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A Survey and Measurement of Residues of Lindane (Organochlorine Pesticides) in Cultivated Cucumber of Mazandaran Province (Iran)

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Abstract: In this study samples of Cucumber (*Cucumis sativus* L.) were analyzed for concentrations of lindane (organochlorine pesticides). Samples were gathered on four sites in Sari city (north, south, east, west and central areas) in Mazandaran province of Iran. Quantitative determination of the lindane was performed by gas chromatography electron-capture detection (GC–ECD). Samples contained detectable concentrations of lindane but at concentrations below the proposed limit by WHO. No significant difference was found between sites about lindane concentrations but Central area showed maximum level in lindane concentrations ($p < 0.05$) . Concentrations of lindane in cucumber sampled in this study should not be public concern among peoples in Mazandaran province.

Key words: Lindane, organochlorine pesticides, cucumber, Iran

Introduction

Several hundred compounds are available for use as pesticides and the widespread application of these agents in contemporary agriculture has resulted in considerable environmental contamination and over 20,000 deaths in year as WHO estimated. South countries use these poisons nowadays considerably. Signs and symptoms such as, nausea, vomiting, headache, tremor, ataxia, toxic and clinic convulsion, alteration in EEG pattern, weakness, wheezing, arrhythmia, agranolocytosis, rhabdomyolysis, disseminated intravascular coagulation, lactic acidosis, Hypotension and hepatic and renal damage can be occurred in toxicity by these poisons (Dewailly *et al*., 1999; Harris *et al*., 1997; Hayes, 1994).

Lindane is a moderately toxic compound via oral exposure for animals and human (Karl *et al*., 1993). Effects of high acute exposure to lindane may include central nervous system stimulation (usually developing within 1 hour), mental/motor impairment, excitation, clonic (intermittent) and tonic (continuous) convulsions, increased respiratory rate and/or failure, pulmonary edema, and dermatitis. Other symptoms in humans are more behavioral in nature such as loss of balance, grinding of the teeth, and hyper-irritability. Most acute effects in humans have been due to accidental or intentional ingestion, although inhalation toxicity occurred (especially among children) when it was used in vaporizers (Lino *et al*., 1999; Timothy, 1995; Abbassy *et al*., 1999). Workers may be exposed to the product through skin absorption and through inhalation if handled incorrectly. Lotions (10%) applied for scabies have resulted in severe intoxication in some children and infants. It is reported that single administrations of 120 mg/kg inhibited the ability of white blood cells to attack and kill foreign bacteria in the blood of rats, and 60 mg/kg inhibited antibody formation to human serum albumin. It is not clear whether these effects were temporary, or for how long they may have lasted (Abbassy *et al*., 1999; Caldas *et al*., 1999; Keith, 1997). Lindane is also presently used in lotions, creams, and shampoos for the control of lice and mites (scabies) in humans (Gudrun and Lillemark, 1998).

Lindane is very stable in both fresh and salt water environments, and is resistant to photodegradation. It will disappear from the water by secondary mechanisms such as adsorption on sediment, biological breakdown by microflora and fauna, and adsorption by fish through gills, skin, and food (Lopez-Avila *et al*., 1995; Silgoner *et al*., 1998; Trigg *et al*., 1998). Signs and symptoms such as, nausea, vomiting, headache, tremor, ataxia, toxic and clinic convulsion, alteration in EEG pattern, weakness, wheezing, arrhythmia, agranolocytosis, rhabdomyolysis, disseminated intravascular coagulation, lactic acidosis, Hypotension and hepatic and renal damage can be occurred in toxicity by these poisons.

In Iran a half of pesticides are used in Mazandaran province and according to above have mentioned and analysis of chlorinated hydrocarbon pesticide residues (Lindane) in cultivated cucumber of Sari by GC have investigated in this study.

Materials and Methods

Sampling time and location: Sampling was carried out in *cucumber field* of *Sari city,* in considered areas and immediately after the produce was gathered. In *Sari* districts, five areas were chosen and in each area five were considered randomly for sampling.

Chosen areas in Sari district:

1) Dashte Naz in the North area of Sari.
2) Eastern and Western Dodangeh in the south area

of Sari.
3) Khazar Abad and Shafra in the East area of Sari.
4) Semeskandeh area in the west area of Sari.
5) The central area of Sari.

20 samples in addition were taken, and one sample as control was taken from the field in which pesticides have not been used. The time of sampling was almost Aug 2004 and immediately of *cucumber the* reaping. Nearly 500 gr of *cucumber* was removed from each field, separately peeled off, labeled and enclosed and then dispatched to laboratory.

Methodology: Sample preparation and poison extraction in conformity with 1CPS. WHO & ILO textbook was performed under standard methods (US Environmental Protection Agency ,1986). Samples were washed 3 times to remove all dust. Samples were dried by sunlight perfectly. Dry samples were separately milled and this step was carried out two times for each sample to achieve better extracts. The 50 g of each grinded sample was transferred to Erlennneyer 250ml. In order to extract poisons, 100 ml N-Hexane was added to Erlenmeyer containing sample, because have aliphatic stretchers and appropriate solubility in organic solvents. The appropriate volume of solvent for extraction is nearly two fold of what has had sample. The Erlenmeyer in steps was placed on shaker for 20 min. (50 shakers per min) to permit the solvent perfectly penetrates that followed by 5 min motionless state. Using of Buckner funnel and filter paper (watman No. 42), samples were filtrated and taken to next step. In this stage, samples were transferred to vacuum distillatory with the optimum temperature (70^{o}C), according to boiling point of the solvent (n-Hexane) and decomposition point of the Analyte. Following the solvent evaporating, Acetone was added to residual contents in volumetric flask to desired volume. the moved to special vials for GC. The vials must be closed tightly labeled and covered with aluminum foil. Vials were transferred to center investigation Center laboratory to be analyzed by GC. before injection of samples. A 10 ml of pure lindane solution in n-hexane by 1 ppm concentration, was added to 50 g of one sample, in order to extraction quality of poisons be determined. Then extraction according to AOAC was carried out and eventually injection to GC and detection by ECD indicated the presence of lindane in samples. Lindine was identified in all samples.

Statistical analysis: Since there is no available previous data to establishing a comparison and to concluding an increase or decrease in residual poison, in this study dealing with two hypotheses have been considered:
1) There is significant difference between four sites populations.
2) There is significance difference between four sites population's first hypothesis was by using student's t-test and later by using one-way ANOVA.

Results and Discussion

Our results showed that all of the cucumber samples have had residual lindane on a scale of ppb in which this amount of poison has no oral acute toxicity (US Environmental Protection Agency, 1986; Van der Velde *et al,*, 1994 ; Kumar *et at*., 1995; Lovley, 1993), But lindane has a long half-life and too much stability in environment, more over it biomagnifytng in fatty tissues, hence, long term using of products that contain residual poisons such as cucumber and rice (Moffat, 1995; Norwell, 1984) can cause or lead to health complications such as liver disorders or even gastrointestinal cancer and so on and this can be consider as one reason of high incidence of GI cancers in Mazandaran. On the other hand, these results should be taken into consideration especially by farmers and responsible persons in agriculture offices.

Table 1: The average mean lindane in cucumber sample of Sari areas (P<0.05)

Area	Lindane (ppb)	Area	Lindane (ppb)
North 1	3.10	West 3	1.29
North 2	4.11	West 4	1.86
North 3	2.71	East 1	2.35
North 4	2.40	East 2	3.96
South 1	2.25	East 3	3.85
South 2	1.97	East 4	3.40
South 3	2.70	Center 1	3.06
South 4	3.65	Center 2	4.03
West 1	1.45	Center 3	2.70
West 2	1.30	Center 4	2.80

According to Table 2, the mean of residual lindane in the cucumber samples from center of Sari is more than other areas but any significant difference between areas not found (p<0.05) .this results can be explained as below: 1) Water that use in this areas (center) is from flowing water unlike the other areas that use well water for irrigation. 2) Over flowing water of other areas in the noticed areas.

Table 2: The average Mean and SEM lindane residues geographical area of Sari

Area	Mean	SEM
North	3.08	0.37
South	2.64	0.36
West	1.47	0.13
East	3.39	0.36
Center	3.14	0.30

In all sites, lindane concentrations do not exceed the French Food Standards (5 ppm) authorized for PCB in foods since 16/02/1988 (French Food Safety Agency).
In our study, almost all the sites (site 1-5) have values lower than 5 ppm.
It is assumed, therefore based on our data, that the

current concentrations of pollutants in the Mazandaran province should not pose a serious threat to the cucumber, and that chemical contamination should not be a limiting factor but following suggestions proposed for further safety.

1) Measurement of poison residues in food products (agricultural, sea, etc) should be regularly performed according to per capita consumption of poisons.
2) Establishment of reference laboratory, which was equipped with analytical apparatus such as GC. GC-Mass, HPLC, etc in the districts unavoidable.
3) Health care organization such as fishiness agriculture, cucumber, environmental and the ministry of health investigational centers have to precisely identify environmental pollution and determine better strategies to achieving wholesome foods.
4) Establishing the poison and environmental pollution information center to guide the people all the time and inform them about the control of toxicity, can be helpful.
5) Educating the province's farmers about the better using of poisons especially chlorinated poisons that their using has been abolished, is necessary.
6) Replacing new methods in combat against vegetable pest such as biological pesticides (e.g. trichograma beens against phyllophagous worm) and bacterial pesticide (e.g. Bacillus).
7) Chlorinated poison residues in husbandry products such as dairy products should be determined.
8) Measuring chlorinated poison residues in sea products, because the contaminated water eventually reach to sea.
9) Measuring chlorinated poison residues in human (Milk, fatty tissue, blood, liver, etc.) should be done.

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References

Abbassy, M.S., H.Z. Ibrahim and M.M. Abu El Amayem 1999. Occurrence of pesticides and polychlorinated biphenyls in water of the Nile river at the estuaries of Rosetta and Damiatta branches. North of Delta, Egypt. J. Environ. Sci. and Health. Part B - Pesticides, Food Contaminants and Agricultural Wastes, 34: 255-267.

Caldas, E.D., R. Coelho, L.C.K.R. Souza and S.C. Silva, 1999. Organochlorine pesticides in water, sediment and fish of Pavanoa Lake of Brasilia, Brazil. Bull. Environ. Contain. Toxicol., 62: 199-206.

Dewailly, E., H. Motto and L. Raskin, 1999. Concentration of organochlorines in human brain, liver and adipose tissue autopsy samples from greeland. Eviron-health-perspect, 107: 823-8.

Harris, C.A., 1997. Organocjiorines pesticides residues in human milk in the United Kingdom. Human-Exp-Toxical., 18: 602-606.

Gudrun, H. and L. Lillemark, 1998. Steen Balchen and Carsten Schriver Hojskov. (1998), Reduction of organochlorine contaminants from fish oil during refining. Chemosphere, 37: 1241-1252.

Hayes, A.W., 1994. Principles and Methods of Toxicology, 3''' ed. New York, Raven press, p.389-394. ICPS. WHO & ILO (1990). Environmental health Criteria 104, Principles for the toxicology assessment of pesticide residues in food; world Health Organization Geneva, p: 13-15.

Karl, H., P. Ho and R. Kirn, 1993. Organochlorine residues in the edible part of eels of different origins. Z-lebensm-Unters-Forsch, 197: 385-388.

Keith, L.H., 1997. Environmental endocrine disrupters. A Handbook of Property Data. Wiley, New York, p: 621.

Kumar, P.B.A.N., V. Dushenkov, H. Motto and L. Raskin, 1995. Phytoextraction: the use of plants to remove heavy metals from soils. Environ. Sci. Tec., 29: 1232-1238.

Lino, C.M., R. Keska and E. Lambas, 1999. Determination of prganocholorine pesticides in medicinal plantssold in coimbra, Portugal. J-AOAC-Int., 82: 1206-1213.

Lopez-Avila, V., R. Young, J. Benedicto, P. Ho, R. Kirn and H.G. Beckert, 1995. Extraction of organic pollutants from solid samples using microwave energy. Anal. Chem., 67: 2096-2102.

Lovley, D.R., 1993. Dissimilatory metal reduction. Annu. Rev. Microbiol., 47: 263-290.

Moffat, A.S., 1995. Plants proving their worth in toxic metal cleanup. Science, 269: 302-303.

Norwell, W.A., 1984.Comparison of chelating agents as extractants for metals in diverse soil materials. Soil Sci. Soc. Am. J., 48: 1285-1292.

Silgoner, L., R. Keska, E. Lambas, O. Cans, E. Rosenberg and M. Grasserbauer, 1998. Microwave assisted extraction of Organochlorine pesticides from sediments and its application to contaminated sediment samples. Fr. J. Anal. Chem., 362:120-124.

Timothy, C.M., 1995. Toxicology of pesticide In: General & Applied Toxicology (Ballantyne B. Timoty, C. M. and Turner P. eds). London, MacMillan Press Ltd, pp: 1199-1200.

Trigg, R.J., G.A. Keenan, D. McMullan and A.I. Conner, 1998. Automated SFE combined with GC-MS for the determination of Organochlorine compounds in sludge and sediment. J. Environ. Anal. Chem., 70: 47-57.

US Environmental Protection Agency, 1986. Organochlorine Pesticides and PCBs. EPA Method 8080.

Van der Velde, E.G., M. Dietvorst, C.P. Swart, M.R. Ramlal and P.R. Kootstra, 1994. Optimization of supercritical-fluid extraction of Organochlorine pesticides from real soil samples. J. Chromato. A., 683: 167-174.