

POLYCHLORINATED BIPHENYLS IN FAT OF WILD-BOARS FROM DIFFERENT REGIONS OF NORTH-EASTERN POLAND – SHORT COMMUNICATION*

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This paper presents the results of studies on the content of polychlorinated biphenyls (PCB's) in the fat of wild-boars shot in 10 selected areas of north-eastern Poland. All examined fat samples contained polychlorinated biphenyls. The mean level of PCB's in fat samples collected from wild-boars was 5.1 $\mu\text{g}/\text{kg}$. The highest mean levels of PCB's were noted in wild-boars from the Supraśl and Miłomłyn area. The presented data reveal that the levels of polychlorinated biphenyls were much lower than tolerated values for nutritive products, and at present there are no hygienic and toxicologic reservations. These studies illustrate the exposure of selected animal species and indirectly humans to these xenobiotics in north-eastern Poland.

INTRODUCTION

Polychlorinated biphenyls (PCB's) are regarded as xenobiotics of high toxicity to animals and humans. These substances get into the environment mainly through evaporation, waste processing, chlorination of drinking water and sewage, and blanching of cellulose pulp, [Ballschmitter *et al.*, 1987a; Ballschmitter *et al.*, 1987b; Takasuga *et al.*, 1994; Merriman *et al.*, 1991].

The PCB's are used as hardeners for plastics and varnishes, insecticide solvents and germicidal compounds, cooling-liquids in thermostats, dielectrics for use in transformers and condensers, as well as in the rubber industry [WHO, 1976]. The essential route of spreading these substances is atmospheric transport [Oehme, 1991; Holsten *et al.*, 1991]. Polychlorinated biphenyls are compounds of high chemical persistence, and are considered to be "ubiquitous" in animal and human organisms and in the environment [Oehme, 1991; Muir *et al.*, 1988]. The reasons for animal and food product contamination are various [Safe, 1994; Clarke *et al.*, 1983]. The main reservoir of these substances is fat tissue [WHO, 1976]. The PCB's may cause, among others, numerous biochemical disturbances including induction of some enzymatic groups [Cockerline *et al.*, 1981], morphological changes, disturbances in reproduction and growths, impaired immunological response, and they show a weak carcinogenic effect as well as interfere with endocrine [Kimbrough, 1980; Ahlborg *et al.*, 1992; Safe, 1994; Birnbaum, 1994]. Polychlorinated biphenyls are ranked as typical environmental contaminants, due to their definite hazards to the health of the consumers of currently produced food. Therefore, systematic testing of PCB's content in food, as one of food contamination indicators,

seems advisable. The purpose of the present paper is to define the polychlorinated biphenyls level in the fat tissue of wild-boars and to estimate toxicologic threats. The examined animals were shot in selected hunting areas of north-eastern Poland.

MATERIAL AND METHODS

The studies were performed on wild-boars shot during the 1999/2000 hunting season in selected hunting areas of north-eastern Poland (Warmia and Mazury, Podlaskie province). Fat samples (about 100 g) were collected from randomly-selected animals (10 animals from each locality) in the "Las" Game Meat Processing Company in Olsztyn. They were stored in a freezer before they were analysed. Extraction and purification were made according to the method of Ludwicki *et al.* [1996] and Niewiadowska [1984]. Quantitative determinations were made using gas chromatography with an electron capture detector (ECD). The identification of PCB's was made comparing the retention time of sample peaks with the peaks of standard solution Aroclor 1260, while the concentration was calculated according to the standard method. Precision and salvage of the used method were checked under internal control conditions. The detection limit was 0.001 mg/kg fat and recovery rate was 96.5%. On the basis of results it was found that the used method is enough precise and sensitive.

RESULTS AND DISCUSSION

The results, as mean values are presented in Figures 1 and 2. The average content of PCB's in fat collected from wild-boars from north-eastern Poland was 5.1 $\mu\text{g}/\text{kg}$. In the

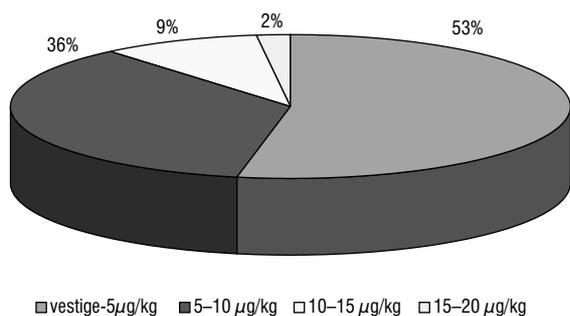


FIGURE 1. PCB's content distribution in the fat of wild-boars from north-eastern Poland.

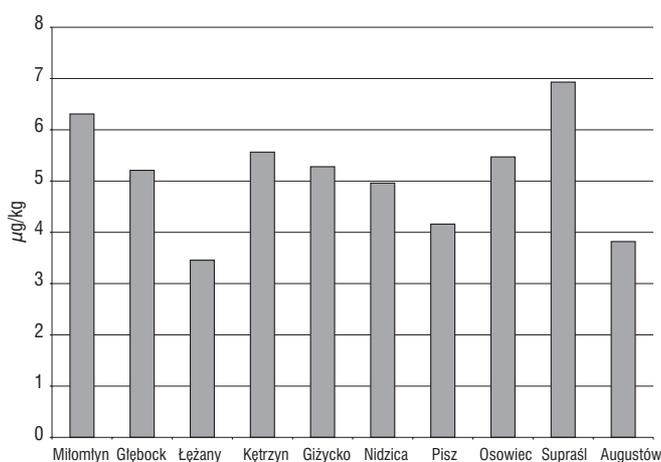


FIGURE 2. PCB's level in the fat of wild-boars from the north-eastern Poland.

majority of the samples, the PCB's content was lower than 5 µg/kg. The highest results in unit samples were only 3 times higher than the mean value for a particular material. The data presented in Figure 1 reveal that 53% of the fat samples ranged from a vestigial amount to 5 µg/kg, 36% of the samples contained polychlorinated biphenyls at the level of 5–10 µg/kg. In 9% of the samples, PCB's content was 10–15 µg/kg, and the lowest percentage (2%) included samples containing from 15 to 20 µg/kg of fat. The lowest average concentrations of PCB's were noted in wild-boars from the Łęczany, Augustów and Pisz areas – 3.5; 3.8 and 4.2 µg/kg, respectively, and the highest in wild-boars from Supraśl (6.9 µg/kg) and Miłomłyn (6.3 µg/kg). In previous studies conducted in 1990/1991 in the area of the provinces of Poznań, Zielona Góra, Piła and Gorzów Wielkopolski, Przybycin and Juskiewicz [1993] showed the mean level of PCB's in wild-boars fat to be 47 µg/kg. In similar examinations of 1993 in the former Olsztyn province, Zasadowski [1994] determined the average concentration of PCB's in the fat of wild-boars to be 21.8 µg/kg. In national monitoring studies performed in 1995–98 in Poland, the polychlorinated biphenyls level in wild-boars fat was 83.0; 42.0; 28.0 and 44.0 µg/kg [Raport, 1999], respectively, while in the year 2000 it was 6.0 µg/kg fat (as polychlorinated biphenyls congeners PCB IUPAC nr. 28, 52, 101, 118, 138, 153, 180) [Raport, 2000]. Comparing our researches, in which total PCB was marked as Aroclor 1260, with results contained in Report 2000 (in this paper PCB's residues

were examined as polychlorinated biphenyls congeners), coefficient 3.5 was used for counting the sum of examined congeners concentrations. When we compare our study results of 1999/2000 to the 2000 nation-wide study on the PCB's concentrations in the wild-boar fat [Raport, 2000], we can find out that polychlorinated biphenyls mean level in the north-eastern Poland region was lower. Determined levels of PCB's in the fat of wild-boars shot in the 1999/2000 hunting season in north-eastern Poland were much lower than proposed maximum acceptable levels in human food [Niewiadowska, 2000]. The PCB's concentration in terms of fat cannot exceed 0.2 mg/kg in meat and meat-products and 0.1 mg/kg in milk and dairy-products [Żmudzki et al., 2001]. These levels are considered limit values for PCB's concentrations in food [Commission Decision 99/449/European Community of 9 July 1999]. Comparing present contents of polychlorinated biphenyls in the fat of wild-boars with earlier research concerning this species, it can be concluded that the concentration of these xenobiotics decreases considerably in tissues of wild-boars living in the area of north-eastern Poland (Figure 3). It also appears that the current low average PCB's levels in wild-boar tissues (5.1 µg/kg of fat) may result from the reduction of polychlorinated biphenyls emission to the environment, as well as from the specificity of this region dominated by farming and tourism, while industrial plants are few in number and do not cause environmental contamination of this type.

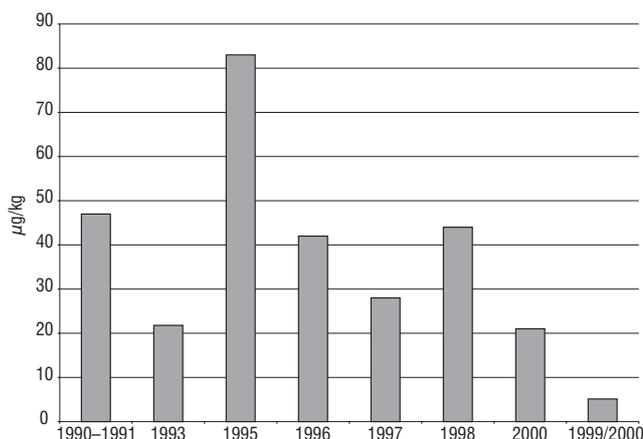


FIGURE 3. Average PCB's content in the fat of wild-boars from north-eastern Poland, compared to the average level for the whole Poland; 1990–1991 – Poland [Przybycin & Juskiewicz, 1993], 1993 – Warmia and Mazury [Zasadowski, 1994], 1995/96/97/98 – Poland [Raport, 1999], 2000 – Poland [Raport, 2000], 1999–2000 – north-eastern Poland (own studies).

It is noteworthy that animals delivered to the purchasing centre (as revealed by sanitary-veterinary investigations) were characterized by correct for their age – body weight, body size, good hair condition, and there were no visible pathologic changes indicating sickness-processes. Observations of the number of wild-boars in north-eastern Poland indicate that this population is stabilized with a slight upward tendency. Therefore, it can be supposed that the found PCB's concentrations in this species had no significant influence on their health condition and reproductiveness, and there was no threat to the general population.

CONCLUSIONS

The findings of this paper indicate that polychlorinated biphenyls contamination of wild-boars from north-eastern Poland is very low. No changes indicating pathologic processes resulting from environmental pollution with these xenobiotics were observed in animals. A high percentage of low PCB's concentrations in the fat of wild-boars indicates that the content of these compounds in the environment and animal organisms is dropping. The determined PCB's concentrations in the fat of wild-boars shot in north-eastern Poland should be rated as low and many-times lower than the acceptable limits. This proves that the food of animal origin produced in north-eastern Poland (in respect of PCB's) does not pose risk to the consumers' health and is export-attractive. The conducted investigations may constitute a contribution to further evaluations and comparisons in the sphere of environmental monitoring studies.

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POLICHLOROWANE BIFENYLE W TŁUSZCZU DZIKÓW POCHODZĄCYCH Z RÓŻNYCH REJONÓW PÓŁNOCNO-WSCHODNIEJ POLSKI – KOMUNIKAT NAUKOWY

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W pracy przedstawiono wyniki badań dotyczące stężeń polichlorowanych bifenyli (PCB) w tłuszczu dzików upolowanych w 10 wybranych rejonach północno-wschodniej Polski. We wszystkich próbkach badanego materiału wykrywano obecność polichlorowanych bifenyli. Średnie stężenie PCB w tłuszczu dzików wynosiło $5,1 \mu\text{g}/\text{kg}$, a najwyższe średnie wartości stwierdzano u dzików z rejonu Supraśla i Miłomłyn (rys. 2). Wykazano, że u badanego gatunku poziomy polichlorowanych bifenyli były zdecydowanie niższe od wartości tolerowanych w produktach spożywczych i nie budzą aktualnie zastrzeżeń higieniczno-toksykologicznych. Dane obrazują też narażenie wybranego gatunku zwierząt, a pośrednio i człowieka na te ksenobiotyki w rejonie północno-wschodniej Polski.