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Organochlorinated Pesticides Residues Concentration in Vegetables from Wukari Environ, Taraba State

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Abstract

Sample of commercially sold pumpkin leaves, water leaves, pepper, tomatoes and spinach in Wukari (Taraba South) were investigated for the presence and level of organochlorine pesticides (OCPs) (hexachlorobenzene CHCB), Hexachloroethane (Pp'DDI), Aldrin, Trithralin, Heptachlor Epoxide, Eudrin, Merix, Endosulfan and Methoxychlor), using Hewlett-Packard (Hp 689) Gas Chromatography equipped with electron capture detector. Ocps were detected in all samples analysed, the total residue concentration was found to be highest in pepper (6.2650mg/kg), followed by tomatoes (5.7461mg/kg), spinach (5.0846mg/kg), Pumpkin leaf (4.5356mg/kg) and water leaf (3.3308mg/kg), respectively, while the average concentration of each OCPs residues were found to be (0.8678 mg/kg) for HCHs, (0.0012mg/kg) for HCB, (0.5764 mg/kg) for aldrin, (0.5310 mg/kg) for trifluralin, (0.1635 mg/kg) for heptachlor epoxide, (0.5046 mg/kg) for dieldrin, (0.8841 mg/kg) for endrin (0.3460 mg/kg) PP'DDT, (0.3847 mg/kg) for endosulfan and (0.0056mg/kg) for methoxychlor. The OCPs residue consideration were below FAOs (2.50mg/kg) and WHO (200 mg/kg) maximum concentration limits.

1. Introduction

Pesticides are applied on vegetable for many purposes such as insecticides for insects, Rodenticides for rodent, fungicides for fungi, fumigant for pathogens, Avericides for birds and Micros for Microorganisms, Herbicides for Herbs, Hactericides for bacterial, Namatocides for Herbs, bactericides for Parasites etc. The application of these pesticides leave some levels of potentially harmful residues of Polychlorinated or Organochlorine pesticides which persist in vegetables or food stuffs for a considerable period, even up to the consumer hand (Bull, 1992).

The contamination of environment and food by chlorinated organic pesticides has become a topical issues of consideration concern in many part of the world and has led many researchers to investigate their occurrence, distribution and concentrations in commercially sold vegetable and other food stuffs (Yu et al., 2000; soliman, 2001; Howran et al., 2006; Bai et al., 2006; fontcuberta et al., 2008).

Organochlorine pesticides have been used extensively worldwide since the early 1950s (Kin et al., 2006; Kuet and Seng, 2004) until restriction were introduced in some developed and developing countries due to their persistence in the environment and

growing evidence of adverse associated health implications. In some developing countries like Nigeria, the use of pesticides in agriculture and public health as a quick and tailor made panacea to numerous pest challenges continue despite well-known threats to human health and environment. Literature on Organichlorine pesticide residues in vegetables and food stuffs from Nigerian markets are sparse (Atuma, 1985; Adeyeye and Osibanjo, 1999; Unyimandu and Duchy, 2002; Anyakora *et al.*, 2008; Musa *et al.*, 2010). Organochlorinated Pesticides are known to exhibit high lipophilicity and this is traceable to their environmental bio-persistence and food chain contamination (Botella *et al.*, 2004). The toxicity of the OCPs can be acute and chronic. The Chronic effects arising from exposure to contaminated food are mostly unknown but there is growing evidence of cancer, neurological damage, endocrine disruption and with defects consequential from exposure (Miller and Sharpe, 1998; IARC, 2001; ATSDR, 2005).

Wukari is geographically located in Taraba State, Nigeria co-ordinate around 7°, 15°, 0° North and 9°, 47°, 0° East with a population estimate of 92933 persons, whom are mostly farmers. Determination OCPs in Vegetable consumed in Wukari will help create awareness to farmers and also educates them in minimizing or stoppage of the use of organochlorinated pesticides on vegetables. In view of the compelling evidence of health effect on humans based on studies, United Nation (UN) organization has formed specialized group; Food Agriculture Organisation (FAO) and World Health Organisation (WHO), with the aim to establish restrictive measures to protect the environment against pollution.

2. Materials and Methods

2.1. Sample Collection

Identical Vegetable items were purchased from three market across wukari environ, namely wukari main market, yam market and new market.

The vegetable items were Pumpkin leaves, water leaves, pepper, tomatoes and green leave (Spinach). At each market, vegetable samples were purchased from three randomly selected sellers; three samples of identical vegetable items were collected randomly from each market forming one composite sample for each, a total of five (5) samples were collected and wrapped in aluminum foil accordingly, tag V₁ V₂ V₃ V₄ and V₅ respectively, then taken to the laboratory.

2.2. Sample Preparation and Extraction

The sample was rinsed with water, washed using a soft

brush in a washing bath. 10g of each sample was homogenized in a mortar with 10g of sodium sulfate (Na₂SO₄). The homogenate was transferred to extraction column and each sample was extracted twice with 40ml of dichloromethane (CH₂Cl₂). The extract was filtered through 0.45µm membrane filter paper to remove traces of water. The volume was reduced to 2ml with a rotary evaporator (wang, 2002 and APHA 6630B).

Adsorption chromatography was performed on the sample using activated silica gel to remove the crude hydrocarbons. The silica gel was deactivated with 3.0% water (w/w). Covered with (Na₂SO₄) and eluted with 60 ml hexane. The eluted was concentrated by rotary evaporation to 0.5ml and then poured in a separating funnel to separate the aqueous from the organic layer. The collected organic layers were injected to GC-ECD (Hewlett-Packard, HP 6890) for the investigation of suitable extracting solvent. The mixtures were then extracted and cleaned up at the suitable condition obtained prior injecting GC-ECD for the reading and curve. Organochlorine pesticides were quantified by Gas chromatography equipped with electron capture detector (GC-ECD). All solvents used were of analytical grade and all the pesticides standard were 95% pure. Stock solution of each residue at different concentration level 1.0 to 400.0 mg/l were prepared in methanol and store at 4°C. Preparation of different concentration levels at stock and solution is due to their sensitivity to the ECD detector.

The organochlorine working standard solution was freshly prepared before each analysis by volumedilution in distilled water, and an internal standard 1-chloro-4-fluorobenzene (2 mg/L) was added to the vial prior to GC analysis. The reference standard of organochlorine pesticides Hexachlorobenzene (HCB), Hexachlorohexane (HCH), Aldrin, Trifluralin, Dichloran, Heptachlox epoxide, Dieldrin, Endrin, Mirex, Dichloro-diphenyltrichloroethane (P,P-DDT), endosulfan, methoxychlor of 1.0mg/L were prepared and extracted with Dichloromethane.

3. Result/Discussion

The result of the determination of OCPs in the collected vegetable samples is shown in figure 1. It showed that from the vegetables samples collected in wukari market, pepper has the highest OCPs of (6.2650 mg/kg) and water leaf has the least with OCPs of (3.3308 mg/kg). while figure 2 showed that endrin and HCHs are the most concentrated OCPs residue content in these vegetables with an average of 0.8841mg/kg and 0.8678mg/kg respectively.

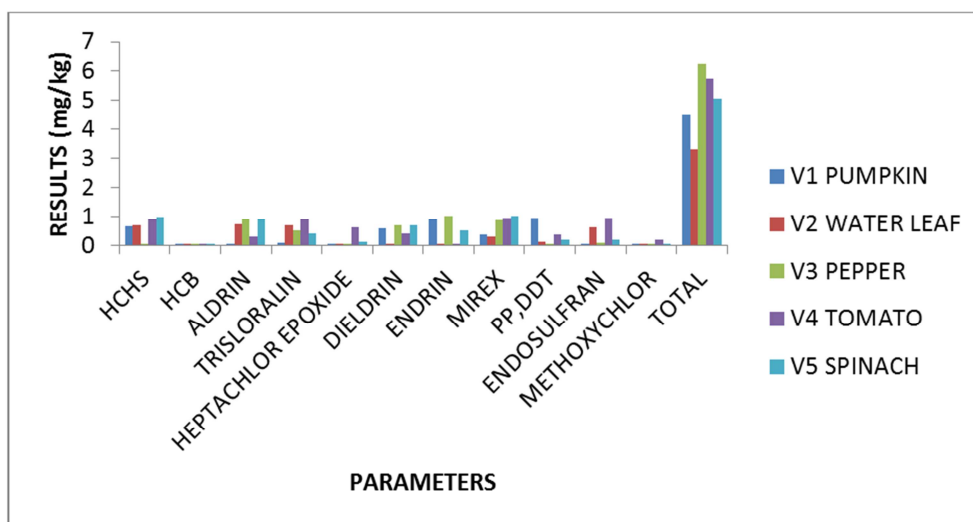


Figure 1. Result of the determination of OCPs in the collective vegetable samples.

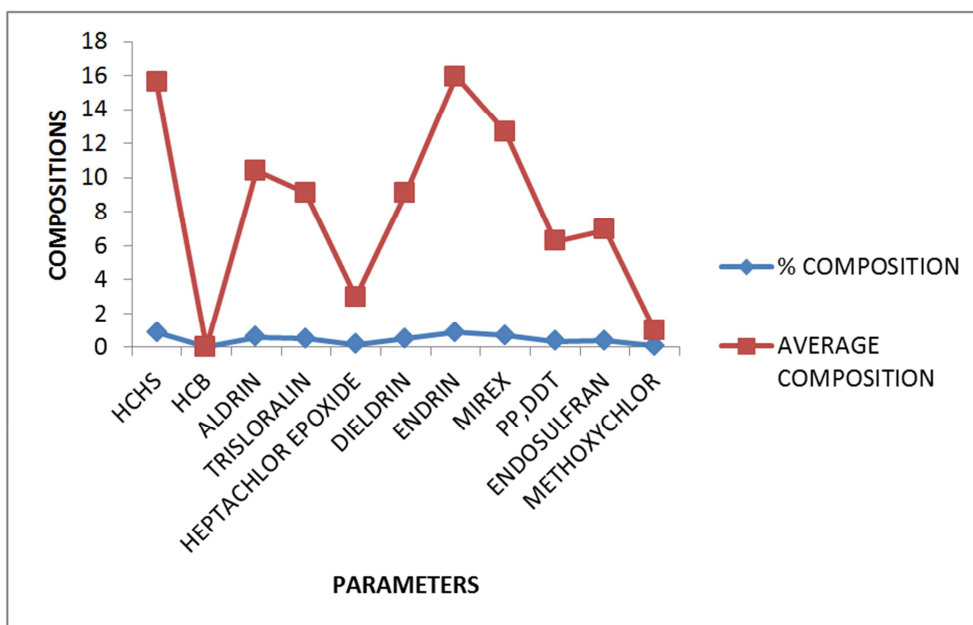


Figure 2. Range, Average concentration across the vegetable samples and percent composition of OCPs residues in vegetables consumed in Wukari.

4. Discussion

The data obtained from figure 1 showed that the vegetable samples collected from wukari markets contain significant level of OCPs. Pepper has the highest level of OCPs of 6.2650mg, followed by tomatoes (5.7461mg/kg) Spinach (5.0846 mg/kg), Pumpkin leaves (4.5357 mg/kg) and water leave (3.3308 mg/kg). This high level OCPs in pepper and tomatoes maybe as a result of long period of cultivation time on the field. Also the significant level of the OCPs found in spinach, pumpkin and water leaves maybe as a result of water used for irrigation, crop harvested at this time of the year when sample were collected (June). Vegetables in Wukari are cultivated near or around streams or other surface water due to town runoff, which serve as water sources for irrigation due to leaching. This water contain some significant level of OCPs and also the direct use of this

pesticides from farmland may be the reason for the OCPs residues.

Figure 2 shows that endrin and HCHs are the most concentrated OCPs residue content in these vegetables with an average of 0.8841 mg/kg and 0.8678 mg/kg respectively followed, Mirex (0.7029 mg/kg) aldrin (0.5764 mg/kg), trifluralin (0.5310 mg/kg) dieldrin (0.5046 mg/kg), endosulfran (0.3849 mg/kg), DDT (0.3402 mg/kg), heptachlor epoxide (0.1634 mg/kg), methaxychlor (0.0555 mg/kg) and HCB (0.0012 mg/kg)

The high amount of endrin in the vegetables samples may be as a result of uncontrolled disposal of refuge in the town, according to environmental protection agency (EPA) dump site contain high level of endrin (ATSDR, 1996). The low level of HCB may be as a result of the global banned under the stockholm convention persistent organic pollutant (ACGIH, 1991 and UNEP, 2004).

The high level of HCHs seen in the vegetable samples was however not a surprise, since HCH isomers are commonly used in developing countries for agriculture activities such as crop protection. Although lindane is the only isomer with pesticides properties, they are known to be persistent, bioaccumulative, toxic and mobile in the environment (ATSDR, 2005).

The amount of DDT maybe due to high use of insecticides in controlling mosquito for preventing malaria in Wukari, which might have entered the vegetable by diffusion because DDT is one of major content of some insecticides. Also the level of Aldrin found could be due to the use of the Aldrex 40, for crop protection because the Aldrin is the major component of Aldrex 40 (Egwaikhida *et al.*, 2007). The direct or indirect application of pesticides for agricultural purposes and domestic uses maybe the major cause of the OCPs residue and also most of the OCPs concentration maybe due to uncontrolled burning of bushes, houses and other materials in Wukari which might have resulted to the release of some volatile organochlorine (VOCL) to atmosphere which can be diffused into these vegetable samples (Egbebi and Seidu, 2011).

5. Conclusions

The present study reveal significant level of organochlorine pesticides concentration in of organochlorine pesticides concentration in vegetables sold and consumed in Wukari environ. The highest level of OCPs concentration were seen in pepper, tomatoes, spinach, pumpkin and water leaves respectively in descending order. The OCPs detected were Endrin, HCHs, Mirex, Aldrin, Triflurachin, Dieldrin, endosulfan, DDT, Heptachlor epoxides, methoxychlor and HCBs respectively in descending order of average concentration across the vegetable samples collected. Although the concentrations of these OCPs are slightly lesser than the MRLs as recommended by WHO and FAO, but with a high tendency of being persistence, bio-accumulation and biomagnifications in the biosphere and the entire environment. Hence, there is a serious need for monitoring of these pesticides residues in vegetables, food and environment, as this will go a long way towards preventing various environmental and public health hazards.

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