

RISK DUE TO CHEMICAL CONTAMINATION OF THE ENVIRONMENT FOR FOOD HYGIENE AND VETERINARY PUBLIC HEALTH

Jacek Szczawinski

Warsaw Agricultural University, Faculty of Veterinary Medicine, Department of Food Hygiene and Public Health

Key words: chemical contamination, environment, feedingstuffs, food of animal origin

Introduction

The biological and chemical agents which cause food poisoning are many and varied but that they almost all have one feature in common: they accompany the animal from the stable to the table. For this reason, any attempt to maintain a high level of protection of consumers without taking account of what is happening throughout the whole production chain leads to failure. The stable to table approach to food safety is a holistic approach embracing all elements, which may have an impact on the safety of food, at every level of the food chain from animal feed manufacturers to consumers. The phrase is used to encompass the production of all foods of animal origin and can be applied not only to meat but also to milk, eggs, fish and other products from aquaculture (2). However, the major sources of environmental chemicals may contaminate animal feed and constitute a hazard not only to animal health but also to human. Therefore, some researchers suggest that phase “from the field to the table” is more adequate. Apart from environmental contaminants, foods may contain chemicals used as veterinary drugs, food additives, processing aids, mycotoxins or natural toxins, which are not taken into consideration in this paper.

The main purpose of this work was to compare chemical contamination of environment, feeds for animals and food of animal origin on the basis of the most recent results of national monitoring systems.

The state of environment in Poland

Pollution of air, water and arable land can result in the contamination of crops grown for food or animal feed, food producing-animals and surface and ground waters used as sources of water for drinking and food production and processing.

At present, air quality in Poland may generally be described as good (6). Over the past decade, Poland has significantly reduced its emission of most pollutants. In years 1990-2002 emissions of sulphur dioxide, carbon monoxide decreased more than two-fold,

emissions of nitrogen oxides decreased by more than one third, and emissions of non-methane volatile organic compounds were reduced by almost 30%. Air pollution measurements carried out within the frame of the State Environmental Monitoring System indicate that concentrations of main pollutants have stayed well below the limit values. Exceeding of limit values is very rare and limited to areas exposed to the direct impact of emission sources (5, 6).

An analysis of monitoring data indicates that quality of surface waters (both stagnant and flowing) has improved during last years. The reduction of pollutant loads and of the total volume of wastewater discharged to surface water has been recorded. Parameters which indicate excessive river water pollution include chlorophyll, total phosphorus and nitrite nitrogen. In general, underground waters are of good quality, better than subsoil water quality and much better than surface water. The share of low-quality waters is significant in shallow, poorly insulated aquifers, which still serve as a source of water for a large part of rural and suburban populations (5, 6, 7, 8).

The quality of Poland's agricultural soil in terms of concentration of pollutants important for human health and environment, i.e. heavy metals and certain organic compounds, is good. Concentrations of heavy metals in the vast majority of soil (97% of arable land area) may be described as natural or slightly increased (6). In 2003 exceeding the concentration of lead and zinc was recording only in 0,6% of analyzed soil samples (5). The consumption of fertilizers and pesticides is low. Since 1995 the application rate of fertilizers (NPK) has been about 85 kg/ha. In 2001-2003 there was a slight increase to about 91-94 kg/ha. This is still much less than in countries like the Netherlands (510 kg/ha), Germany (237 kg/ha) or France (270 kg/ha). The pesticide application rate in Poland ranged from 0,48 to 0,78 kg/ha in years 1990-2003. It is considerably lower than in countries with intensive agriculture (e.g. 10,59 kg/ha in the Netherlands, 2,87 kg/ha in Germany, 5,8 kg/ha in France). The monitoring data indicate that low and slightly increased concentrations of polycyclic aromatic hydrocarbons (PAHs) were found in 82,4% samples analyzed in 2000 and in 79,2% of samples analyzed in 1995. Slightly and moderately polluted soils represented 17,6 % in 2000 and about 20,3% in 1995. Only one sample (0,5%) corresponded to a high degree of pollution was recorded in 1995. Increased PAH concentrations were recording in the vicinity of local emission sources (5, 6, 10, 11).

Chemical contamination of feedingstuffs

In 2003 national programme of official inspections of animal feedingstuffs under surveillance of veterinary inspection for the year 2004 was prepared in the Department For Hygiene of Animal Feedingstuffs, National Veterinary Research Institute in Pulawy, according to Council Directive 95/53/EC of 25 October 1995 (1). In Poland, no comprehensive programme of official inspection based on the UE principles, in accordance with Directive 95/53/EEC, has had been in place yet. Schedule of sampling of feedingstuffs in individual Provinces of Poland was elaborated under this program. The place of sampling, testing laboratory, territory and method of examination were taken into account in the schedule (3, 4, 9). Summary results related to chosen environmental pollutants are presented in table 1.

Table 1. Chemical environmental pollutants in feed materials, additives, premixes, water and compound feedingstuffs – results obtained under official inspections of animal feedingstuffs under surveillance of veterinary inspection in 2004

Pollutants		Feed materials		Additives, premixtures, water, compound feedingstuffs	
		No. of examinations	Above permissible value	No. of examinations	Above permissible value
Heavy metals	Arsenic	58	0	111	0
	Cadmium	162	0	297	3
	Lead	167	0	310	2
	Mercury	66	0	126	0
	Total	453	0	844	5
Dioxins and PCB	PCDD+ PCDF	57	4	120	3
	Dioxinlike PCB	29	1	62	0
	Congeners PCB (nr 28, 52, 101, 118, 138, 153, 180)	30	0	81	0
	Total	116	5	263	3
Pesticides	Phosphoorganic	0	0	3	0
	Chloroorganic	2	0	9	0
	Total	2	0	12	0

It was found that level of heavy metals was exceeded only in 5 (0.38%) out of 1297 tested samples. Permissible level of cadmium was exceeded in compound feedingstuffs for ruminants (2 samples) and for swine (1 sample). Exceeded concentrations of lead were also found in one compound feedingstuffs for ruminants and in one for swine.

Permissible levels of pollutants belonging to dioxins and PCB were exceeded in 2.11% of samples, mostly feed materials from fish and other marine products (5 cases).

PCDD + PCDF in concentrations above permissible level were recorded once in compound feedingstuffs for poultry and twice in compound feedingstuffs for swine.

Chemical contamination of animals and food of animal origin

The best source of actual information on chemical contamination of animal tissues and food of animal origin in Poland is National Veterinary Residue Control Program. The program is organised by the General Veterinary Inspectorate and Ministry of Agriculture and Rural Development (11, 12). The results obtained in 2003, related to some environmental pollutants, are presented in table 2.

Table 2. Chosen chemical pollutants in animals and food of animal origin - results and number of analyses performed in different species in the national residue control program in Poland in 2003

Species	Organo-chlorine compounds	Polychlorinated biphenyls (PCB)	Organo-phosphorus compounds	Chemical elements			
				(Pb)	(Cd)	(Hg)	(As)
Number of examinations							
Bovines	162	159	156	428	428	428	427
Pigs	333	311	249	1056	1057	1057	1056
Sheep/Goats	20	20	21	42	42	42	42
Horses	40	41	42	300	300	300	300
Chickens	195	195		398	397	397	396
Turkeys	49	49		106	106	106	106
Geese	35	36		82	87	82	82
Ducks	40	39		80	80	80	80
Fish	104	98		95	95	95	95
Milk	213	197	201	207	206	206	206
Eggs	133	132		136	136	136	136
Rabbits	30	30		60	60	60	60
Wild game	96	96		192	192	192	192
Honey	27	27	25	41	41	41	41
Import	41	41		26	26	26	26
Total number of examinations							
All species	1518	1471	694	3249	3253	3248	3245
Above action level							
All species	1	0	0	26	37	1	0

The plan of residue control was prepared by the National Veterinary Research Institute (National Reference Laboratory) in Pulawy and approved by Chief of Veterinary Officer (CVO). The number of samples for each group and place of sampling were taken to fulfil the minimum requirements of the Annex IV of Council Directive 96/23/EC and Commission Decision 97/747/EC. Sampling for the residue examinations were done by

official inspection veterinarians who were following sampling instruction of CVO Decision of February 23, 2001 and October 31, 2003 in reference to Commission Decision 98/179/EC and Annex III of Council Directive 96/23/EC. The results presented in table 2 are only small part of results obtained under the program. The report containing detailed data on the programme and the obtained results of investigated substances is available on the website of General Veterinary Inspectorate - <http://www.wetgiw.gov.pl/>.

As shown in table 2, limits of cadmium and lead were exceeded the most often in food of animal origin. Permissible concentration of cadmium was exceeded in 37 out 3253 tested samples (1.1%), whereas level of lead was exceeded in 26 out of 3249 samples (0.8%). Cadmium, in higher than acceptable concentrations, was found in tissues of beef, pigs, horses, geese, turkeys, chickens, rabbits and wild game. High concentrations of lead were found in samples taken from tissues of beef, pigs, geese, chickens and wild game. Mercury and organochlorine compounds at concentrations above action level were found only once in the samples of wild game.

Generally, results of the national veterinary residue program indicate that food of animal origin in Poland contains very low levels of contaminants and is safe for consumers.

Conclusions

The most recent results of national monitoring systems in Poland show that relationships between contamination of environment, feedingstuffs and food of animal origin are the most obvious in case of heavy metals, particularly lead which was found in the concentrations exceeding permissible values in soil, feed for animals and animal tissues. Important pollutant in Poland is also cadmium which was relatively often recorded in samples of feedingstuffs and food of animal origin. Fortunately, general emission of those heavy metals has systematically decreased in Poland since 1990 (5), what should have advantageous effect on contamination of environment, feedingstuffs and food of animal origin in future.

References

1. Council Directive 95/53/EC of 25 October 1995 fixing the principles governing the organization of official inspections in the field of animal nutrition(OJ L 265, 8.11.1995, p. 17)
2. Federation of Veterinarians of Europe. Food safety. The stable to table approach. <http://www.fve.org>.
3. General Veterinary Inspectorate and Ministry of Agriculture and Rural Development: Results of the National Veterinary Residue Control Plan in Live Animals and Animal Products in Poland 2003. <http://www.wetgiw.gov.pl/>.
4. Główny Inspektorat Weterynarii. Krajowy plan kontroli urzędowej środków żywienia zwierząt w zakresie nadzoru Inspekcji Weterynaryjnej na rok 2004. Warszawa 2004.
5. Główny Urząd Statystyczny: Ochrona środowiska. Warszawa 2004.

ISAH 2005 - Warsaw, Poland
Vol 1

6. *Inspection for Environmental Protection: The state of environment in Poland. 1996-2001 report. Environmental Monitoring Library. Warsaw 2003.*
7. *Inspekcja Ochrony Środowiska. Stan czystości rzek, jezior i Bałtyku na podstawie wyników badań wykonywanych w ramach państwowego monitoringu środowiska w latach 2000-2001. Biblioteka Monitoringu Środowiska. Warszawa 2002.*
8. *Inspekcja Ochrony Środowiska. Stan czystości rzek, jezior i Bałtyku na podstawie wyników badań wykonywanych w ramach państwowego monitoringu środowiska w latach 2002-2003. Biblioteka Monitoringu Środowiska. Warszawa 2004.*
9. *Kwiatek K.: Krajowy program urzędowej kontroli środków żywienia zwierząt w zakresie nadzoru Inspekcji Weterynaryjnej na rok 2004. Pulawy, 2003.*
10. *Ministerstwo Rolnictwa i Rozwoju Wsi. Rada Monitoringu Jakości Gleb, Roslin, Produktów Rolniczych i Spożywczych. Raport z badań monitoringowych jakości gleb, roślin, produktów rolniczych i spożywczych w 2000 roku. Warszawa 2001.*
11. *Ministerstwo Rolnictwa i Rozwoju Wsi. Rada Monitoringu Jakości Gleb, Roslin, Produktów Rolniczych i Spożywczych. Raport z badań monitoringowych jakości gleb, roślin, produktów rolniczych i spożywczych w 2001 roku. Warszawa 2002.*
12. *Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi z dnia 20 marca 2003 r. w sprawie badań kontrolnych pozostałości chemicznych, biologicznych, leków i skażeń promieniotwórczych u zwierząt żywych, w tkankach lub narządach zwierząt po uboju i w produktach spożywczych pochodzenia zwierzecego (Dz. U. Nr 55, poz. 487).*
13. *Zmudzki J., Niewiadowska A., Wojton B.: Weterynaryjny krajowy program badań kontrolnych pozostałości w tkankach zwierząt i żywności pochodzenia zwierzecego. Medycyna Wet. 2005, 61 (6), 649-653.*