



Organochlorine Pesticides Determination of Okumesi River Umukwata for Pen Aquaculture in Schools: A Tool for Wealth Creation in Nigeria

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ABSTRACT

The ambition of any nation is the provision of sound and qualitative education which will equip its citizens with relevant skills and competencies that will engender and wealth creation for a good living standard, rapid economic growth and development. Vocational training in agriculture has been highly rated as a tool for wealth creation especially aquaculture deploying pen aquaculture. Good quality water is an imperative in pen aquaculture and that underscores this study. The focus of this study is the determination of the organochlorine pesticides content of Okumesi River Umukwata for its suitability for pen aquaculture in schools for wealth creation. This study is an ex post facto research. Three research questions were answered and a hypothesis tested. To accomplish this, Okumesi River Umukwata was mapped out into five (5) research blocks, water samples were collected from five sampling sports at 10 cm depth and covered subsurface. The samples from each research block were bulked, a composite drawn and fixed with HNO_3 and stored in ice cooled boxes for analysis. The analytical standards adopted were CAEM, USEPA 8081A and APHA and the analytical instruments used for determination of the organochlorine pesticides is Agilent 7280A GC. The results of the analysis are: adrin, $1.40 \pm 0.04 \mu\text{g/l}$, heptachlor epoxide, $0.45 \pm 0.11 \mu\text{g/l}$, cis chlordane, $2.33 \pm 0.12 \mu\text{g/l}$, endosulfan $0.74 \pm 0.01 \mu\text{g/l}$ and transchlordane $0.49 \pm 0.11 \mu\text{g/l}$. The results of the organochlorine pesticides investigated in Okumesi River Umukwata were subjected to tests of significance with ANOVA with denominator 20 and numerator 4 at 0.05 level of significance. The F ratio calculated value is 4.83 while F ratio critical is 2.87. Thus rejecting H_0 . The study recommends that pen aquaculture should not be implemented in Okumesi River Umukwata with the current pollution status; source of pollution should be identified the contained and remediation should be commenced in Okumesi River Umukwata for pen aquaculture in schools for wealth creation in Nigeria.

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INTRODUCTION

Wealth of a nation is a "magnum opus" of the Scottish economist Adam Smith 1776: enquiry into nature and

causes of wealth of a nation. This book gave the world first insight on how wealth can be created. Comprehending the concept wealth will be a prelude for



apprehending wealth creation. Dell (2020) defined wealth as a measure of the value of assets worth owned by an individual, community or a nation. It is the abundance of valuable material possession (Merriam 2018). Wealth according to Samson (2020), Bedwell (2019) is the quantification and qualification of possessions, property, how much a person has in his savings or assets. It is the sum total of all assets that is owned by a person (cash houses furniture and money in the bank) (Milakovic 2020). Wealth creation is the process of creating and building a stable source of sustenance so that one will not have to struggle to make ends meet (Harris 2018). Mann (2020) defines wealth creation as the steady and consistent accumulation of income and assets. It is the ability to put in place business that can generate steady income to give the individual financial liberty (Jones 2019; Douglas 2018; Biden 2016). Amon (2018) sees wealth creation as the potential and passion to create something that generates income and engender financial freedom. It is the ability to invest time and money in a steady income yielding venture (Bradson 2015). For Ferguson (2018) Osmond (2016), Zell (2015) wealth creation is the process of developing an investment strategy that will create a steady income flow for an enhanced standard of living. It is the roadmap to economic well-being and financial freedom (Petris 2016; Goldberg 2017; Sach 2018).

According to Hansen (2012) wealth creation is only feasible in a country where the educational system places more emphasis on manipulative education such as technical and vocational education. This same position was canvassed by Osmond (2014), Maduagu (2012), Umeri (2010) who stated that Nigeria education system should de-emphasize paper qualification and put more emphasis in creative psychomotor curriculum such as technical and vocational education.

The curriculum should emphasize what you can produce to create jobs not as job seekers (Edward, 2018). David (2012) reiterated that technical and vocational education which is the training, acquisition and utilisation of relevant skills by adults and youths is indispensable for wealth creation. Ikeoji (2010) also supported this standpoint that technical and vocational education will equip youths to be self-employed and wealth creators. Osugo (2010); Tahiru 2008; Adeyinka (2012) advised that youths should be exposed to technical and vocational training in skills such as metal work, joinery, welding and fabrication, painting, animal production, crop production, and aquaculture for self-employed, and wealth creation.

In response the Federal Government through Nigeria Educational Development and Research Council (NERDC) introduced trade and entrepreneurship in secondary school curriculum in 2013. The rationale of the trade and entrepreneurship curriculum according to NRDC (2013) is that at graduation from senior secondary school the child would have been well prepared for academics in tertiary education as well as being well equipped with trade and entrepreneurial skill to make a living and create wealth. The trade and intrapreneurship skills were in 34 skill areas such as block making, GSM repair, craft and painting, animal husbandry, aquaculture, (fish farming) and so on.

Azusu (2014), Okwara (2016), Onwudiegwu (2016) admonished youths to embrace aquaculture agriculture for self-empowerment, food security and wealth creation. Agripreneur in aquaculture will enhance job and wealth creation by the youths rather than looking for non-existing white collar jobs (Digba 2016, Abulu 2016). Adeosun (2017), Posu (2018) advised that youths should venture into aquaculture adopting pen aquaculture which has low investment outlay as it eliminates the problem of water. Food and Agricultural



Organisation (FAO) (2007) defined pen aquaculture as a practice of housing fish in an enclosure with the bottom formed by the bottom of the stream, lake, river or sea.

Bamgboye (2016), Uzoma (2015), Adigun (2017) cautioned that in adopting pen aquaculture, water analysis should be conducted for the presence of pollutants to prevent bioaccumulation and biomagnification. Aneke (2016), Gilman (2013), Zamahi (2018) listed water pollutants to include microplastics, polybrominated diphenyl ethers (PBDEs), heavy metals, detergents, pesticides such as organophosphates and organochlorines. Bioaccumulation is the presence of toxicants in the tissue of organisms while biomagnification is the tendency of the toxic substance to multiply rapidly in organisms tissue (International Union of Pure and Applied Chemistry, 2013) Organochlorine are compounds containing carbon and chlorine atoms which are used in pesticides formulation (United States Environmental Protection Agency (USEPA), 2012, Agency for Toxic Substances and Disease Registry (ATSDR), 2012). Human exposure to organochlorine pesticides result in health complications such as endometriosis cancer infertility in both male and female and so on.

Fish is an important source of protein vitamin fat and carbohydrate (Nzekwu, 2015, Ogune, 2013). Fish is the only source through which the rural poor can achieve their daily protein requirement of 56 g for male and 46g for female as advised by the World Health Organisation (WHO) (Njoku 2005). Nigeria fish demand according to the National Bureau of Statistics (2019), Audu (2016), Adesina (2014) is 2.7 metric tons and the local production is 750,000 metric tonnes. The shortfall between demand and production is usually bridged through importation. According to the United States agency for International Development (USAID) (2013) Nigeria

spends 625 million Dollars in fish importation. National Bureau of Statistics (NBS) (2019) puts the amount of money Nigeria spends on fish importation at 125 billion Naira. According to Ruwani (2020), Oteriba (2018), Okoye (2017) when Nigeria spends so much in fish importation, she imports unemployment and exports employment. It is against this backdrop that the study of the organochlorine pesticides content of Umukwata for pen aquaculture in schools for job and wealth creation for Nigeria youths became imperative.

Research Questions

This study was guided by the following research questions:

1. What are the concentrations of adrin, heptachlor epoxide, Cis chlordane, endosulfan I and trans chlodane in Okumesi River Umukwata.
2. Are the organochlorine pesticides content in Okumesi River Umukwata within the maximum allowable concentration as stipulated by WHO (2014)?
3. Can pen aquaculture be deployed in Okumesi River Umukwata by the schools and youths of Umukwata for wealth creation?

Research hypothesis:

Ho: there is no significant difference between the organochlorine pesticides content in Okumesi River Umukwata and WHO maximum allowable concentration for organochlorine pesticides in water

Study Area

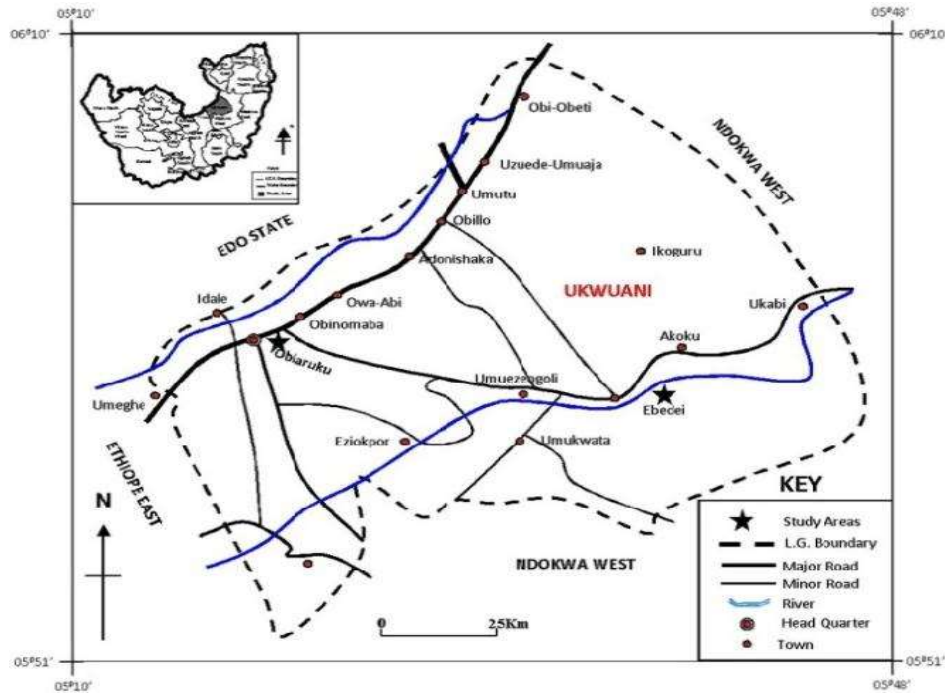


Figure 1: Map of Ukwani showing Umukwata Source: Ojieh, V. N. (2012)

Umukwata is a peasant community in Ukwani Local Government Area Delta State. It lies within the geographical coordinates of 5.8089°N and 6.2402°E. The people of Umukwata are mainly farmers with some engaged in fishery, some are artisans while some are petty traders. Okumesi River runs north east of Umukwata and acts as the cesspool of the agriculture waste such as fertilizers and pesticides through runoff, flash floods and erosion.

MATERIALS AND METHODS

The design of this study is an ex post facto. Okumesi River Umukwata was mapped out into five (5) research blocks (Miller, 2012; Cole, 2013). From each of the research blocks, water samples were

collected from five (5) sampling spots at the depth of 10 cm and covered subsurface. The samples from each block were bulked, a composite drawn and fixed with nitric acid HNO_3 and stored in ice cooled boxes for analysis. The analytical standards adopted were Chemical Analysis for Ecological Matters (CAEM) United States Environmental Protection Agency (USEPA) 3570 and American Public Health Association (APHA). The analytical instrument adopted for determination is Agilent 7820A GC.

RESULTS

The result of the concentrations of organochlorine pesticides in Okumesi River Umukwata is as in Table 1.

Table 1: Concentration of the organochlorine pesticides in Okumesi River, mean, standard deviation and WHO MPC in $\mu\text{g/l}$

Parameters	Research Stations					Mean	Std. Dev	WHO MPC $\mu\text{g/l}$
	A	B	C	D	E			
Adrin	1.42	1.33	1.41	1.40	1.43	1.40	0.04	0.030
Heptachlorepoxide	0.38	0.64	0.42	0.40	0.43	0.50	0.11	0.015
Cis Chordane	2.12	2.33	2.41	2.40	2.38	2.33	0.12	0.05
Endosulfan I	0.91	0.72	0.74	0.68	0.67	0.74	0.10	0.08
Trans Chlordane	0.67	0.38	0.47	0.45	0.46	0.49	0.11	0.01

The mean concentration of the organochlorine pesticides content of Okumesi River are presented in Figure 2.

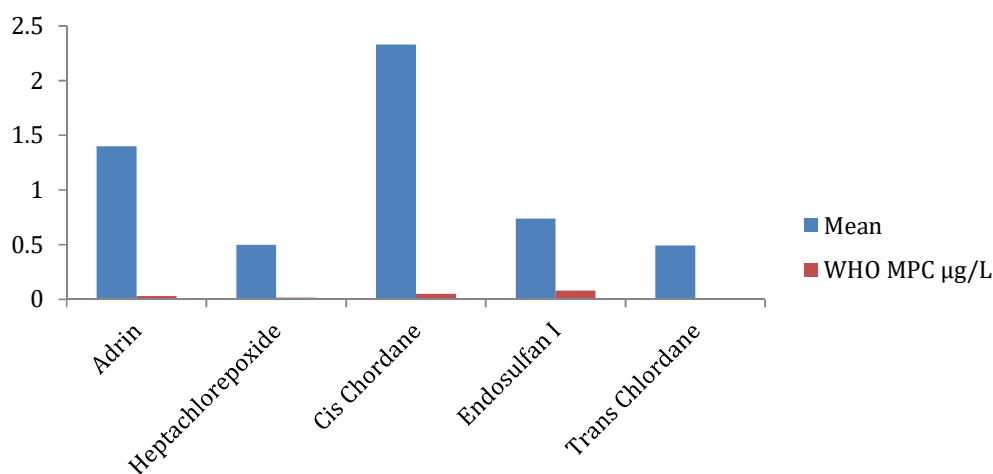


Figure 2: Organochlorine pesticides content of Okumesi River Umukwata and WHO MPC in $\mu\text{g/l}$

Table 2: Analysis of the variance of the organochlorine pesticides concentration of Okumesi River Umukwata

Source of variation	SS	df	MS	F	p-value	F crit
Between Group	66702.21134	4	16675.55283	948228.8658	4.82783E-	2.866081
Within Groups	0.35172	20	0.017586		52	
Total	66702.56306	24				

The results of the organochlorine pesticides content of Okumesi River Umukwata were subjected to test of significance with analysis of variance (ANOVA) with denominator 20 and numerator 4 at 0.05 level of significance. The F ratio calculated value is 4.83 while F-ratio critical is 2.87, thus rejecting H_0 which states that there is no significant difference between the organochlorine

pesticides content of Okumesi River Umukwata and WHO maximum allowable concentration for organochlorine pesticides in water.

DISCUSSION

Youths empowerment, job and wealth creation are global aspirations. The quest of every country is to provide youths with functional education that will



activate job and wealth creation. Aquaculture which has been recommended as a viable option for job creation among youths requires good quality water for its implementation hence this study. The results of the analysis of Okumesi River Umukwata revealed varying concentrations of organochlorine pesticides.

The concentration of adrin in Okumesi River Umukwata is between 1.43mg/l and 1.33mg/l with a mean concentration of 1.40 ± 0.04 mg/l. The WHO maximum permissible concentration for adrin in water is 0.30mg/l. The concentration of adrin in Okumesi River is higher than the maximum allowable concentration. Elevated concentrations of adrin in water has been reported by Ojodu (2015) in River Ose in Ondo state and Omoikhudu (2018) in Ikpoba river Benin City. The concentration of heptachlor epoxide in Okumesi River Umukwata the analysis revealed is between 0.43 μ g/l and 0.38 μ g/l with a mean concentration of 0.45 ± 0.11 μ g/l. The WHO maximum permissible concentration of heptachlor epoxide in water is 0.015 μ g/l. The concentration of heptachlor epoxide is higher than the recommended concentration by WHO. Increased concentration of heptachlor epoxide was recorded by Adeyemi (2015) in Ogun River, Ogun State and Okeke (2013) who also recorded high concentration of heptachlor epoxide in Oguta Lake, Imo State. The analysis of Okumesi River Umukwata revealed that the concentration of cis chlordane is between 2.40 μ g/l and 2.12 μ g/l with a mean concentration of 2.33 ± 0.12 μ g/l. The WHO stipulated concentration for cis chlordane in water is 0.05 μ g/l. The concentration of cis chlordane in Okumesi River Umukwata is higher than the acceptable limit. This report is similar to the report of Ugagbe and Ubeku (2018) in Okan River, Agbarho Delta State. It is however at variance with the findings of Ojo & Odum (2013) who recorded low cis chlordane in Ogbese

River Ondo state. Endosulfan 1 concentration the analysis of Okumesi River Umukwata revealed is between 0.91 μ g/l and 0.67 μ g/l with a mean concentration of 0.74 ± 0.01 μ g/l.

The World Health Organisation maximum permissible concentration for endosulfan in water is 0.08 μ g/l. The concentration of endosulfan 1 in Okumesi River Umukwata is higher than the recommended limits. High concentrations of endosulfan 1 in water has been reported by Clarke and Adeleke (2013) in Olomoge, Badagry, and Lagos. Badru (2018) also reported elevated endosulfan 1 in Bateren River Warri South Delta state. Trans-chlordane analysis in Okumesi River Umukwata showed that trans-chlordane concentration is between 0.67 μ g/l and 0.38 μ g/l with a mean concentration of 0.49 ± 0.11 μ g/l. The WHO maximum allowable concentration for trans-chlordane in water is 0.01 μ g/l. The concentration of trans-chlordane in Okumesi River is higher than the limit recommended by World Health organization. This report is in tandem with the report of Adepoju (2015) who reported high concentration of trans-chlordane in Otin River Osun State but dissimilar with the result of Badejo & Odion (2016) who reported low trans-chlordane in Erinle river in Osun State too.

CONCLUSION

Unemployment, poverty and hunger are global challenges that require solutions. Sound educational system that will provide the youths with competent skills for job and wealth creation such as TVET have been highly favoured in many climes including Nigeria. Vocational training in agriculture, such as in pen aquaculture requires good quality water for its implementation, and that mandated this study. The result of the analysis of Okumesi River Umukwata has shown that the River is highly polluted with organochlorine pesticides investigated and may not be suitable for



the deployment of pen aquaculture in its present pollution status to avoid bioaccumulation and biomagnification of the pollutants which will endanger the health of consumers and hence, antithesis to wealth creation.

RECOMMENDATIONS

Sequel to the results of the analysis, the study recommends thus:

1. Pen aquaculture should not be carried out in Okumesi River at the present pollution status
2. Pollution source should be identified and plugged
3. Decontamination and remediation should be carried out in Okumesi River Umukwata to allow for the deployment of pen aquaculture for wealth creation in Nigeria.

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