Research Article

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE)

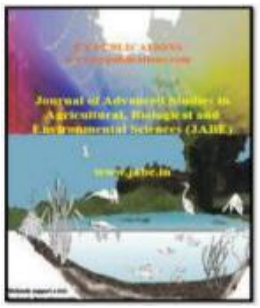
A Peer Reviewed & Refereed, International Open Access Journal

www.jabe.in **Vol.2.Issue.1.2015 (Jan-Mar)** **E-ISSN:2394-2606**

QUALITATIVE AND QUANTITATE DETERMINATION OF CHEMICAL CONTAMINATION IN AGRIFORM PRODUCTS

V V J GOPALA KRISHNA

Sr. Lecturer in Chemistry, Mrs A V N College, Visakhapatnam, Andhra Pradesh



Article History

Received on:10-02-2015

Revised on:24-03-2015

Accepted on:30-03-2015

ABSTRACT

Residues of organochlorine pesticides in poultry products collected from the local markets of Visakhapatnam were determined by gas-liquid chromatography with an electron capture detector. In eggs, the compounds most frequently detected and concentrated were: heptachlor epoxide, p, p'-DDT and p, p'-DDE; in cheese the most frequent contaminants were: dieldrín and p, p'-DDE. At the same time, a preliminary epidemiological study was carried out, in which various pathological manifestations were detected in the people interviewed and their families.

Keywords: Organochlorine insecticides, analysis. Pesticide residues, analysis. Cheese, analysis. Eggs, analysis. Chemical contamination of food, analysis.

INTRODUCTION

Man, by using synthetic pesticides for various purposes (agriculture, livestock, public health, etc.) has contaminated almost all substrates of the biotic and abiotic environment; This has happened because of the easy dispersion of these compounds and, mainly, due to the great persistence of many of them in the environment. Such contamination of ecosystems has caused very serious problems such as the presence of pesticide residues in food[1].

Organochlorines are pesticides that have aroused greater concern due to their undesirable effects on living things and the environment. These products are very insoluble in water, are soluble in compounds of low polarity, very stable (their half-life is greater than ten years), bioaccumulative and, many times, their degradation products are more toxic or persistent than the original compound[2]. Organochlorine compounds cause serious toxicological effects, including altering the body's immune response[3]. Due to the physicochemical properties of organochlorine pesticides, cattle that have been exposed to them - either directly or indirectly - secrete the original compound and its biotransformation products together with milk; therefore, dairy products contain these products in high concentrations, even after processing[4].

On the other hand, poultry can also be exposed to pesticides - either by the consumption of contaminated food or by their use in chicken coops - and eliminate the residues of these compounds through the egg. In general, the concentrations of pesticide residues in eggs are directly related to the concentrations of the pesticide in poultry feed[5].

Visakhapatnam also Known as Vizag is one of the coastal city of Andhra Pradesh in India with the highest agricultural production was praised for this study; this population is very close to agricultural fields that are continuously sprayed with pesticides; In addition, the water for human consumption is taken from the channels that come from the irrigation districts, as well as from wells near the crop fields that are less than four meters deep.

Research Article
Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE)
A Peer Reviewed & Refereed, International Open Access Journal
www.jabe.in Vol.2.Issue.1.2015 (Jan-Mar) E-ISSN:2394-2606

The objectives of the study were: 1) to identify and quantify organochlorine pesticide residues in cheese and chicken eggs; 2) compare the results with those obtained in other countries and, 3) based on the results, suggest the chemical and epidemiological studies that should be carried out later in the area.

MATERIALS AND METHODS

Vizag, is a community of more than 20lakhs inhabitants; therefore, it was only possible to collect and carry out the analysis in five different batches of egg and four of cheese, which were obtained in stores and private homes. After removing the eggshell, the batches were homogenized separately. Both homogenized eggs and cheeses were stored in amber glass jars with screw cap and Teflon back cover and stored at -20 ° C until analysis. In both cases, lipid extraction was performed with 25g of 5% deactivated Florisil and 200ml of a mixture of methylene chloride: petroleum ether, (40:60, v / v)[6]. The cheese lipids were purified on a chromatographic column prepared with 10g of 3% deactivated alumina and 20g of activated Florisil, which was eluted with 200ml of a mixture of methylene chloride: hexane (25:75, v / v) (Albert et al. 4, 1986). Egg lipids were purified in the same way only that the column was eluted with 200ml of a mixture of petroleum ether: ethyl ether (85:15, v / v) (FDA9, 1978). The qualitative, quantitative and confirmation analyzes were carried out on a gas-liquid chromatograph with a 63Ni electron capture detector (Varian 3700). Two stationary phases were used: SP-2250 1.5% / SP-2401 1.95% on Supelcoport 100/120 and 0V-210 3% on Gas Chrom Q 100/120.

RESULTS AND DISCUSSION

Table 1 shows the results of the qualitative analysis of residues of organochlorine compounds in chicken eggs and cheese.

Table 1: Residue level and per cent occurrence of organochlorine pesticides in chicken eggs and cheese

	Market -1						Market-2				
Compound	1	2	3	4	5	%	1	2	3	4	%
heptachlor epoxide			+	+		40					
dieldrin								+			25
p, p'-DDE	+	+	+	+	+	100	+	+	+	+	100
p, p'-DDT	+	+	+	+		80					

As can be seen, all samples showed residues of organochlorine pesticides or their biotransformation products, which varied from one to three compounds per sample. The p, p'-DDE was identified in 100% of the egg and cheese samples, while heptachlor epoxide was only identified in 40% of the egg samples and dieldrin in 25% of the cheese samples. Similarly, 80% of the eggs presented p, p'-DDT, which was not identified in the cheeses.

Therefore, it can be assumed that the poultry in this city are directly exposed to organochlorine pesticides; not so dairy cattle, to which this type of substances may not be applied directly since, otherwise, the cheese would present pesticide residues and not dieldrin and p, p'-DDE, which are biotransformation products of the aldrin and p, p'-DDT, respectively.

The concentrations of the residues of these compounds in chicken eggs are presented in Table 2. As can be seen, samples 2 and 3 had the highest concentrations of total equivalent DDT. Samples 3 and 4 presented heptachlor epoxide, which is the main transformation product of heptachlor.

Table 2: The concentrations of organochlorine residues in chicken eggs

Compound	Concentrations in ppm				
Sample number→	1	2	3	4	5
heptachlor epoxide	BDL	BDL	0.015	0.007	BDL
Dieldrin	0.093	0.382	0.125	0.129	0.002

Research Article
Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE)
A Peer Reviewed & Refereed, International Open Access Journal
www.jabe.in **Vol.2.Issue.1.2015 (Jan-Mar)** **E-ISSN:2394-2606**

p, p'-DDE	0.024	0.067	0.333	0.036	BDL
p, p'-DDT	0.117	0.449	0.458	0.165	0.002

*BDL=below detectable limit

It is important to mention that 10% of the heptachlor epoxide, 25% of the sum of DDT and fell 35% of the hexachlorobenzene from the daily intake of organochlorine pesticides in chickens are excreted in the egg[7]. Therefore, it is inferred that the hens of the Vizag are chronically exposed to considerable concentrations of organochlorine pesticides and that, without a doubt, these substances must be slowly bioaccumulating in the tissues of these birds. Therefore, the human population, by consuming chicken and egg meat can, in turn, bioconcentrate these wastes, with the consequent toxicological repercussions that will manifest themselves, especially in the long term[8].

Table 3 shows the concentrations of organochlorine compounds determined in cheeses from the Vizag city local markets. It is noted that all samples had p, p'-DDE, which had an average concentration of 0.034 / mg / g (ppm) and that only one sample had two compounds: dieldrin and p, p'-DDE.

Table 3: the concentrations of organochlorine compounds determined in cheeses from the Vizag city local markets

Compound	Concentration in ppm			
Sample number→	1	2	3	4
dieldrin	BDL	0.114	BDL	BDL
p, p'-DDE	0.055	0.015	0.015	0.051

*BDL=below detectable limit

Based on these results, it can be postulated that organochlorine pesticides have ceased to be widely used in this area, since the contamination of cheeses with these substances is a consequence of their concentration through the trophic network and their bioaccumulation.

The above is confirmed in literature, which compares these results with the concentrations of organochlorine pesticide residues determined in cheeses from the literature[9], a city that is approximately 500km from the State capital of Andhra Pradesh, India.

Thus, it is observed that in the cheeses from literature, the compounds p, p'-DDT, p, p'-DDE and HCH were present at the time of said study, and that the concentration of p, p'-DDE was 10 to 20 times higher than the current one in the Vizag city; therefore, it can be assumed that the p, p'-DDT used at that time has degraded to give p, p'-DDE, which is clearly presented in the results obtained in this study. However, the possibility that at some point other pesticides such as aldrin have been used in the region should not be discarded. As can be seen, the average concentrations of p, p'-DDE were higher in the present study, compared to Spain and Iran by approximately 40 and 80%, respectively. The average concentrations of p, p'-DDT for the samples from Spain and Iran are very similar to each other while those obtained in the products of the vizag were slightly lower; Nevertheless; the concentration of sum of DDT in India was 44 and 40% respectively in relation to these countries, even though the presence of p, p'-DDD in the chicken egg was described in the latter.

This suggests that, in those countries, poultry consumed plant food that was contaminated with organochlorine pesticide residues, since the plants biotransform the p, p'-DDT mainly ap, p'-DDD, and not ap, p '-DDE, as generally occurs in birds and mammals[10]. Therefore, it is hypothesized that the poultry of the Visakhapatnam are directly exposed to organochlorine pesticides. When the comparison of the average concentrations of organochlorine compound residues in cheeses from Visakhapatnam, other countries[11]. It can be observed that in Italy[12] there were problems of contamination by organochlorine pesticide residues in

Research Article
Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE)
A Peer Reviewed & Refereed, International Open Access Journal
www.jabe.in Vol.2.Issue.1.2015 (Jan-Mar) E-ISSN:2394-2606

cheeses on the date of that study, since in that country five different compounds were determined and in the Vizag only two. The concentrations of p, p'-DDE were very similar in the two studies. In Mexican cheeses, dieldrin was also found, which was extremely toxic in the short and long term[13].

However, the concentrations determined for the ingestion of these residues in eggs and cheese of the Vizag are higher than the Acceptable Daily Intake (ADI). If you remember that in general the food of the Indian population is based on agricultural products, and that Indian can consume two eggs and a little more than 100g of cheese daily. It is observed that the ingested residues of p, p'-DDE and p, p'-DDT in eggs are 43 and 33 times greater than the ADI. In cheese, the results are even greater since dieldrin residues exceed more than 500 times the ADI. Similarly, the results of the ingested concentrations of p, p'-DDE in cheese and heptachlor epoxide in eggs are slightly more than twice as high as the ADI.

It should be noted that many times the practical limits for residues of organochlorine pesticides in foods, which have been proposed by countries and various international organizations, do not take into consideration the long-term effects and interactions of two or more chemical substances within the organism such as additive, synergistic and potentiating effects; nor is nutritional status taken into account, although, in general, a low protein diet increases the toxicity of a pesticide[14]. In this regard, it should be remembered that in Asian countries, including India, health and nutrition conditions are well below those considered normal.

Alongside the chemical study described here, a preliminary epidemiological survey was conducted with 41 people from the Vizag. It found that there is a high number of cases of alcoholism and smoking that nutrition and hygiene are poor and that waste disposal is inadequate. There were also 39% of cases of diabetes mellitus, 19% of allergic manifestations, 10% of cancer cases, 24% of cases of relatives with cancer and 14 spontaneous abortions among the 27 women interviewed.

It is known that applications of agrotoxins on vegetables in the Araku Valley are extremely high in relation to other crops and other regions of the country. Data on organochlorine pesticide residues in system waters, drainage of the Irrigation District No. 10 of the State of Andhra Pradesh show that in it the concentrations of certain pesticides, such as lindane, aldrin, heptachlor, chlordane, eldrin and p, p'- DDT exceeded the limits established by the BIS[15].

Therefore, it is recommended to follow up in chemical studies of pesticides in the Vizag taking into account the corresponding ecological parameters. These analyzes should preferably be in water and air since, according to talks with some inhabitants, it can be postulated that these are the most contaminated environmental substrates in said city; In addition, determinations of other types of pesticides, such as organophosphates and carbamics, should be made.

On the other hand, it is necessary to conduct an environmental education campaign in the area at all possible levels about the potential danger of pesticide misuse.

The most important thing is the need for efficient control of the use of pesticides in India; especially for organochlorines, to prevent it from being indiscriminate since, in developed countries, the registration of these products has already been cancelled, restricted or suspended due to adverse effects such as cancer, mutations and teratogenesis that originate in experimental animals, and the alterations they cause in non-harmful species[16].

References

1 Aulakh, R.S., J.S. Gill, J.S Bed, J.K. Sharma, B.S. Joia and H.W. Ockerman, 2006.Organchlorine pesticide residues in poultry feed, chicken muscle and eggs at a poultry farm in Punjab. India. J. Sci. Food. Agric., 86(5): 741-744.

2 Heise, S., 1992 Pesticide residue in food as a potential health hazard in the world. Proc. 3rd World Congress on food borne infection and intoxication, pp.701-706 Berlin, Germany.

3 J.S. Bedi, J.P.S. Gill, R.S. Aulakh, P. Kaur, A. Sharma and P.A. Pooni, Pesticide residues in human breast milk: Risk assessment for infants from Punjab, India, Science of The Total Environment, 10.1016/j.scitotenv.2013.06.066, 463-464, (720-726), (2013).

4 Jadhav VS, Public Health Implications of Pesticide Residues in Meat, Veterinary World, 10.5455/vetworld.2011.178-182, (178), (2011).

5 Aruna Chhabra, Pramod Singh and Balbir Wadhwa, Analysis of Pesticide Residues in Animal Feed, Handbook of Pesticides, 10.1201/9781420082470.ch21, (571-582), (2010).

6 Kasozi G. N., Kiremire B. T., Bugenyi F. W. B., Kirsch N. H., Nkedi-Kizza P. 2006. Organochlorine residues in fish and water samples from lake victoria, Uganda. J. Environ. Qual. 35: 584–589.

7 Davies, J. E., W. F. Edmundson, C. H.Carter, and A. Barquet. 1969. Effect of anticonvulsant drugs on dicophane (DDT) residues in man. Lancet, 2:7.

8 Rita, P., P. P. Reddy and S.V. Reddy (1987) Monitoring of workers occupationally exposed to pesticides in grape gardens of Andhra Pradesh.Environ. Res. 44: 1.

9 Jevsnik,M., V.C.Flajs, and D.Z.Doganoc, 2004.Evidence of organochlorine pesticide and polychlorinated biphenyl residues in Slovenian poultry tissues from 1997 to 1999. J. Food. Protect., 67: 2326-2331

10 Kahunyo, J.M., C.K. Maitai and A.Froslie,1986. Organchlorine pesticide residues in chicken fat: A survey.Poultry Sci, 65: 1084-1089

11 Liska, B.J., B.E.Lanlois, G.C.Mostert and W.J.Stadelman, 1964. Residues in eggs and tissues on rations containg lowlevels of DDT. Poultry Sci., 43: 982-984.

12 Aulakh, RS; Gill, JPS; Bedi, JS; Sharma, JK; Joia, BS; Ockerman, HW (2006). Organochlorine pesticide residues in poultry feed, chicken muscle and eggs at a poultry farm in Punjab, India. J.Sci. Food Agric. 86: 741-744

13 Chávez-Almazán LA, Diaz-Ortiz J, Alarcón-Romero M, Dávila-Vazquez G, Saldarriaga-Noreña H, Waliszewski SM. (2014). Organochlorine pesticide levels in breast milk in Guerrero, Mexico. Bulletin of Environmental Contamination and Toxicology 93(3): 294–298.

14 Agency for Toxic Substances and Disease Registry – Chlordane (1997) In ATSDRs Toxicological Profi les on CD-ROM [CD-ROM]; Lewis Publishers: BocaRaton, FL, 1997.

15 https://www.britannica.com/science/DDT

16 World Health Organization (WHO) (2010). Exposure to highly hazardous pesticides: A major public health concern, WHO, Geneva.