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Research Paper

Characterization Of Organochlorine Pesticides Content Of Olomoro Wetland Isoko South For Happa Aquaculture In Secondary Schools As A Tool For Optimizing Human Capital Development In Nigeria

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ABSTRACT
This study is an ex-post facto research that investigated the organochlorine pesticides content of Olomoro wetland for its suitability for happa aquaculture in secondary schools. The study answered 3 research questions and tested a null hypothesis. To achieve the objectives of the study, Olomoro wetland was mapped out into 5 research stations corresponding to the quarters that make up the clan, and then each of the 5 research stationswere mapped out into 5 research cells. Water samples were collected with clean sampling plastic bottles from 5 spots in each cellat 10cm depth and covered subsurface. Samples from each cell were bulked, composite taken, fixed with HNO_3 and placed in ice cool boxes for analysis. The analytical standards adopted were CEAM, ASTM and APHA and the analytical instrument deployed was Agilent LC/MS triple quadrupole model 6495. The results obtained were: αHCH 0.25 ±0.10 µg/l, endrin 0.26±0.05 µg/l, heptachlor, 0.32±0.04 µg/l, cis-chlordane 0.14±0.08 µg/l and endolsulfan 0.26±0.10 µg/l. The result of the organochlorine pesticides content in Olomoro wetland werefurther subjected to test of significance with ANOVA deploying SPSS model 21 at 0.05 level of significance. The p value is 0.32, thus rejecting Ho. The study recommends that happa aquaculture should not be implemented in Olomoro wetland due to organochlorine pesticides pollution of the wetland, the pollution source should be sought and discontinued and clean up and remediation should be embarked upon in the wetland to restore it to its former healthy status to enable the implementation of happa aquaculture by schools and youths in Olomoro and its environ.

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I. Introduction

The desire of every nation is to achieve sustainable economic growth and development and this aspiration is predicated on the quality of the country's workforce, which is a function of its human capital development policies. Human capital according to Simpson (2018), Jackson (2020) is the qualification, skills, knowledge of a group of persons, workforce usually considered as the asset of the organization. David (2018), Kinn (2019), Joseph (2019) refer to human capital as the measure of the abilities of a workforce in an organisation or state or nation and it is the composite of skills, education, intelligence and working capacity, while human capital development is the measure of the knowledge and skills of a workforce gained through education and training. It is the economic value of employees garnered through training before or during engagement in the organization (John 2021, Henryson 2021). According to World Bank (2021) human capital is the composite or aggregate of the skills and knowledge available in an organization or a nation state and attempt at improving on the existing knowledge and skill is the development. Human capital development are the skills, attributes and capacity of the labour force gained through training which influences their productivity towards a higher profitability (Eduardo 2018, Macaulay 2019, Sanchez 2020). This was reiterated by Schultz, (2020) that human capital development involves the education and training of individuals for greater efficiency and enhanced productivity for profit maximization. Marshall (1998) succinctly defines human capital development as the investment in education and training or skills, knowledge and other values that could crystallize to increase productivity for the achievement of the organizational or national goals. This assertion is in agreement with the views of Gozam (2021) Sampaul (2021) who see human capital development as the aggregate efforts made by an organization or a country to improve the quality of its workforce for increased economic growth and development. ForOkojie (2020 human capital developmententails the training, the skills in technical and vocational areas which will give rise to increased economic growth and development. Ndanusa (2018), Madibo (2019) opined that for a nation to achieve economic growth and sustained development there must be conscious effort to invest on the human capital development in both secondary and tertiary levels of education. Nduka (2018), Abubakar (2018) declared that Nigeria economy may not witness any appreciable growth trajectory unless sustained investment is made on technical and vocational training and education. Nigeria can only achieve economic growth and development if emphasis is placed on technical and vocational education training for enhanced youth empowerment and food security (Ogene, 2018, Salubi, 2018, Ekanem, 2020). Adamu (2016) enjoined the Nigerian government to implement the senior secondary school trade and entrepreneurship curriculum to the later because it is the veritable tool for youths human capital development in various trades such as photography, GSM repairs, block moulding, animal husbandry and aquaculture. Odali, (2020) re-echoed the need for training of youths in secondary schools in aquaculture because it is human capital development at the secondary and tertiary school that will result in stable economic growth. Youths aquaculture is a recipe for youths employment, job and wealth creation which will result in economic growth and development (Ojomu, 2018).

Nigeria's fish demand stands at 3.00 million metric tonne while the local production is1.1 million metric tonnes (Adesina, 2014, Ogbe 2016, Abubakar, 2020). Nigeria is the fourth greatest importer of fish globally coming after America, Japan and Indonesia (Food and Agriculture Organisation 2018). Itsannual fish import volume is put at 1 billion USD (United State Agency for International Development (USAID), 2018).

Youths venture into aquaculture will check the foreign exchange depletion, create employment and thus increase economic growth (Ruwani, 2018, Nwankwo, 2019). Ogwu (2021), Bamgboye (2021) enjoined youths to take to aquaculture deploying happa aquaculture due to its very low financial outlay. Happa is a net cage either rectangle or squared in shape placed in natural water for rearing fish of varying species and sizes (Ogwu, 2021; Odion, 2019, Nweke, 2019). Bako (2018) Ogboru, 2016, Tor, (2019) advised that in deploying happa culture water analysis should be conducted before implementation for the possible presence of water pollutants to avoid bioaccumulation and biomagnification.Bioaccumulation is the tendency of pollutants in an aquatic environment to penetrate the tissues of organisms within the ecosystem while biomagnification is the tendency for such pollutants to bio-multiply once in the tissue of the organism. (Atshana and Atshana, 2013, Ogwu, 2022).Ikiro, (2012), Iketua, 2019, Atshana and Atshana, 2012) list water pollutants to include polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), microplastics, dioxins, furans, heavy metals, pesticides such as organophosphate, carbamates and organochlorines. Organochlorine are compounds containing carbon and chlorine atoms used in manufacturing pesticides (United States Environmental Protection Agency, 2012). Organochlorine pesticides presence in the human system result in health complications such as cancer endometriosis osteoporosis infertility and so on (Agency for Toxic Substances and Disease Registry 2012, International Agency for Research in Cancer (IARC), (2012). Wetland is an ecosystem that harbours water for 3 to 6 months in a year (Ogwu, 2020, Achudume, 2020). It is against the foregoing hat this study became incumbent. The focus of the study therefore is the determination of organochlorine pesticides content of Olomoro wetlands, Isoko South for its suitability for happa aquaculture in secondary schools as a tool for human capital development, for optimising economic development in Nigeria.

The organochlorine pesticides investigated are: alpha lindane (aHCH), endrin, heptachlor, cis chlordane and endolsulfan.

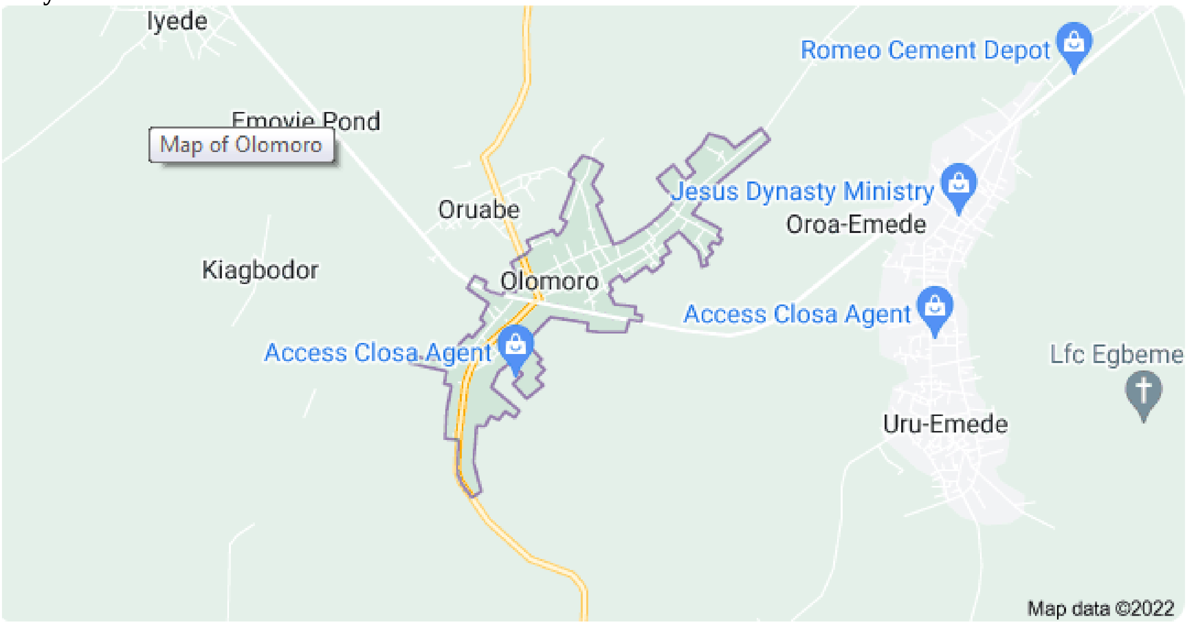
The study is guided by the following research questions:

1. What are the concentrations of alpha lindane (aHCH), endrin, heptachlor, cis chlordane and endolsulfan in Olomoro wetlands?
2. Are the concentrations of the organochlorine pesticides within the levels recommended by the World Health Organisation (2014) for water?
3. Can happa aquaculture be practiced in Olomoro wetland by the schools in Olomoro and environs?

The study is guided by an hypothesis as below.

Ho: There is no significant difference between the concentration of the organochlorine pesticides in Olomoro wetlands and WHO maximum allowable concentrations for organochlorines in water.

Study Area



Map of Olomoro
Source: Google map 2022

Olomoro is a clan in Isoko South local government area of Delta state, Nigeria. It lies within the geographical coordinates of latitude 5° 24' 43" N and longitude 5° 24' 43" E and has a population of 655,450 inhabitants (2006 National Population Commision). Olomoro is a wetland settlement and this made the people to be predominantly fishermen and farmers. The women are cassava processors and petty traders (Okoro, 2019). Some of the people of Olomoro are artisans while a few of them work as civil servants teaching in schools, and working in health centres and customary courts. Olomoro is surrounded at all flanks by wetlands and are the recipient of the wastes from farm inputs such as pesticides used in controlling weeds and insects pests and fertilizers applied for soil fertility enrichment.

II. Materials And Methods

This is an ex-post facto research. The research area Olomoro was mapped out into 5 research stations corresponding to the quarters that make up the clan. These are: Ukoli quarters, Egbo, Oviri, Okpe and Iwride quarters. The wetland in each research stations were further mapped out into 5 research cells. (Adaigbo, 2015, Adewale, 2016, Ogunaike, 2018). From each of the research cells, water samples were collected with clean plastic sampling bottles tied to marked string from 5 sampling spots at 10cm depth. The samples from each cell were then bulked, a composite taken and fixed with nitric acid to ward off oxidation and stored in ice cool boxes for analysis.

The analytical standards adopted for the study are American Society for Testing and Material (ASTM), Chemical Analysis of Ecological Matter (CEAM) and American Public Health Association (APHA). The instrument used for the determination of the pesticides is Agilent liquid chromatography and mass spectroscopy triple quadrupole 6495 model (LM/MS).

III. Results

The result of the organochlorine pesticides content of Olomoro wetlands are as in Table 1.

Table 1: Organochlorine pesticides content of Olomoro wetlands and WHO maximum allowable concentration fororganochlorines in water in ug/l.

Parameters	Sample Sites					mean	SD	WHO MPC µg/l
	A	B	C	D	E			
Lindane	0.22	0.13	0.4	0.33	0.21	0.26	0.10	0.01
Endrin	0.24	0.31	0.32	0.3	0.41	0.32	0.05	0.005
Heptachlor	0.11	0.21	0.13	0.14	0.21	0.16	0.04	0.1
Cis chlordane	0.21	0.33	0.21	0.41	0.35	0.30	0.08	0.005

Endolsulfan	0.21	0.23	0.42	0.31	0.11	0.26	0.10	0.08

The organochlorine pesticides concentration of Olomoro wetlands were also presented as in Figure 2

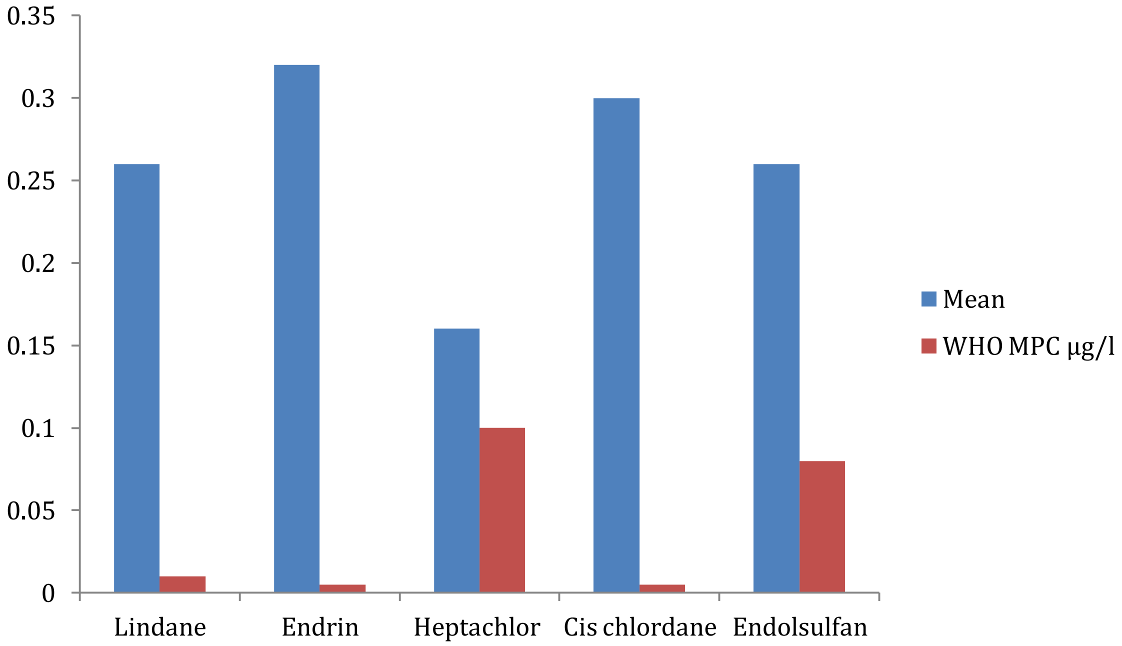


Figure 2: Organochlorine pesticides content of Olomoro wetlands and WHO MAC in ug/l.

The organochlorine pesticides of Olomoro wetland were subjected to test of significance with analysis of variance statistical instrument with special package for social science (SPSS) model 21 at 0.05 level of significance. The p. Value is 0.32 thus rejecting Ho.

IV. Discussion of Findings

The analysis of the organochlorinepesticides content of Olomoro wetlands revealed varying concentrations of organochlorine in the ecosystem.

The mean concentration of alpha lindane the analysis revealed is 0.25µg/l. andWHO maximum allowable concentration for αHCH in water is 0.01 µg/l. The concentration of αHCH in Olomoro wetland is higher than acceptable level of αHCH in water. This result is similar to that of Odukoya and Olawole, (2018) who reported high αHCH in Ose River Ondo state but it is at variance with Okpor (2019) who reported low αHCH in Ase Creek, Benekuku Delta state.

The mean concentration of endrin in Olomoro wetland the analysis showed is 0.26 µg/l, while the maximum allowable concentration of endrin in water by WHO is 0.005 µg/l. This elevated level of organochlorine is as a result of adoption of chemical pest control in Olomoro and environ by the farmers. High concentration of endrin in water has been reported by Emodogo and Ogbeide (2018) in Orogodo River BojiBoji, Agbor. Okonkwo (2016) equally reported high endrin in Omambara River in Anamba state. The analysis of the wetland water of Olomoro wetlands showed that the mean concentration of heptachlor is 0.32 µg/l. The WHO (2014)maximum allowable concentration of heptachlor in water is 0.1 µg/l. The concentration of heptachlor in Olomoro wetland is higher than the stipulated limit for organochlorines in water. This findings is in agreement with the report of Ogwu (2020) in Igigo wetlands in Utagba-Uno and Nwafor and Ubeku, (2018) who reported high concentration of heptachlor in on Njaaba River, Imo state.

The investigation of the content ofCis-chlordane in Olomoro wetland showed that the mean concentration of cis-chlordane is0.30 µg/l. The maximum allowable content of cis-chlordane in water by WHO is 0.005 µg/l. The concentration of Cis-chlordane in Olomoro wetland is higher than the acceptable. This report is at variance with the reports of Hassan and Adekunle (2018) in Ogun River Ogun state but similar to the reports of Ugwoke and Nwoye (2017) in Oji River Enugu state Nigeria. The organochlorine analysis of Olomoro wetlands revealed that the endolsulfan mean concentration in Olomoro wetland is 0.26 µg/l. The maximum permissible concentration of endolsulfan in water as recommended by WHO is 0.08 µg/l. Endosulfan concentration of Olomoro wetland is higher than recommended limit. Increased concentration of endolsulfan in water was reported by Anyakora and Adepoju (2016) in Lagos lagoon in Bonny Camp, Lagos. Alani (2018) equally reported high endolsulfan in Ikpoba River, Benin City.

V. Conclusion

The dream of any nation is to achieve a formidable workforce to grow the economy for good living standards for its citizens and this can only be achieved by investing on the human capital base of the country. Educating youths in aquaculture adopting happa aquaculture has been tipped as a very viable model for optimizing human capital developmentfor improved economic growth and development. Good quality water is a major factor in happaaquauclture hence this study of the organochlorinepesticides content analysis of Olomoro wetland for its suitability for happa aquaculture in secondary schools.

The result of the analyses showed an unacceptable level of organochlorinepesticides in the wetland pollution which only source in the environment is through agriculture. The implementation of happa aquaculture therefore may not be advised in the present pollution status of the wetland.

VI. Recommendations

Against the backdrop of the result of the analyses of the organochlorine pesticides content of Olomoro wetland, the study recommends thus:

1. Happa aquaculture should not be implemented in Olomoro wetlands due to organochlorine pollution of the wetland.
2. The source of the pollution should be identified and discontinued
3. Decontamination and cleanup and remediation should be commissioned in the wetland to return the health of the wetland to its previous pristine condition to allow for the deployment of happa aquaculture in the wetland for optimising human capital development for economic growth and development in Nigeria.

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