

## CONTENT OF CHOLESTEROL AND OXYSTEROLS IN SELECTED POLISH MEAT PRODUCTS

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### Background

Cholesterol is the main sterol compound in food of animal origin. Its content may influence the serum cholesterol content and creates the risk for cardiovascular disease. Recently, the attention has been focused on products of cholesterol oxidation (Guardiola at al., 1996; Bischoff&Byron, 1977; Kumar&Singhal, 1991). Oxysterols are formed mainly during food processing and storage. According to the publicity, meat and meat products are the main source of consumed cholesterol and oxysterols. This problem is the subject of a lot of scientific investigations (Paniangvait at al., 1995; Zubilaga&Maerker, 1991; Park&Addis, 1986; Honikel&Arneth 1996; Dorado at al. 1999). In spite of that, information on the cholesterol and oxysterols content in meat cuts and meat products is still incomplete and inaccurate. The wide and cooperative studies (with USDA) on the content of cholesterol and most important oxysterols in selected popular Polish meat products have been undertaken (Wąsowicz&Uchman, 1999).

### Objectives

The objective of this study was to monitor the content of cholesterol and oxysterols in most popular Polish sausages. The correlations between their content and fat content were checked as well.

### Materials and methods

Selected meat products were produced on the commercial scale in the large plant located in Poznań. The samples for all determinations were taken on the next day after production.

The proximate analysis were made according to Polish Standards. Cholesterol content (mg/100g of sample) and oxysterols content were measured following the GC and GC/MS procedure described by Przygoński (1999). The following main products of cholesterol oxidation were determined: 7 $\alpha$ -hydroxy cholesterol (7- $\alpha$ -OH-C), 7 $\beta$ -hydroxy cholesterol (7- $\beta$ -OX-C), 7-ketocholesterol (7-keto-C), 20 $\alpha$ -hydroxy cholesterol (20 $\alpha$ -OH-C), 25-hydroxy cholesterol (25-OH-C), 27-hydrox cholesterol (27-OH-C), cholesterol  $\alpha$ -epoxy ( $\alpha$ -epoxy-C), cholesterol  $\beta$ -epoxy ( $\beta$ -epoxy-C), cholesterol-3 $\beta$ ,5 $\alpha$ ,6 $\beta$ -triol (triol-C). The sum of these oxysterols was also calculated and taken into consideration.

All determination were made minimum in three replications and obtained results used for the necessary statistical calculations.

### Results and discussion

Characteristic of selected sausages is presented in the Table 1 according to the classification proposed by Kinsman (1981). The results of determination of fat and cholesterol content in selected sausages are also shown in the Table 1.

These presented results show no significant correlation. Different situation has been observed for oxysterols. In the case of 7 $\alpha$ , 20 $\alpha$ ,  $\alpha$ -epoxy and triol no correlation between their content and fat and cholesterol contents has been found.

Very high correlation for regressions: 7 keto = f (fat, cholesterol) and  $\alpha$ -epoxy = f (fat, cholesterol) were observed. Some significant correlation for 7 $\beta$ , 25OH, 27OH and total sum of oxysterols (Fig 1) also exist. Obtained results should be properly connected with parameters of sausage processing.

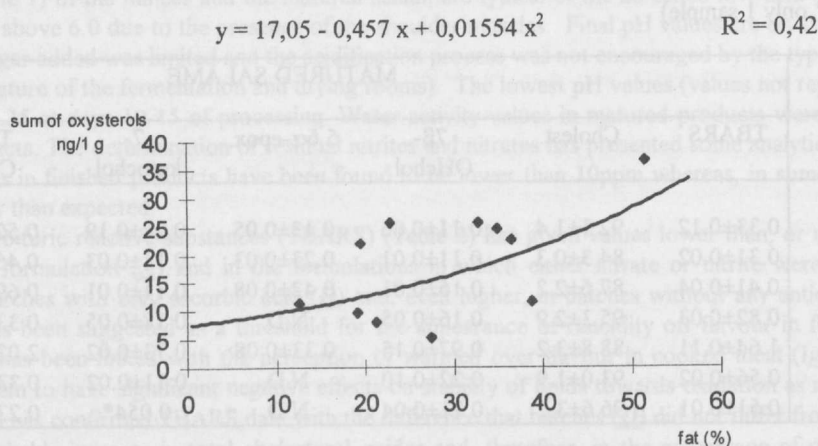


Fig 1. Sum of oxysterols as the function of fat content in sausages

Table 1. Characteristics of selected sausages

No	Name of sausage	Type			cooked	uncooked	smoked	unsmoked	grind/ chop		fermented	meat ingredients		Fat (%)	Cholesterol (mg in 100g of sample)	oxysterols (ng in 1g of sample)		
		moist	semi-dry	dry					fine	medium		beef	pork			7 keto	$\alpha$ epoxy	total content
1	parówkowa	X			X		X		X			X	X	27,4	59,2	0,774	0,169	5,420
2	mortadela	X			X		X		X			X	X	21,2	34,7	0,610	0,130	8,040
3	mielonka	X			X			X		X		X	X	12,6	36,8	2,291	0,995	11,598
4	ślaska	X			X		X			X		X	X	19,4	27,2	4,556	1,484	22,022
8	pasztetowa (I)	X				X	X		X				X	32,7	25,3	6,336	1,742	25,832
9	pasztetowa (II)	X				X		X	X				X	36,5	84,8	1,720	0,680	22,610
10	metka łososiowa	X				X		X	X			X	X	51,5	35,4	5,198	2,056	36,523
12	jałowcowa		X		X		X			X		X	X	38,7	82,2	1,060	0,402	11,646
13	kabanosy			X	X		X			X			X	22,8	42,6	2,771	0,899	25,681
14	salami			X		X	X		X		X	X	X	34,9	24,4	5,563	2,423	24,494
15	polska		X			X	X			X	X		X	19,1	61,3	1,200	0,810	9,780

**Conclusions:**

1. No correlation between fat and cholesterol content in checked sausages was found.
2. Correlations between some (7 keto,  $\beta$ -epoxy and sum of oxysterols) oxysterols and fat and cholesterol content were observed.
3. Processing parameters probably have strong influence on cholesterol oxidation during sausage manufacturing.

**References:**

1. Bischoff F., Byron G., (1977), The pharmacodynamics and toxicology of steroids and related products. *Adv. Lipid Res.* 15, 61-67
2. Dorado M., Martín Gomez E.M., Jiménez-Colmenero F., Masoud T.a. (1999), Cholesterol and fat contents of Spanish commercial pork cuts. *Meat Science* 51, 321-323
3. Guardiola F., Codony R., Addis P.B., Rafecas M., Boatella J., (1996), Biological effects of oxysterols: current status, *Fd. Chem. Toxic.* 34, 193-211
4. Honikel K.O., Arneth W. (1996), Cholesterol content of various meat species and its relation to fat content. In *Proceedings of 42 International Congress of Meat Science Technology* (pp 214-215), Lillenhammer, Norway
5. Kinsman D., (1981), Principal characteristics of sausages of the World listed by country of origin, U.C., Department of Animal Industries
6. Kumar N., Singhal O.P., (1991), Cholesterol oxides and arteriosclerosis, *J.Sci. Food Agric.* 55, 497-510
7. Paniangvait P., King A.J., Jones A.D., German B.G., (1995), Cholesterol oxides in food of animal origin; *J.Food Sci.* 60, 1159-74
8. Park S.W., Addis P.B. (1986), Further investigation of oxidized cholesterol derivatives in heated fats, *J.Food Sci.* 51, 1380-81
9. Przygoński K., Jeleń H., Wąsowicz E., Determination of cholesterol oxidation products in infant formulas by gas chromatography and mass spectrometry, *Die Nahrung* (1999) - in press
10. Wąsowicz E., Uchman W., (1999), Grant No FG-Po-96-3
11. Zubillaga M.P., Maerker G. (1991), Quantification of three cholesterol oxidation products in raw meat and chicken, *J.Food Sc.* 56, 1194-96