Cholesterol content and fatty acid composition in pork meat products manufactured in Poland

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Introduction

In Poland habitually consumed diet is regarded as high fat (about 38.5-40.5% of energy) and high cholesterol (above 400-500 mg/day). In the early 1990s among the developed countries, Poland was on the third place according to the mortality from coronary heart disease (CHD) among men and on the fourth place according the mortality from CHD among women. The risk of heart attack among men aged 19-[illegible] years in Poland is twice more than in men at comparable age in Germany or Sweden (Szostak and Cybulska, Rywik et al. 1996).

Increased serum cholesterol concentration is a risk factor or risk marker of early-onset of CHD. Common strategies taken to reduce morbidity and mortality from CHD generally involve the reduction of serum total cholesterol through lowering the intake of total fat (below 30% of energy) and dietary cholesterol (up to 300 mg/day). Simultaneously reduction of the consumption of saturated and increase of the consumption of polyunsaturated fat is recommended to maintain the right proportion of dietary saturated to monounsaturated to polyunsaturated fatty acids as 1 : 1 : 1.

National Program of Cholesterol Prophylaxis has been realized in Poland since 1987. It's main objective is to increase the awareness of the general public regarding the necessity of the improvement state of nutrition and life style as well as the increase in the assortment of food products low cholesterol and saturated fats on market. Simultaneous monitoring of fat and cholesterol content as well as the profile of fatty acids in foods and labeling the foods facilitate the appropriate composition of habitually consumed diet, and therefore the prophylaxis of CHD.

A natural consequence of the consumer preference for products low in cholesterol, several methods for the reduction of cholesterol in commonly consumed foods have been developed successfully over the past few years. These approaches are biological (involve microorganisms, principally Nocardia and Rhodococcus, enzymes: cholesterol oxidase and cholesterol reductase), chemical (solid-liquid extraction, extractions with organic solvents, complex formation) or physical processes (distillation, crystallization, supercritical fluid extraction). The application of these procedures to animal foods is technically feasible. However, because the cholesterol content in pork as well as in beef depends on the content of fat in meat (lard contains about 86 mg of cholesterol per 100g and muscles pork 65 mg of cholesterol/100 g; tallow - 100 mg of cholesterol/100 g and beef muscles - 60 mg of cholesterol/100 g) it seems to be more reasonable and costless to manufacture low cholesterol products through development the new recipes. This refers particularly to the highly processed products like sausages.

Material and Methods

The samples of pork meat products were collected according to sampling plan of monitoring from different regions of Poland and kept frozen until further analysis. The cholesterol contents and fatty acids profiles in pork meat products were determined by high resolution gas chromatography according to the procedures already published (Obiedzinski et al. 1996).

Results and Discussion

Results from Food Monitoring Program indicate that the content of cholesterol in pork meat products manufactured in Poland differ significantly (table 1).

Table 1. The minimum - maximum content of cholesterol (mg/100 g) in selected pork products manufactured in Poland

Product	Cholesterol content (mg/100 g)
Canned shoulder	41-48
Bacon	60-77
Sausage	38-84
Frankfurter type sausage	48-60
Mortadela	48-79
Hot dogs	50-69
Commuted sausage	53-68
Ham type sausage	40-71
Ham	39-55

The new recipes will enable tthe manufacturing of dietetic low cholesterol products. Appropriate labeling of food products will make easier to choose the right low cholesterol products and include them into every day diet.

Average consumption of meat in Poland in 1995 was 60.5 kg per capita/year; in this average consumption of pork was 38.7 kg per capita/year; animal fat (lard) was 8.3 kg per capita/year (Raporty Rynkowe MRiGŻ, 1995).

Triacylglicerols are the predominant form of all lipids associated with fats in food. For example over 98% of the fatty acids in meat, fish and vegetable oils are in triacylglycerols. Nearly all the remaining fatty acids are also esterified components of the phospholipids and cholesterol.

The composition of fatty acid pool in each kind of animal fat and meat is different (table 2).

Table 2. Fat, fatty acids and cholesterol content in selected foods

	Cow's milk	Skinless chicken	Lean beef	Lean pork	Pink salomon
Total fats*)	3.8	3.6	9.9	9.3	6.1
Total SFA)**	66.5	32.6	45.4	39.9	28.5
Total MUFA)**	29.2	44.7	50.0	53.2	32.6
Total PUFA)**	4.3	22.7	4.6	6.9	38.9
Cholesterol*)**	12.5	85	85	80	65

*) expressed as weight percentage of total food
**) expressed as weight percentage of total fatty acids in food
***) expressed as milligrams of cholesterol per 100 grams of food.

Additionally there are three means by which the fatty acid composition of meat products can be altered. The most direct approach would be to add the desired fats during the formulation of emulsified meat products. Another approach is to feed the animals with fodder which have the desired fatty acid composition, with the hope that this would result in corresponding changes in the fatty acid composition of the meat. Effecting significant changes in fatty acid composition of cattle, and ruminants in general, may require the genetic selection of animals that have greater genetic propensity for depositing stearate and/or oleate.

The ratio of SFAs : MUFAs : PUFAs in polish pork meat products in 1995 did not differ significantly. For example in ham, popular sausage and frankfurter type sausage it was 36:52:8; 40:52:8; 39:52:8, respectively. In comparison to earlier published data in pork meat products the content of SFA has decreased and the content of MUFA has increased. The cause of the changes in the fatty acids composition might be changes not only in animal nutrition, but also changes occurring during the manufacturing processes.

Similarly, as in case of cholesterol, the labeling of products with the ratios of each group of fatty acids apart from the fat content make easier to choose the appropriate food items.

Triacylglycerols differ according to the type and placement of the three fatty acids on the glycerol and are the primary storage form of lipids in the animal body and in many plant seeds.

Stereospecyfic distribution of fatty acids on triacylglicerol structures influences the technological behavior of fats as well as their absorption fate. Long chain fatty acids in external (sn-1 and sn-3) position may impair the fat absorption and therefore the physiological response to dietary fats.

Transestrification enables the obtaining of fats with modified structure without changing the composition of fatty acid pool. It is another approach to modify the utilization of fat in human organism. However, such approach might be better utilized in case of manufacturing plant fats.

Conclusions

The consumption of pork meat products in Poland is rather high. The content of cholesterol in pork meat products manufactured in Poland differ significantly (table 1). It is also possible to produce new dietetic pork meat products with modified composition of fatty acids. The availability on market new pork meat products with low cholesterol content and appropriate fatty acid composition facilitate the right composition of every day consumed diet, and therefore prophylaxis and dietary treatment of lipid metabolism disorders which are the main risk factor of coronary heart disease.

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