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Analysis of Residual Level of Organochlorine Pesticide in Some Food Items in Anambra State

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ABSTRACT

Organochlorine pesticide residueswere measured in guinea corn, maize, beans, bambara groundnut and millet. These cereals were bought from 5 markets in different locations of Anambra state, Nigeria .40g of each of the powdered cereals was used for the extraction process by the method of Carlo, et al.,(2009), while the products of extraction was analyzed using gas chromatography. The mean of the overall pesticides in µg/kg(with standard deviation) in the food samples were: Maize 0.0377 (±0.0041), Beans0.0359(± 0.0047), Bambara groundnut 0.0360 (±0.0039), Guinea corn0.0352(±0.0046), Millet0.0052(±0.0068). Our results revealed that foods from Onitsha generally showed the highest pesticide level. Among all the pesticides, aldrin was found to exhibit the highest concentration of the pesticides in the foods. It was observed that cereals from Anambra State were exposed to some levels of contamination of Organochlorine pesticides, although these levels may not be a serious health challenge to the public, hence there is need for a concerted effort towards continuous monitoring of these pesticide residues in our foods and environment. However, this research has opened avenues for other researchers in Anambra State and beyond to discover other frontiers towards the preservation of foods.

Keywords: *Cereals, Gas chromatography, Organochlorine pesticides, Regulatory agency, Residual levels.*

INTRODUCTION

Organochlorine pesticides residues (aldrin, dieldrin,lindane, Chlordane, Heptachlor, Endrin, Methoxychlor, Tetradifon, Toxaphene) used for food preservation were measured in different cereals to determine their maximum residual limits *vis-à-vis* to enable us select suitable pesticide ideal for food preservations in our environment.

Pesticides are substances or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacterium), antimicrobial, disinfectant or device used against any pest. Pests include insects, plant pathogens, weeds,molluscs, birds, mammals, fish, nematodes (roundworms) and microbes, that destroy property, spread disease or are vectors for diseases [1].When a crop is treated with a pesticide, a very small amount of the pesticide, or indeed what it changed to in the plant {its 'metabolites' or 'degradation product'), can remain in the crop until after it has been harvested. This is known as the 'residue'[2]

Pesticide residues may be present in fresh fruit and vegetables or processed food and drink made from crops (e.g. juice, bread or any other manufactured food or drink) or fresh/processed animal products.Organochlorine pesticide are halogenated organic compounds classified as dichlorodiphenylthanes, hexachlorocyclohexanes, cyclodienes, chlorinated benzenes. Examples include Lindane, Aldrin and Dieldrin[3]. Pesticides are used in agriculture, household, vertenary, wood preservatives, and disinfectants. They are broadly used in farming due to their economic benefits in fighting crop pests and reducing competitions from weeds, thereby improving yields and protecting crop quality, reliability, and the price of production [4]. The high efficacy and low cost of organochlorine pesticide compared with alternative pesticides is the reason for their continued use in developing countries[5]. The US Environmental Protection Agency*(*EPA) classifies aldrin, lindane and dieldrin as probable human casinogens, where increased rates of liver tumours were found in both rats and mice that ingested low levels of them in the diet. In addition, exposure to large amount of aldrin, lindane and dieldrin, can harm the nervous system, producing a range of symptoms from headache and dizziness to seizures, convulsions and more rarely death [6].

MATERIALS AND METHOD

Samples: The samples for the work inculude guinea corn (*Sorghum bicolour*), maize (*Zea mays)*, beans, " *Phaseolus vulgaris* " bambara groundnut (*Vigna subterranean)*, millet (*Sorghum bicolour)*.These samples were purchased from 5 different localized markets in Anambra state.

Materials

Commercially available pesticide standard, (aldrin, dieldrin,lindane, Chlordane, Heptachlor, Endrin, Methoxychlor, Tetradifon, Toxaphene), solvents for dissolving food materials.

Extraction of pesticide from sample:

The method of Carlo, *et al.,* 2009, was used in the extraction process in which 40g of a finely chopped representative sample was weighed, and

the following were added to it: 10ml 10% H_2SO_4; 20ml ethanol; 40ml petroleum ether (40-60^o), 100ml diethyl ether. It was then blended at high speed for 15 min, filtered with suction and the residue washed with a mixture of equal volume of diethyl ether and petroleum ether. 100ml 4% w/v Na_2SO_3 solution was added and Shaked for 1 min, different phases were allowed to separate and the aqueous layer was ran off into another separating funnel.

Clean up was done using 25ml diethyl ether and 50ml$CHCl_3$.

Examination of the extracts using Gas-Liquid Chromatography;

An HP5890 (11) gas chromatograph coupled with an HP5971 mass- selective detector (Hewlett-packard, USA) was used with the following operational conditions:Borosilicate glass (2m* 4mmi.d.) Column;10% DC-200 Stationary phase. Support materials was ChromasorbWHP; Particle size was 80-100 meshes; Column temperature was 200^{o}C and Helium served as carrier gas.

Statistical analysis

The result was expressed as mean. Comparisons were made using analysis of variance (ANOVA) and student t- test and $P< 0.05$ was regarded as significant.

RESULT

Fig1 and table 1 showed the overall organochlorine pesticide concentrations in the cereal samples with millet having the highest pesticide concentration of 0.0552 µg/Kg, followed by maize 0.0377 µg/Kg, and the others having almost the same level of organochlorine pesticide concentrations (Guinea Corn, 0.0352 µg/Kg;Beans, 0.0359 µg/Kg; Bambara groundnut, 0.0360 µg/Kg)

Guinea Corn showed the highest concentration of aldrin pesticide with value of 0.0532 µg/Kg see table 2 while Hepachlor was see in highest concentration in Maize (0.04460 µg/Kg) chlordane was in lowest concentrations in Beans see table 2. When pesticides were compared between different food samples no significant difference was seen see table 2.

The pesticides from various locations were compared with one another. The Heptachlor, chlordane, lindane, and Tetradiform exhibited a significant variation at $P<0.05$ while there was no significant difference seen in

Aldrin ,Endrine, Diedrin, Methaoxychlor and Toxaphene see table 3.

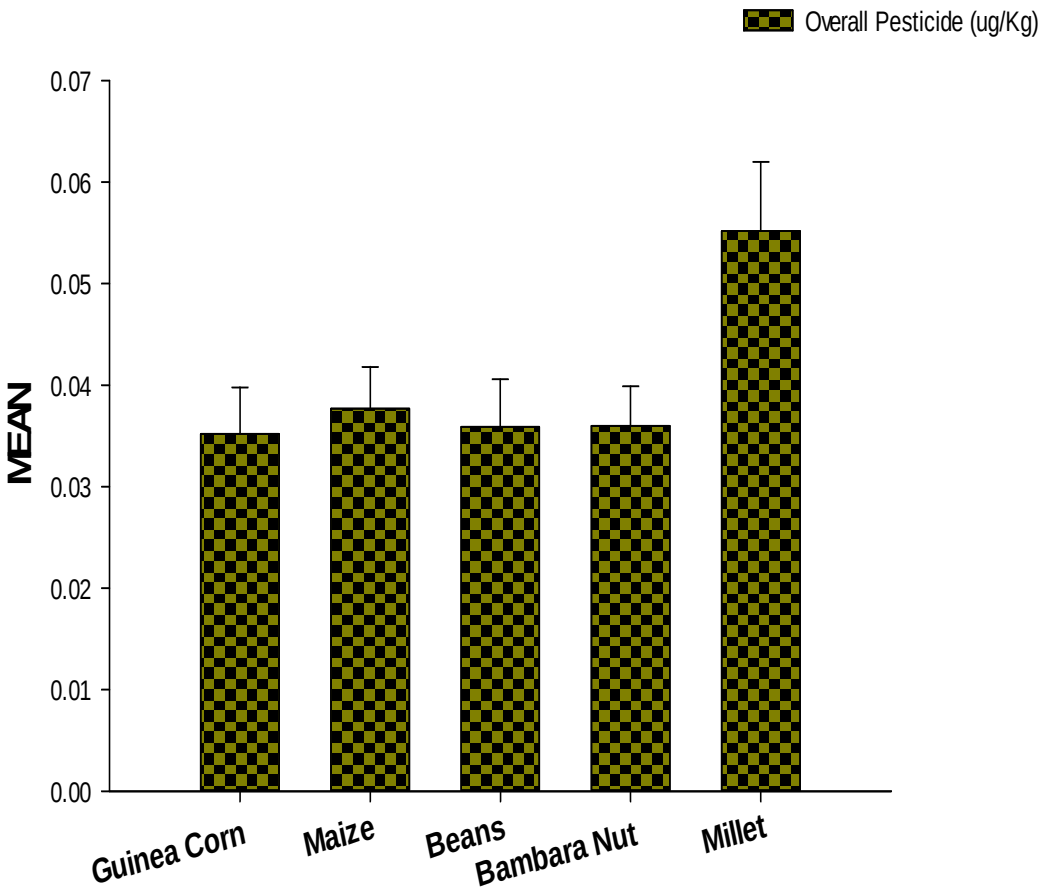

Fig 1: overall pesticide residues concentration in food items

Table 1 overall pesticide residues concentration in food items

Food items	Mean of Overall pesticide µg/Kg (±SD)
Guinea Corn (*Sorghum bicolour*)	0.0352 (±0.0046)
Maize (*Zea mays*)	0.0377(±0.0041)
Beans, (*Phaseolus vulgaris*)	0.0359(±0.0047)
Bambara groundnut (*Vigna subterranean*)	0.0360(±0.0039)
Millet (*Sorghum bicolour*)	0.0552(±0.0068)

Table 2: Pesticide Concentration (µg/Kg) in Different Food Items

Samples	Aldrrin (STD)	Heptachlor (STD)	Chlordan (STD)	Lindane (STD)	Endrine (STD)	Diedrin (STD)	Methoxychlor (STD)	Tetradiform (STD)	Toxaphene (STD)
Maize	0.0424 (0.4399)	0.04460 (0.0100)	0.04060 (0.0066)	0.0472 (0.0258)	0.0376 (0.0220)	0.0352 (0.0141)	0.0376 (0.0168)	0.0336 (0.0135)	0.0336 (0.0135)
Millet	0.0364**a** (0.0193)	0.0320 (0.0202)	0.0456 (0.0267)	0.0314 (0.0145)	0.0280 (0.0157)	0.0788 (0.0928)	0.0274 (0.0145)	0.0385 (0.0129)	0.0236 (0.4501)
Guinea Corn	0.0532**a** (0.0275)	0.0308 (0.0147)	0.0388 (0.0195)	0.0402**b** (0.0260)	0.0308 (0.0114)	0.0316 (0.0135)	0.0322 (0.0081)	0.0366 (0.0178)	0.0324 (0.0112)
Beans	0.0468**a** (0.0181)	0.0366**bc** (0.0052)	0.0350 (0.0182)	0.0312**c** (0.0105)	0.0310 (0.0142)	0.0358 (0.0144)	0.0336 **c** (0.0148)	0.0374 (0.0118)	0.0358 (0.0157)
Bambr nut	0.0424**a** (0.0174)	0.0352**d** (0.0113)	0.0358 (0.0147)	0.0442 (0.0256)	0.0350 (0.0857)	0.0300 (0.0163)	0.0330 (0.0128)	0.0410 (0.0170)	0.0342 (0.0108)
F	1.0060	0.8370	0.2430	0.5780	0.3170	1.1170	0.3530	0.1180	1.004
P	0.4280 (NS)	0.5180 (N/S)	0.9100 (N/S)	0.6820 (N/S)	0.8630 (N/S)	0.3760 (N/S)	0.8390 (N/S)	0.9740 (N/S)	0.429 (N/S)

a= $p<0.05$ for other samples compared with Maize

b= $p<0.05$ for other samples compared with Millet

c= $p<0.05$ for other samples compared with Guinea corn

d = $p<0.05$ for other samples compared with Beans

Table 3: Pesticide Concentration in different locations(µg/Kg)

Locations	Aldrin (STD)	Heptachor (STD)	Chlordan (STD)	Lindane (STD)	Endrine (STD)	Diedrin (STD)	Methoxychlor (STD)	Tetradiform (STD)	Toxaphene (STD)
Onitsha	0.2630 (0.4285)	0.0320 (0.0076)	0.0452 (0.022)	0.0582 (0.025)	0.0304 (0.012)	0.0756 (0.093)	0.0332 (0.0134)	0.0278 (0.0139)	0.2360 (0.4501)
Nnewi	0.0226 (0.0096)	0.0234 (0.0100)	0.0164[a] (0.016)	0.0152[a] (0.006)	0.0186 (0.008)	0.0134[a] (0.004)	0.0166[a] (0.00434)	0.0218 (0.0067)	0.0164[a] (0.0046)
Ihiala	0.0384[a] (0.0115)	0.0364 (0136)	0.0382[a] (0.008)	0.0328[a] (0.008)	0.0380 B (0.015)	0.0432[a] (0.008)	0.0416 (0.0114)	0.0384 (0.0102)	0.0396[a] (0.0074)
Ekwulobia	0.0426[a] (0.0078)	0.0350 (0.0070)	0.0396[a] (0.008)	0.0330[a] (0.012)	0.0332 (0.009)	0.0344 (0.009)	0.0352 (0.0071)	0.0430 (0.0078)	0.0392 (0.0606)
Awka	0.0546[a] (0.0092)	0.0524 (0.0089)	0.0564 (0.014)	0.0550[a] (0.010)	0.0422 (0.016)	0.0448[a] (0.008)	0.0372[b] (0.0059)	0.0548 (0.0062)	0.0408[a] (0.0098)
F	1.375	5.890	6.045	7.880	2.507	1.390	4.129	9.854	1.019
P	0.2780 (N/S)	0.003 (S)	0.002 (S)	0.001 (S)	0.075 (N/S)	0.2730 (N/S)	0.0130 (N/S)	0.000 (S)	0.421 (N/S)

Keys [a]=P<0.05 compared with sample from Onitsha

[b]=P<0.05 compared with samples from Nnewi

DISCUSSION

Pesticides are substances meant for attracting, seducing and then destroying or mitigating any pest and are a class of biocide. The most common use of pesticides is as plant protection(also known as crop protection products) which in general protects plants from damaging influences such as weeds, plant diseases or insects. This use of pesticides is so common that the term pesticide is often treated as synonymous with plant term as

pesticides are also used for non agricultural purposes. The term pesticides includes all of the following: herbicide, insecticide, insect growth regulator, nematicide, termiticide, molluscicide, piscicide, avicide, rodenticide, predacide, bactericide, insect repellant, animal repellant, antimicrobial, fungicide, disinfectant (antimicrobial) and sanitizer [8]

Onitsha and Nnewi markets in Anambra State are landing spots for cereals bought from Northern part of the Country, this work revealed that there was a significant observations in the level of pesticides concentration as compared with cereals bought from other markets in the State. This could be attributed to the fact that before the crop treated pesticides could reach to other locations, the concentration of the potency of the pesticides may have been reduced during transportation.

The result of our research findings showed that all cereal samples contain some levels of organochlorine pesticide:-Guinea Corn (*sorghum bicolour*) 0.0352 (±0.0046); Maize (*zea mays*) 0.0377(±0.0041); Beans (*phaseoulus vulgaris*) 0.0359(±0.0047); Bambara groundnut (*vigna subterranean)* 0.0360(±0.0039); Millet (*sorghum bicolour*) 0.0552(±0.0068).These levels were seen to fall below the maximum residual limit (MRL) of 0.1 µg/Kg, as adopted by World health organization (WHO), Commission of the European community (CEC) and Food and Agriculture Organization of the United Nations (FAO)[5].

Reference [9] published that in 21 samples of wheat he worked on, the wheat samples showed that 12.6% contained some levels of pesticide residues in the range of 0.012-0.120 µg/Kg. Toxaphene, was seen to be mildly elevated above MRL in millet from Onitsha with value as 1.041µg/Kg but was statistically insignificant. Pesticide residues in this study were higher than concentration found in cereals in United States of America(USA), but lower than the range of those reported by GEMS/FOOD from several country, lindane in this study were lower than the value reported in Italy and India, [9]. Dieldrin exhibited a lower pesticide concentration[5]. In USA, like in most developed countaries, most of the organochlorine pesticides have been banned or are highly restricted because of their harmful effect and pollution of the environment[10]. But these pesticides are still commonly used in third world countries [11],due to their cheap costsand ignorance of their deleterious effects.

From the study it has been shown that cereals from Anambra State of Nigeria are exposed to some levels of contamination of organochlorine pesticides, although these levels may not pose a iserious health hazard to the public. However there is need for continuous monitoring of these pesticide residues in our food and environment especially for people living in Sub sahara Africa where there are non-availability of modern storage facilities. This research work has expose some inherent dangers which arise as a result of preservation of foods with organochlorine pesticides and then also highlight measures to adopt in the curbing of the menace of using pesticides in food storage.Consequently, this research finding has enlightened us to be aware of the contamination of our environment through the

use of organochlorine pesticides and build up a good data-base for a regulatory legislative law to be enacted towards the protection of the environment and the people. A lot of visitas will be opened for future researchers to channel their energy and seek for research grants from donor agencies to carry out further researches on how to preserve food free of pesticides in developing countries and beyond.

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