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Determination of Organochlorine Pesticides in Carrot Harvested along the Banks of River Getsi, Kano State, Nigeria

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ABSTRACT
Human risk investigation on twenty (20) organochlorine pesticides (OCPs) in carrot plant cultivated along the banks of river Getsi, Kano state was undertaken. The samples were collected, stored, later extracted and cleaned up using florisil method. Analysis was carried out using gas chromatography-mass spectrometry with electron capture detector. Results obtained revealed human risk index of OCPs in carrot to be averagely 30% (which is lesser than 1 but few OCPs) greater than 1 despite the average). Among Human Risk Index greater one (HRI>1) include only delta-BHC (benzene hexachlorate), aldrin, heptachlor epoxide, diedrin, endrin, and endrin aldehyde. Notwithstanding the aforementioned Organochlorine pesticide health risk index greater than 1, are not among the OCPs such as dichlorodiphenyltrichloromethane (DDT), dichlorodiphenyldichloroethylene (DDE), heptachlor, endosulfans, and chlordanes that are regarded as endocrine disrupting chemicals. The cumulative health risk assessment associated with pesticide exposure in the vegetables studied shows negligible effects on the consumers. Even though the hazard indices recorded for carrot plant were low (30%) for consumers, does not imply full proof safety. Pesticide residues could accumulate over a period of time and this could have adverse chronic effects on consumers.

Keywords: Benzene hexachlorate, Dichlorodiphenyldichloroethylene, Dichlorodiphenyltrichloromethane, Human Risk Index, Organochlorine pesticides

INTRODUCTION
OCPs such as DDT, Mirex, BHC, chlordane, Methoxyclor, dieldrin, and heptachlor are included in the group of persistent organic pollutant (POP). These compounds become a big concern in the environment (atmosphere, waterway and land) due to their resistance, global transport, distribution and toxicity. Moreover, OCPs have been linked to carcinogenicity and endocrine disruption in mammals and humans since its bioaccumulation in fatty tissues and biomagnification through food chains (Housseni *et al*., 2018; Isaac *et al*., 2018). OCPs were already banned in developed countries; however some of developing countries still use these pesticides due to the low cost, its effectiveness and also the leftover from the previous stock. As results, OCPs residue remains as major pollution in environment such as soil, waterways and atmosphere. Organochlorine pesticides which are the most popular synthetic organic pollutant mostly abbreviated as OCPs are chemicals designed to combat, prevent or control the various pests and vectors on agricultural crops, domestic animal and human beings (Suphia *et al*., 2017). They are toxic organic chemical agents that are intentionally released into the environment to alleviate the spread of pests and vector diseases. Among the OCPs, the following were studied in this research; HCB, HCH (lindane), aldrin, heptachlor, dieldrin, endrin, mirex and DDT with its metabolites o,p-DDE, p,p-DDE, o,p-DDD, p,p-DDT and p,p-DDT. This research work was aimed at conducting human risk assessment of organochlorine pesticides levels in carrot plant cultivated on bank of River Getsi. By the end of the study, organochlorine pesticide data benchmark will be established which may be use for planning, budgetary control, remediation among others.

MATERIAL AND METHOD
Description of Sampling Site
River Getsi is the receptor of domestic waste, effluent and wastewater flow from Nassarawa area of Bompai industrial estate. The river runs through the city from South to North part of the municipality (use for irrigation among others), covering extensive hydrogeological areas.

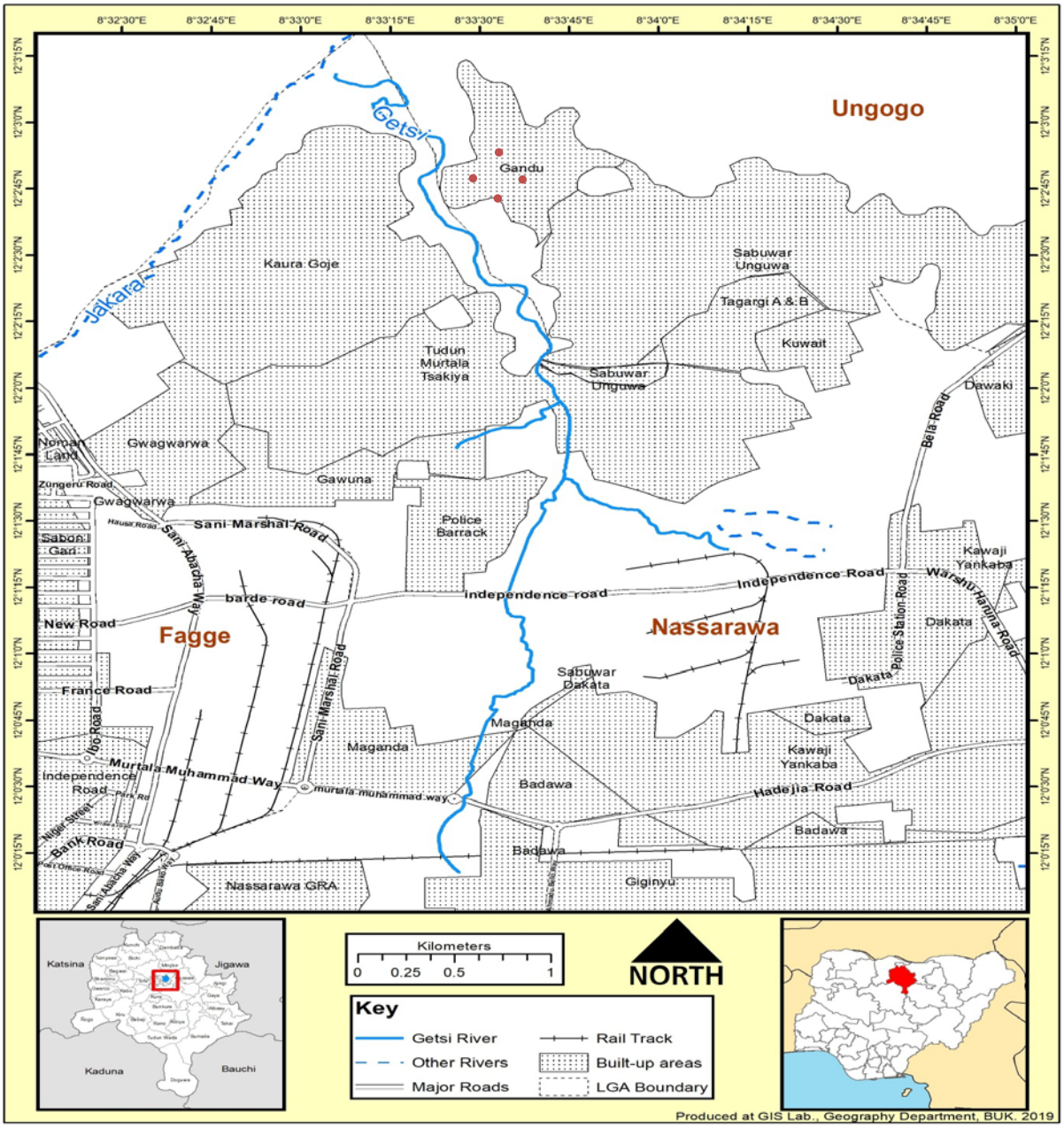

Figure 1: Sampling points along River Getsi

Sample collection and preparation

Nine Samples of carrot plant was collected randomly along the bank of River Getsi during mid-point of dry season. The sampling, collections and preparation of the carrot samples were conducted according to international standard guideline (Audu and Lawal, 2005). One (1) kg of nine (9) homogenous composite samples was kept in separate sterile polythene bag, sealed, labeled with unique sample identity, placed in ice chest box and transported to laboratory. In the laboratory, 50g of carrot samples (previously washed, dried, chopped and blended into powder) was added to 250 cm^3 beaker containing 100 cm^3 of cyclohexane / dichloromethane (1:1,v/v) with 20 g anhydrous sodium sulphate and later sonicated for 30 minutes at 40^0 C. The solvent extracts were concentrated to 1cm^3 using a rotary evaporator and were kept clean prior to GC-MS analysis (Okop *et al.*,2011;Wu *et al.*,2012).

RESULTS AND DISCUSSIONS

Twenty (20) OCPs were determined in the carrot samples analyzed. The level of pesticides residues found include mean value, average daily intake, estimated daily intake, health quotient and health risk index, presented in Table 1.

Table 1: Human Risk Assessment of OCPs in Carrot

OCPs	Mean	ADI		EDI	HQ	Health Risk
ALPHA – BHC	0.61	0.008	Adult	5.66E-04	0.07	NO
	0.61	0.008	Child	7.08E-04	0.09	NO
BETA – BHC	0.24	0.003	Adult	2.23E-04	0.07	NO
	0.24	0.003	Child	2.78E-04	0.09	NO
GAMMA - BHC (LINDANE)	0.04	0.003	Adult	3.71E-05	0.01	NO
	0.04	0.003	Child	4.64E-05	0.02	NO
HEPTACLOR	6.89	0.0001	Adult	6.40E-03	63.98	YES
	6.89	0.0001	Child	7.99E-03	79.92	YES
DELTA – BHC	0.05	0.003	Adult	4.64E-05	0.02	NO
	0.05	0.003	Child	5.80E-05	0.02	NO
ALDRIN	5.86	0.0001	Adult	5.44E-03	54.41	YES
	5.86	0.0001	Child	6.80E-03	67.98	YES
HEPTACHOR EPOXIDE	0.15	0.0001	Adult	1.39E-04	1.39	YES
	0.15	0.0001	Child	1.74E-04	1.74	YES
ENDOSULFAN 1	0.22	0.006	Adult	2.04E-04	0.03	NO
	0.22	0.006	Child	2.55E-04	0.04	NO
4, 4-DDE	1.33	0.02	Adult	1.24E-03	0.06	NO
	1.33	0.02	Child	1.54E-03	0.08	NO
DIEDRIN	3.23	0.0001	Adult	3.00E-03	29.99	YES
	3.23	0.0001	Child	3.75E-03	37.47	YES
ENDRIN	8.17	0.0001	Adult	7.59E-03	75.86	YES
	8.17	0.0001	Child	9.48E-03	94.77	YES
4, 4-DDD	7.57	0.02	Adult	7.03E-03	0.35	NO
	7.57	0.02	Child	8.78E-03	0.44	NO
ENDOSULFAN 11	3.77	0.006	Adult	3.50E-03	0.58	NO
	3.77	0.006	Child	4.37E-03	0.73	NO
4, 4-DDT	1.01	0.02	Adult	9.38E-04	0.05	NO
	1.01	0.02	Child	1.17E-03	0.06	NO
ENDRIN ALDEHYDE	5.7	0.0002	Adult	5.29E-03	26.46	YES
	5.7	0.0002	Child	6.61E-03	33.06	YES
ENDOSULFAN SULFATE	2.51	0.006	Adult	2.33E-03	0.39	NO
	2.51	0.006	Child	2.91E-03	0.49	NO
METHOXYLCLOR	4.07	0.005	Adult	3.78E-03	0.76	NO
	2.51	0.005	Child	2.91E-03	0.58	NO

ADI: Average Dietary Intake **EDI:** Estimated Daily Intake **HQ:** Hazard Quotient

Human risk index of OCPs in carrot presented in Table 1 have averagely 30% (which is lesser than one but has few outlier of OCPs greater than 1 (HQ > 1), which include delta-BHC, aldrin, heptachlor epoxide, diedrin, endrin, and endrin aldehyde. Although, the aforementioned organochlorine pesticides are outlier health (greater than 1) are not among the OCPs such as DDT, DDE, heptachlor, endosulfans, and chlordanes that are regarded as endocrine disrupting chemicals. It is in agreement with Suphia *et al.*, (2017) whose determination of carrot samples gave Hazard quotient (HQ) and hazard index (HI) of each OCPs below unity (less than 1). It also correlates with Housseni *et al*., (2018) whose research result on food consumption rate of vegetables (especially carrot) shows low consumption of vegetables contaminated. And the cumulative health risk investigated through pesticide exposure in the carrot vegetables shows negligible effects on the consumers.

CONCLUSION

Carrot is one of the most serious vegetables consumed not only alone but in combination with other vegetables for salad meal among others. Carrot is very rich in carotene, Vitamin C among other minerals. Consumption of carrot by children could present both carcinogenic and non carcinogenic health risks. Adults are less likely to have any health risk from consuming these carrot. The risk analysis results obtained reveals, EDI of carrots were far below ADI and MRLs. The HQ and HI analysis were below the unity, thus there may not be a concern for non-carcinogenic effect Even though the hazard indices recorded for carrot vegetable were low for consumers, does not imply full proof safety. Pesticide residues could accumulate over a period of time and this could have adverse chronic effects on consumers. Enforcing law on the import and use of toxic pesticide will help in mitigating the risk associated with the consumption of contaminated carrot.

REFERENCE

Audu, A. A. and Lawal, A. O. (2005). Variation in metal contents of plants in vegetable gardens site in Kano Metropolis. *J. Appl. Sci. Environ. Manage.,10(2):105-109.*

Housséni Ahoudi, Kissao Gnandi, Gnon Tanouayi, Kamilou Ouro-Sama1, Jean-Christophe

Yorke, E. Edmond Creppy & Christian Moesch (2018). Assessment of pesticides residues contents in the vegetables cultivated in urban area of Lome (southern Togo) and their risks on public health and the environment. Available online at http://www.ifgdg.org Int. Journal Biol. Chem. Sci. 12(5): 2172-2185.

Isaac W. Ofosu, Samuel Akomea – Frempong,Emmanuel De-Graft Owusu-Ansah and Godfrey

Darko (2018). Exposure and risk assessment of selected chemical hazard in cabbage and lettuce. J Toxicol Risk Assess 4:014.Doi org/10.23937/2572-4061.1510014

Okop, I. J., Etukudo, I. U., Okorie, F.S. and Obadimu, C. O. (2011). Sampling, Extraction and Analytical Evaluation of Volatile Organic Carbon and Few Hydrocarbon in Petroleum Contaminated Soil in Niger Delta, Nigeria. Conference proceedings of 37th international conference workshop of chemical society of Nigeria, tagged Akwa Ibom, 2014. pp 332-336.

Suphia Rahmawati, Listya Chandra Kirana, Minoru Yoneda & Dan Katharina Oginawati (2017).Risk analysis on organochlorine pesticides residue in potato and carrot from conventional and organic farms in citarum watershed area, west java province, Indonesia.

Tarek M. Galal, Ahmed A.Khalafallah, Omar E.Elawa & Loutfy M. Hassan (2018). Human health risks from consuming cabbage (Brassica olracea L.var.capitata) grown on wastewater irrigated soil, international journal of phytoremediation,20:10,1007-1016,DOI:10.1080/15226514.2018.1452186.

Wu, JH, Li, PY, & Qian, H. (2012). Study on the hydrogeochemistry and non-carcinogenic health risk induced by fluoride in Pengyang County, China. *International Journal of Environmental Sciences*. 2(3): 1127-1134. doi:10.6088/ijes.00202030001