THE RESULTS OF SURVEILLANCE STUDIES ON THE POLYCYCLIC AROMATIC HYDROCARBONS IN SMOKED AND GRILLED MEAT PRODUCTS IN POLAND IN YEARS 1998-2000

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Background

The strategy of providing the human population with safe and quality food calls for plan of establishing and executing the effective food contaminants monitoring system, as a one of the means to create data base for risk assessment. The monitoring system implemented in Poland not only deal with a presence of environmental pollutants in food, but also with residues left over during production or processing and other important components which are significant for nutrition and consumer protection. (Obiedziński and Jankowski 1996).

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental contaminates of the biosphere and represent a very important group of chemical carcinogens or cocarcinogens. It is well documented fact that PAHs are frequently found in various environmental samples, as well as plants, seeds, grain and food products which are exposed to thermal treatment (grilling, smoking, roasting). Reports of some studies on total diet in a number of developed countries indicate that food constitutes are important source of human exposure to PAHs. The Toxicological Committee of Polish Academy of Science recognized PAHs as a group of the most important compounds which presence in human environment should be evaluated and monitored. In presented studies we report our finding regarding polyarenes in polish smoked and grilled meat products.

Objective

The objective of presented study was to determine the levels of contamination of processed meat products with polyaromatic hydrocarbons and collect data for estimation of exposure.

Materials and Methods

The samples of meat products were collected according to sampling plan of monitoring from different regions of Poland during the period 1998-2000, and kept frozen (-30°C) until further analysis. In brief the analytical method used consists of cleanup steps using silica gel column chromatography followed by gel permeation chromatography. Following cleanup steps the separation of PAHs were performed by gas chromatography combined with mass spectrometry working in specific ions mode (SIM).

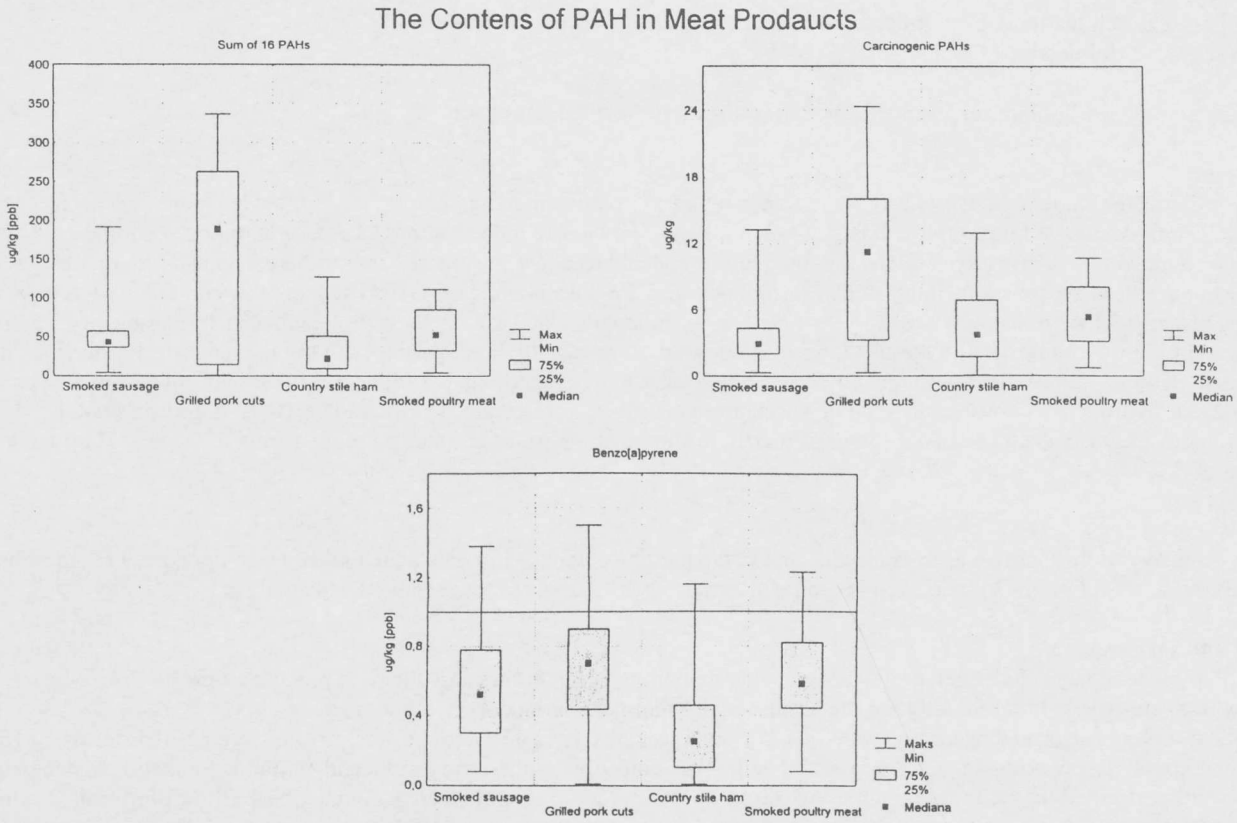
Results

In the Table 1 are presented the results of determination of PAHs in smoked poultry meat products, grilled pork cuts, smoked sausages and country stile ham. The results of determinations of PAHs are expressed as a sum of 16 PAHs according to American Environment Protection Agency, as a sum of known carcinogenic PAHs (see legend under Table 1) and content of benzo[a]pyrene (BaP), which is very often used as indicator compound of contamination of the product by polyarenes. The results of PAHs content clearly indicate that the most contaminated products are grilled pork cuts followed by less contaminated smoked poultry meat products and smoked sausages. The lowest contamination of the products occur in samples of country style hams.

Table 1. The content of polycyclic aromatic hydrocarbons in monitored meat products

The Content of Sum 16 PAHs μg/kg [ppb]				
Type of products	**Smoked Poultry Products**	**Grilled Pork Cuts**	**Smoked sausage**	**Country Stile Ham**
Mean	58,49	149,08	53,66	34,63
Standard deviation	31,23	124,66	28,98	34,10
Minimum	4,60	1,17	4,60	0,43
Maximum	112,12	336,64	191,58	127,58
Median	52,77	188,22	43,60	21,80
90 Percentile	94,04	296,40	96,55	88,83
The Content of Sum Carcinogenic PAHs μg/kg [ppb]				
Mean	5,38	10,54	3,56	4,40
Standard deviation	2,87	6,89	2,26	3,15
Minimum	0,72	0,30	0,34	0,05
Maximum	10,72	24,34	13,28	12,92
Median	5,35	11,22	2,90	3,62
90 Percentile	8,61	18,31	6,61	8,70
The Content of benz[a]pyrene μg/kg [ppb]				
Mean	0,62	0,68	0,58	0,33
Standard deviation	0,32	0,35	0,32	0,27
Minimum	0,08	0,10	0,08	0,10
Maximum	1,23	1,40	1,56	1,26
Median	0,58	0,70	0,54	0,25
90 Percentile	1,00	1,18	1,00	0,70

Legend: Carcinogenic PAHs – benz[a]pyrene, dibenz[a,h]anthracene, benz[g,h,i]perylen, benz[a]anthracene, benzfluoranthenes, indeno[1,2,3-c,d]pyrene; Sum of 16 PAHs – according to EPA



The PAHs can occur as contaminates in different types of food, including vegetables, fruits, cereals, vegetable fats and oils. The contamination of these products could occur mainly form environment sources. Meat products can contain PAHs, predominantly due to smoking and heat treatment such as grilling, broiling, roasting etc. The levels for grilled products are higher compared to smoked, and are characterized by higher variations due to thermal treatment of varying severity which are used. The last observation could be explained by different grilling techniques used. In previous studies we also observed that in respect of smoking methods the use of modern smoking chambers help to decrease level of contamination of the products with PAHs as compared with traditional smoking (Raport, 1996-7). It is necessary to take appropriate action – within the frames of „risk communication" with assistance of public media, to advice consumer on appropriate grilling technologies to minimize the risk of exposure to PAHs.

Our observations are also supported by the fact that the level of benzo[a]pyrene, which was historically used as a reference indicator of carcinogenic PAHs, is rather low, as compared to other substituted PAHs. Generally the level of 1 ppb (μg/kg), which in some countries is used as a legal maximum value (Germany, Finland or Czech Republic) was seldom exceeded, except grilled products (only 38 of 557 analyzed samples have level of BaP>1ppb).

In our previous paper on the basis of the results of food monitoring program in years 1995 - 1999 we made estimation of the exposure of polish consumer to benzo[a]pyrene from different groups of food products. Benz(a)pyrene consumed with meat products makes only 20% of intake, and grilled product not more then 10%. Presented studies are supporting these estimates.

Conclusions

The technology of grilling of meat products require urgent revision in order to diminish the possibility of PAHs formation.

The levels of PAHs detected in smoked and grilled meat products are in the range comparable with the results reported in scientific literature regarding contamination by PAHs of meat products in other countries.

References

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Ocena pobrania wielopierścieniowych węglowodorów aromatycznych wraz z dietą w świetle badań monitoringowych wykonanych w IPMiT w latach 1995 –1997. Olsztyn 1998 r.