Endocrine Disrupting Chemicals in Hungarian Canned Foods

Masaharu YAMAMOTO¹, István LÁNG², Hiroshi SAKAI³, Hiroto NAKADAIRA¹,
Kazutoshi NAKAMURA¹, Yasuo TSUCHIYA¹ and Shoichiro TSUGANE⁴

¹Division of Social and Environmental Medicine, Department of Community Preventive Medicine, Niigata University Graduate School of Medical and Dental Sciences, Niigata

²National Institute of Oncology, Budapest, Hungary

³Niigata Prefectural Research Laboratory for Health and Environment, Niigata

⁴Epidemiology and Biostatistics Division, National Cancer Center Research Institute East, Chiba

Abstract

The aim of this study was to clarify the worldwide residual levels of organochloride compounds, such as BHC and DDT, which were reportedly concentrated in animal tissues by biological food chains. As a part of the investigation of endocrine disrupting chemicals (EDCs), we had a chance to measure the level of these compounds in Hungarian canned foods.

Seven kinds of canned foods were purchased at a market in Budapest, Hungary, and the concentrations of eighteen organochloride compounds (α -BHC; β -BHC; γ -BHC; δ -BHC; p,p'-DDT; p,p'-DDE; p,p'-DDD; o,p'-DDT; heptachlor; heptachlor-epoxide; aldrin; dieldrin; endrin; oxychlordane; trans-chlordane; cis-chlordane; trans-nonachlor; and cis-nonachlor) were measured.

Other than DDT and its metabolites, none of the EDCs were detected (levels <0.4 ppb). DDT and its metabolites, however, were detected in fish, meat and chicken liver pate. One of the DDT metabolites was detected quite frequently: p,p'-DDE was detected at a level of 1.8 ppb in fish soup concentrate, 2.3 ppb in Hungarian luncheon meat, 0.5 ppb in special luncheon meat, and 0.6 ppb in chicken liver pate.

Of eighteen organochloride compounds examined, only DDT and its metabolites were detected in fish, animal meat, and animal liver. It is suggested that the DDT contamination in fish and meat is worldwide even after the ban of its use.

Key words: endocrine disrupting chemicals, organochloride compounds, canned foods, Hungary

Introduction

Organochloride compounds such as BHC and DDT are concentrated in animal tissues by biological food chains, and recently they have been under examination again as endocrine disrupting chemicals (EDCs). Due to the biological concentration of these compounds in animal tissues by food chains, we became aware of the worldwide residual levels of EDCs during our stay in Hungary.

We have been conducting an international collaborative study on cancer epidemiology worldwide^{1,2)}. When we visited Hungary in November, 2000, we noticed that food consumption habits in Japan and Hungary were similar in that both fish and meat are eaten. However, little information on risk assessments in Hungary is available in Japan. The aim of the present study was to deter-

mine the actual levels of contamination in Hungarian foods. We, therefore, analyzed the residual concentrations of eighteen kinds of EDCs, particularly organochloride compounds, such as BHC, DDT, heptachlor, and aldrin in Hungarian canned foods. Canned foods were selected because they could easily be brought into Japan for analysis.

Materials and Methods

1) Sample collection

Several types of canned foods were purchased at a supermarket in Budapest in November, 2000 and sent to Japan for the EDC analysis. The canned foods consisted of fish soup concentrate (280 g), green pea and baby carrot (200 g), green pea (200 g), red bean (200 g), Hungarian luncheon meat (130 g), special luncheon meat (130 g) and chicken liver pate (65 g). After homogenizing the contents of each canned food, the aliquot taken from several different portions was used for EDC measurement.

2) EDC measurement

Sample preparation and EDC detection were performed using a modification of the method described by Akiyama et al.³⁾

Received Jun. 8 2001/Accepted Jul. 26 2001

Reprint requests to: Masaharu YAMAMOTO

Div. of Social and Environmental Medicine, Dept. of Community Preventive Medicine, Niigata University Graduate School of Medical and Dental Sciences, Niigata City 951-8510, Japan

TEL: +81(25)227-2119, FAX: +81(25)227-0764

E-mail: mashie@med.niigata-u.ac.jp

Table 1 Residual levels of organochloride compounds in canned foods produced in Hungary

Organochloride compound	Fish soup concentrate	Green pea and baby carrot	Green pea	Red bean	Hungarian luncheon meat	Special luncheon meat	Chicken liver pate
α -BHC	ND	ND	ND	ND	ND	ND	ND
β -BHC	ND	ND	ND	ND	ND	ND	ND
γ -BHC	ND	ND	ND	ND	ND	ND	ND
δ -BHC	ND	ND	ND	ND	ND	ND	ND
p,p'-DDT	ND	ND	ND	ND	tr.	tr.	0.6
p,p'-DDE	1.8	ND	ND	ND	2.3	0.5	0.6
p,p'-DDD	0.4	ND	ND	ND	tr.	ND	tr.
o,p'-DDT	ND	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND	ND
Heptachlor-epoxid	ND	ND	ND	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	ND	ND	ND	ND	ND	ND	ND
Trans-chlordane	ND	ND	ND	ND	ND	ND	ND
Cis-chlordane	ND	ND	ND	ND	ND	ND	ND
Trans-nonachlor	ND	ND	ND	ND	ND	ND	ND
Cis-nonachlor	ND	ND	ND	ND	ND	ND	ND

¹⁾ Values are expressed as ppb.

²⁾ ND: not detected (<0.4 ppb).

³⁾ tr: trace amount present, but values were not quantified.

Homogenized samples were treated with acetonitrile, and the resulting extracts were successively eluted with ethylacetate. After most of the lipids and pigments of the eluates were removed by gel permeation chromatography, the extracts were cleaned using octadecylsilane-bonded silica and silica gel chromatography. The first and second eluate fractions were then analyzed by gas chromatography using mass-selective detection, with the detection limit condition of 0.4 ppb. As for the detection limit, S/N (Signal/Noise) ratio was considered as 5 equivalent to concentration. A single measurement was undertaken for each sample extracted from several different portions of the canned foods.

Results

Table 1 shows the residual levels of eighteen kinds of EDCs in seven canned foods produced in Hungary. DDT and its metabolites were only detected in canned fish, meat and chicken liver pate. Only trace or ND levels of DDT (e.g. p,p'-DDT and o,p'-DDT) were detected, but one DDT derivative, p,p'-DDE, was detected relatively frequently: the levels of this compound were 1.8 ppb in the fish soup concentrate, 2.3 ppb in the Hungarian luncheon meat, 0.5 ppb in the special luncheon meat, and 0.6 ppb in the chicken liver pate. None of the other EDCs were detected (ND<0.4 ppb).

Discussion

We had the opportunity to measure the concentrations of organochloride compounds, recently classified as EDCs, in canned foods produced in Hungary. During our stay in Hungary in 2000, we noticed that agriculture is an important industry in

Hungary⁴⁾, and large amounts of agricultural chemicals have been used. The present analysis of the organochloride-content in Hungarian foods did not produce any evidence of BHC, aldrin, dieldrin or endrin residues. Of the compounds examined, only DDT and its metabolites were detected in fish, animal meat, and animal liver.

A literature review produced only a few reports on the analysis of DDT residues in canned foods. Only one study reported a high content of DDE in canned cat food made from fish⁵⁾. In a previous study⁶⁾, we compared residual DDT levels over the previous 6 years by analysing fish and meat consumed in Japan. Food items were selected based on the results of a national nutrition survey. The foods were then purchased at a market, cooked and analysed. The resulting DDT concentrations were about 1–50 ppb in fish and 0.1–1 ppb in animal meat. A survey further confirmed the worldwide presence of DDT-contaminated fish and meat, even though more than 20 years have passed since the banning of DDT.

In the present study, our analysis was limited to Hungarian canned foods, because of the need to quarantine fresh food products. In future studies, however, fresh fish, beef and chicken, sold in Hungarian markets should be used. Biological monitoring using human sera, for instance, may also be important improve our understanding of the health effects of EDC-contamination in Hungary.

Acknowledgements

This study was supported by the Grant from the Ministry of Health and Welfare (11140201-d) in 2000.

References

- 1) Chen W, Endoh K, Yamamoto M, Kato T. International comparison of the mortalities of biliary tract cancer. *J. Aichi Med. Univ. Assoc.* 1990; 18: 187–192.
- 2) Yamamoto M, Serra I, Endoh K, Ogoshi K. Epidemiology of gall-

- bladder and bile duct cancers. London: Nishimura/Smith-Gordon, 1999.
- 3) Akiyama Y, Yoshioka N, Tsuji M. Solid-phase extraction for cleanup of pesticide residues suspected as endocrine disruptors in foods. *J. Health Sci.* 2000; 49–55.
 - 4) The Economist Publications. The world in figures. Tokyo: Hara Shobo, 1988. (in Japanese)
 - 5) Furr AK, Bache CA, Gutenmann WH, Pakkala IS, Lisk DJ. Element and chlorinated hydrocarbon content of commercial pet foods. *Cornell Veterinarian* 1976; 66: 513–527.
 - 6) Niigata Prefectural Research Laboratory for Health and Environment. Abstract of research projects. Annual Report of Niigata Pref. Res. Lab. for Health and Environment 2000; 56–57. (in Japanese)