieties are actually different breeds. The Mangalita's head has a medium length when compared to the body. It has a wide forehead and the profile line is a bit convex. The ears cover 2/3 of the nose. The eye color is always brown. The length of the neck is medium and the one of the back is also medium if compared with meat breeds but shorter if compared with the withers height.

The proportion of saturated and unsaturated fatty acids contained by the fat is in favour of the unsaturated ones with long chains, which slow down the oxidation time. The meat is considered a delicacy and is used in producing the famous Serrano ham.

MATERIALS AND METHODS

The materials used in the present paper include various results of fatty acid analysis, which were realised by several Universities in Hungary and Romania, all done on the Mangalita breed, as well as a fatty acid analysis realised on the Great White pigs that were fed with Linseed, which was done by the Institute of Animal Health in Prague and the fatty acid analysis for grassfed cattle, sheep and pigs, conducted by the Department of Veteriary Sciences of Bristol University. All the fatty acid analysis was done by using the gas chromatography method. The paper compares results for fatty acid compositions of pig meat in comparison with cattle or sheep meat and also studies the differences in fatty acid proportions in Mangalita and other pork breeds, as well as in linseed fed pigs. The methods used include the collection and analysis of data, as well as processing it and creating the tables and charts with the use of Microsoft Word and Excel programs.

RESULTS

In the past years, mankind has become more aware of the nutritional value of the food it ingests. There is a tendency against excess red meat and animal fat consumption, as well as one against factory animal breeding.

The main form of fat in our bodies and diet is represented by tryglicerides, which provide energy and insulation, though a large trygliceride quantity in our blood can lead to health problems. Tryglicerides can be divided into saturated and unsaturated fatty acids. Saturared fats are considered the most detrimental to your health. They usually are solid at room temperature and are derived from animal products. When looking at their molecular structure, saturated fats contain the maximum number of hydrogen atoms (hence "saturated" with hydrogen atoms). Eating a diet high in these has been strongly correlated to heart disease. Unsaturated fats, on the other hand, are found foods such as nuts, avocados, and olives. They are liquid at room temperature and differ from saturated fats in that their chemical structure contains double bonds. Additionally, studies have shown that unsaturated fats are also heart-healthy fats - they have the ability to lower LDL cholesterol and raise HDL cholesterol ("good" cholesterol). There are two forms of unsaturated fat - monounsaturated fat and polyunsaturated fat. The polyunsaturated fatty acids (PUFA) Omega 6 (gamma-linolenic acid) and Omega 3 (alpha-linolenic acid) play a very important role in our nutrition, as our body cannot synthetise them in its own, but can obtain them from food. They can be found in fat fish, fish oil, nuts, avocado and vegetable oil and studies have proven that they are effective in controlling blood clotting, protection agains heart disease, autoimmune diseases and can also contribute to bulding cell membranes in the brain and lowering the LDL cholesterol level.

In 2007, J.D. WOOD et al. studied red meat quality by analysing the fatty acid composition of adipose tissue and muscle from pigs, sheep and cattle that were fed a grass diet. As seen in *Table 1* and *Table 2*, pigs have high levels of polyunsaturated fatty acids, including long chained ones. In both muscle and adipose tissue there is a higher quantity of

the major polyunsaturated fatty acid, the linoleic acid, as well as a higher level of arachidonic acid, an essential Omega 6 polunsaturated fatty acid, benefitial for human health due to positive effects on metabolism and prevention of heart diseases.

Table 1. PUFA composition in adipose tissue (g/100g fatty acids)

PUFA	Pig	Sheep	Cattle
Linoleic acid	14.3	1.3	1.1
α linolenic acid	1.4	1	0.5
Arachidonic acid	0.2	-	-

Source: WOOD, et al. (2007)

Table 2. PUFA composition in muscle tissue (*longissimus dorsi*) (g/100g fatty acids)

PUFA	Pig	Sheep	Cattle
Linoleic acid	14.2	2.7	2.4
α linolenic acid	0.95	1.37	0.7
Arachidonic acid	2.21	0.64	0.63

Source: WOOD, et al. (2007)

In 2007, with the purpose of increasing the percentage of unsaturated fatty acids in the composition of pork meat and fat, the Institute of Animal Health in Prague has conducted a study on Great White pigs that were fed a finishing diet supplied with linseed, while previously being fed with concentrates. *Table 3* and *Table 4* depict the acid fatty composition change that was observed in the control group, fed a normal diet, and the experimental group, fed a linseed finishing diet.

Table 3. Fatty acid content in muscle tissue (g/100g of total fatty acids)

Fatty acid	Control group	Experimental group
Linoleic C18:2n-6	9.51	11.24
α-linolenic C18:3n-3	0.44	2.27
Arachidonic C20:4n-6	3.08	2.63

Source: VACLAKOVA - BECKOVA (2007 Institute of Animal Science Prague

Table 4. Fatty acid content in backfat (g/100 g of total fatty acids)

Fatty acid	Control group	Experimental group
Linoleic C18:2n-6	9.18	10.87
α-linolenic C18:3n-3	0.87	4.90
Arachidonic C20:4n-6	0.21	0.17

Source: VACLAKOVA , BECKOVA (2007) Institute of Animal Science Prague

It can be observed that the linoleic and alpha linoleic acids are higher in the muscle tissue and backfat of pigs fed a finishing linseed diet. However, the experimental group shows a lower level of arachidonic acid, which is an essential Omega 6 polyunsaturated fatty acid.

In the past decade, various studies have been conducted on the fatty acid composition of meat and fat from several pork breeds, all fed the same diet. *Figure 1* reveals that the proportion of unsaturated fatty acids is higher in the case of the rustic Mangalita breed, respectively the Red Mangalita with 63.01 % unsaturated fatty acids and Blonde Mangalita with 60.45 %. The Duroc and Mangalita hybrids failed to provide a higher level of unsaturated fatty acids than the pure bred Mangalita pigs.

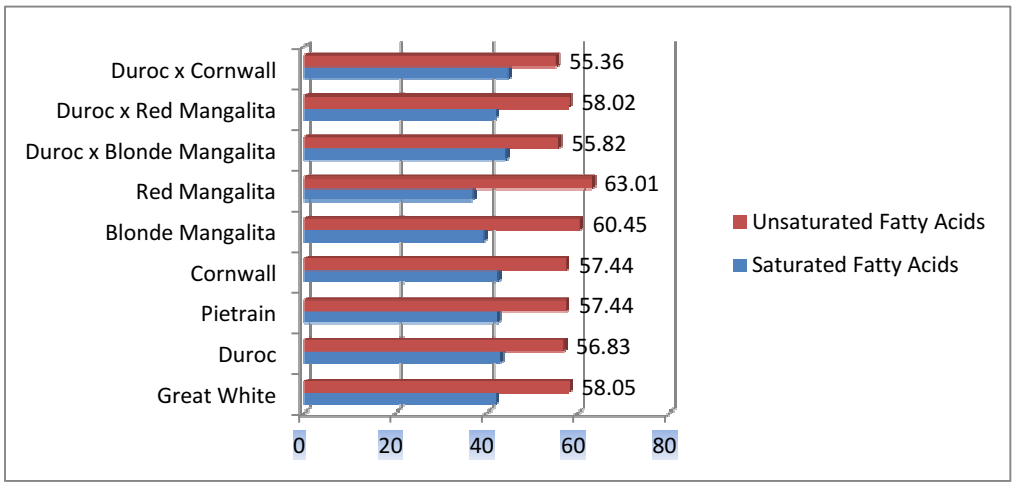

Figure 1. Unsaturated and saturated fatty acid proportions in various pork breeds
Source: LUGASI (2002), SZABO - FARKAS (2005)

CONCLUSIONS

The fatty acid analysis of pork, cattle and sheep muscle and adipose tissue reveals that pork meat from pigs fed with grass contains a higher level of polyunsaturated fatty acids. Moreover, pigs fed a finishing linseed diet also present a higher level of polyunaturated fatty acids than pigs fed a linseed free diet.
The pure Mangalita pork breed meat and fat contains a higher level of unsaturated fatty acids than most modern pork breeds and modern pork breeds and Mangalita hybrids.

Red and Blonde Mangalita are perfect candidates for the type of meat that can revolutionise the current nutrition peconception that red meat and animal fat have a negative impact on human health due to its high level of polyunsaturated fatty acids.

Mangalita is a rustic breed with high pretability for ecological breeding. Considering the fact that the level of linoleic, alpha linoleic and arachidonic acids are higher in pigs fed a grass diet than of pigs fed a diet based on concentrates and a finishing one enhanced with linseed, it has high potential for producing high levels of PUFA without linseed finishing diets, in an ecological breeding system.

Conserving the Mangalita breed is important not only under the aspect of biodiversity conservation and gene pool conservation, but also under the aspect of a healthy human diet, rich in polyunsaturated fatty acids, which can now be assimilated through meat as

well as vegetables, thus ensuring a balanced diet, which offers protection against heart diseases, blood clotting and immune disorders.

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