IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS)
ISSN (P): 2347–4580; ISSN (E): 2321–8851
Vol. 9, Issue 6, Jun 2021, 9–18

ASSESSING THE ORGANOCHLORINE PESTICIDES LOADING OF OKUMESI RIVER EBEDEI UNO FOR CAGE AQUACULTURE IN SCHOOLS; A TOOL FOR LIFELONG LEARNING IN NIGERIA

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Received: 09 Jun 2021 **Accepted:** 15 Jun 2021 **Published:** 21 Jun 2021

ABSTRACT

A country's economic growth, development and sustainability is predicated on its educational system. Lifelong learning has been recognized as a pathway for youth's empowerment, strong economy and good living standards hence its adoption in many economies. Aquaculture is a lifelong learning that requires good quality water for its implementation and that underpins this study. The focus of this study therefore is the determination of the organochlorine pesticides content of Okumesi River Ebedei Uno for its suitability for Cage aquaculture in schools. The study design is ex-post facto, three research questions were answered and a hypothesis tested. To accomplish this, Okumesi River was mapped out into five research blocks and from each of the research blocks, water samples were collected from 5 spots, bulked, a composite drawn, fixed with HNO_3 and stored in ice cooled boxes for analysis. The analytical standards adopted were Steindwandter and Shufter 1978, USEPA 3570 and APHA and the analytical instrument deployed for determination is Agilent 6100 series single quadrupole LC/MS. The analyses revealed thus: endrin aldehyde is 2.39±0.24µg/l; endosulfansulphate; 1.41±0.08µg/l, Pp DDT 2.72±0.61µg/l; endrin ketone; 1.42±0.06µg/l and methoxychlor; 0.69±0.24µg/l. The results of the organochlorine pesticides investigated were subjected to test of significance with ANOVA with denominator 20 and numerator 4 at 0.05 level of significance. The F ratio calculated value is 5.74 while F-ratio critical is 2.87, thus rejecting Ho. The study recommends that aquaculture should not be deployed in Okumesi River at its present organochlorine pollution status, the source of the pollutants should be identified and plugged and remediation and decontamination be carried out in Okumesi River Ebedei Uno for youths lifelong learning in cage aquaculture.

KEYWORDS: *Lifelong Learning, Cage Aquaculture, Pollution, Bioaccumulation, Remediation*

INTRODUCTION

The aspiration of every nation is to provide its citizens with functional and productive education to enable them live as responsible citizens for the growth of the economy and perpetuation of the societal ideas. The productive and manipulative education that will enable youths to achieve their career and professional growth is lifelong learning. Lifelong learning according to Baldwin (2018), Johnson (2013) is a self-motivated voluntary pursuit of knowledge for professional or personal reasons. It is the education that enhances formal development and self-sustainability (Jewell & John, 2016). Brooks (2017), Tedwin (2018) see lifelong learning as an education that is self-initiated which focuses on personal development and occurs outside a formal educational institute. It is the Education premised on the proposition that formal training is only just the beginning, knowledge accumulates at such a fast rate that one must continue to learn to be effective

(Williams 2015, Paulson, 2017). Lifelong learning according to Duker& Jones (2019) is the Education that is conducted usually outside personal class to equip the learners with psychomotor skills which they inturn build on in later life to survive the changing societal demands on such skill. It is learning that is a continuous development of knowledge and skills after formal education and builds on prior knowledge to expand the knowledge and skill (Bertrand 2018). Benson (2019), Quim (2017) declaredthat lifelong is a learning hinged on the assumption that not every knowledge and skill demand can be taught in a formal school setting, individual continues to build on the formal school knowledge to improve their competencies. It is the knowledge that equips the learners with skills in vocational and technical education to enable them earnliving and reduce youths unemployment. Liz (2018), Nell (2017), Song (2012) surmise that lifelong learning is the education that is self-motivating whose objective is professional development and include training in skills such as internship, apprenticeship, and adding to your skills competency during employment. Succinctly put by Donald (2014), Bush and Hall (2019) lifelong learning is learning that involves acquiring skills in manipulative trades such as in technical and vocational (TVET) skills in schools and may include skills in electrical installation, foundry, brick-making, joinery and furniture, crop production, animal husbandry, fish farming or aquaculture and so on.

In response to inculcating lifelong learning in Nigeria youths, the federal government introduced trade entrepreneurship curriculum in senior secondary schools. According to Nigeria Education Research and Development Council (NERDC) (2013) the objective of trade curriculum is to enable the secondary school graduates acquire technical skills in addition to academic knowledge to enable them function as job creators rather than job seekers. The trade curriculum skills include brick-making, photograph, GSM repairs, clothing and textile, animal husbandry, fish farming or aquaculture and so on.

Nigeria youths should be encouraged to go into aquaculture lifelong learning to reduce youths unemployment (Anukwu, 2017; Ogodo, 2017; Ijie, 2018). According to Shimite (2017), Tahir (2017), Adeyemi (2017) providing youths with fish farming skills and encouraging them to go into aquaculture will enable the youths acquire lifelong learning to be responsible members of the society, reduce youth unemployment, youths restiveness and insecurity in Nigeria.

Fish is an important component of human diet as it contains protein, carbohydrate, vitamins, minerals and fat (Banjoko, 2016; Beke, 2018; Tondo 2017). It is the only means rural population can meet up with their daily protein requirements of 56 for men and 46g for women as recommended by World Health Organisation (Oghenetega, 2017; Study, 2012; Itaghene, 2018).

According to Nanono (2019) Nigeria annual fish requirement stands at 2.7 million tons but the country domestic fish production is 80,000 metric tons. Adesina (2014) puts the domestic fish production at 790,000 metric ton and annual fish demand at 2.7 million tones. The gap between the demand and supply is bridged through importation. Nigeria spent 1.2 billion dollars on fish importation in 2017 (Food and Agriculture Organisation (FAO), 2018). Adesina (2014) puts the value of fish importation in Nigeria at 100 billion naira. When Nigeria imports fish, she imports unemployment and exports employment (Audu, 2015; Oteriba, 2019; Ruwani, 2018).

Afolabi (2016), Odogwu (2018) enjoined Nigeria youthsto embrace aquaculture through the adoption of cage aquaculture because of its low investment outlay. Cage aquaculture is the practice of raising fish in cage net anchored in a natural water. (Osagie 2018, Momodu, 2017).Osele (2018) advised that water analysis should be carried out before the deployment of cage aquaculture for possible presence of pollutants to avoid biomagnification and bioaccumulation.

Bioaccumulation is the presence of toxicants in the tissues of organisms while biomagnification is tendency of such toxicants to multiply in geometry in the organism's tissue from one trophic level to another (United States Environmental Protection Agency (USEPA), 2012; International Union of Pure and Applied Chemistry (IUPAC), 2015).

Possible water toxicants or pollutants as highlighted by Anyakora and Coker (2012), Alani (2011) include microplastics, polychlorinated biphenyls (PCBs), poly aromatic hydrocarbons (PAHs), pesticides such as organophosphate (Ops), carbamate and organochlorines (Ocs). Organochlorine are compounds containing carbon and chlorine atoms that are used in pesticides formulation (Atshana and Atshana, 2015). Exposure to organochlorines leads to health complications such as cancer, reproductive problems in male and female, endometriosis, infertility and so on (Jones and Edger, 2018; USEPA, 2014).

The purpose of this study is to determine the organochlorine pesticides content of Okumesi River Ebedei Uno for its suitability for cage aquaculture in schools for lifelong learning.

Theorganochlorines pesticides investigated include: endrin aldehyde, endosulfansulphate, Pp DDT, endrin ketone and methoxychlor.

The Study is Guided by the Following Research Questions As

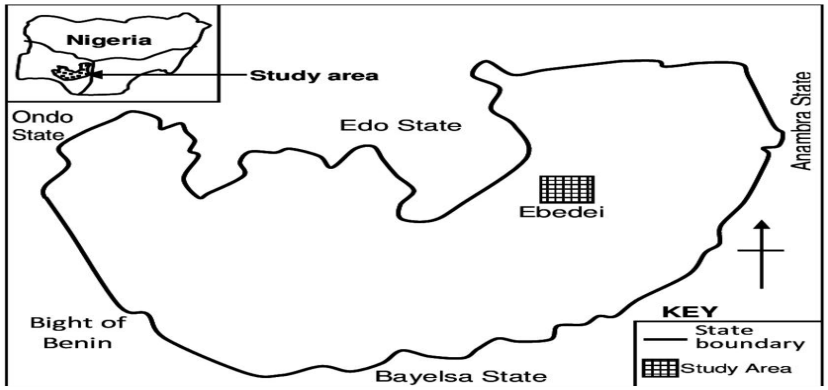
- What are the concentrations of endrin aldehyde, endosulfansulphate, PpDDT, endrin ketone and methoxychlor in Okumesi River Ebedei Uno?
- Are the concentrations of these parameters within the maximum allowable concentrations for these organochlorines in waters stipulated by World Health Organization?
- Can cage aquaculture be deployed in OkumesiEbedei Uno for lifelong learning in aquaculture (fish farming) at its present pollution status

The Study Is Guided By a Hypothesis As Follows

Ho: there is no significant difference between the concentrations of organochlorine pesticides investigated and the World Health Organization maximum permissible concentrations for the organochlorines pesticides in water.

Study Area

Ebedei Uno is an ancestral home of all the Ebedei people with a population of 30554 inhabitants (Nigeria Population Census, 2006). The people of Ebedei Unoare agrarians with some involved in petty trading and very few ARE artisans. Ebedei lies within geographical coordinates of 5.8190°N and 6.2721°E. Okumesi River runs south east of Ebedei and is the recipient of agricultural effluents discharges from agrarian activities especially fertilizers and pesticides through run offs, flash floods and erosion.



Source: Anomohanran, O. (2012)

Figure 1: Map of Delta State showing Ebedei Uno.

MATERIALS AND METHODS

This study is an ex-post facto research. Okumesi River was mapped out into 5 research blocks designated sampling blocks A, B, C, D and E (Abdulfatai, 2015). From each of the sampling blocks, water samples were collected with clean plastic sampling bottles tied to a graduated string from5 spots at 10 cm depth and covered subsurface. The samples from each sampling block are bulked, a composite drawn and fixed with nitric acid (HNO_3) and placed in ice cooled boxes for analysis.

The analytical standards adopted where Steindwandter and Shufter, 1978, United States Environmental Protection Agency (USEPA) 3570 and American Public Health Association (APHA) standards. The analytical instruments deployed for determination of the pesticides is Agilent 6100 series single quadrupole liquid chromatography and mass spectroscopy (LC/MS).

RESULTS

The results of the organochlorine pesticides investigated in Okumesi River Ebedei Uno are as in Table 1.

The mean concentration of the organochlorine pesticides investigated were presented graphically with bar chart as in Figure 2

Table 2 shows the results of the organochlorine pesticides investigated were further subjected to test of significance with analysis of variance with numerator 4 and denominator 20 and 0.05 level of significance. The F ratio package value is 5.74 while F-ratio critical value is 2.87, thus rejecting Ho which states that there is no significant difference between the concentrations of organochlorine pesticides investigated in Okumesi River and WHO maximum permissible concentration for the pesticides in water.

Table 1: Organochlorine Pesticides Concentration, Mean, Standard Deviation and WHO Maximum Allowable Concentration for the Organochlorines in Water in Mg/L

Parameters	Research Stations					Mean	Std. De.	WHO MPC µg/l
	A	B	C	D	E			
Endrin Aldehyde	2.06	2.72	2.36	2.44	2.38	2.39	0.24	0.05
Endosulfansulphate	1.34	1.33	1.42	1.51	1.46	1.41	0.08	0.08
Pp DDT	2.82	2.73	2.72	2.68	2.66	2.72	0.06	1.10
Endrin ketone	1.47	1.33	1.42	1.48	1.40	1.42	0.06	0.10
Methoxychlor	0.26	0.74	0.82	0.81	0.80	0.69	0.24	0.10

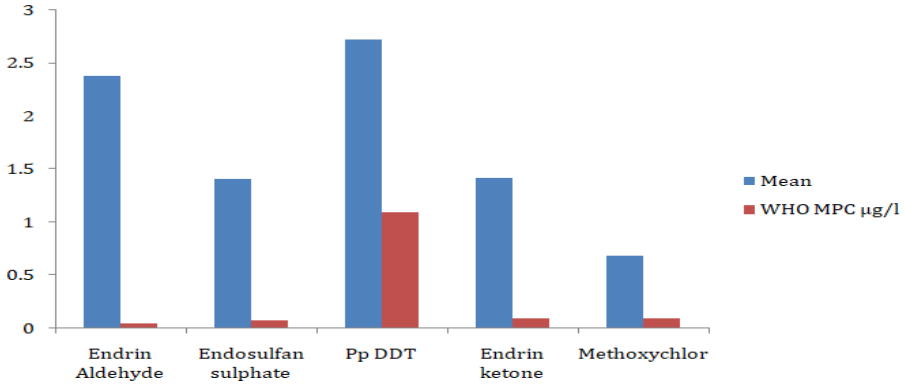


Figure 2: Mean Concentrations of the Organochlorine Pesticides in Okumesi River Ebedei and WHO Maximum Allowable Concentration in Mg/L.

Table 2: Analysis of Variance of the Organochlorine Pesticides Loading of Okumesi River, Ebedei Uno

Source of Variation	SS	df	MS	F	p-value	F crit
Between Group	27823.59146	4	6955.897866	134030.172	5.73971E-44	2.866081
Within Groups	1.03796	20	0.051898			
Total	27824.62942	24				

DISCUSSIONS

The dream of every nation is the inculcation of sound and qualitative education for the sustainability and perpetuation of the ideals of the society and this can only be achieved through the activation of lifelong learning. Aquaculture (fish farming) deploying cage aquaculture is a lifelong learning that requires good water quality devoid of pollutants for its actualization and that underscores this study.

The analyses of Okumesi River revealed the following organochlorine pesticides concentrations. The concentrations of endrin aldehyde are between 2.06µg/l and 2.44µg/l with a mean concentration of 2.39±0.24µg/l. The WHO maximum allowable concentration for endrin aldehyde in water is 0.05µg/l. The concentration of endrin aldehyde in Okumesi River Ebedei Uno is higher than the maximum allowable concentration for endrin aldehyde in water. This result is similar to the result of Anyakora and Coker (2012) in Bonny Camp who recorded high endrin aldehyde and Alani (2011) who also reported high endrin aldehyde concentration in Lekki lagoon, Lagos. The concentrations of endosulfansulphate in Okumesi River the analysis revealed is between 1.33µg/l to 1.57µg/l with a mean concentration of 1.41±0.08µg/l. The WHO maximum allowable concentration for endosulfansulphate in water is 0.80µg/l. Endosulfansulphate mean concentration in Okumesi River is higher than the maximum allowable concentration for endosulfansulphate in water. High concentration of endosulfansulphate in water has been reported by Ogidan & Osagie (2016) in Gelegele wetlands in Benin City. Okpor (2018) also reported high endosulfansulphate in Ashaka wetlands Delta state. The concentration of PpDDT in Okumesi River is between 2.82µg/l to 2.66µg/l with mean concentration of 2.72±0.08µg/l. The WHO maximum allowable concentration for PpDDT in water is 1.10µg/l. The PpDDT concentration in Okumesi River Ebedei Uno is higher than WHO stipulated limit for Pp DDT organochlorine pesticides in water. This report is in agreement with Adegoke (2015) who reported high Pp DDT in Ogun River at Kara River Lagos and Okoye (2017) who also reported high concentration of Pp DDT in Olomoge lagoon Badagry Lagos. The analysis of water of Okumesi River revealed that endrin ketone concentration is between 1.48µg/l and 1.33µg/l with a mean concentration of 1.41±0.06µg/l. The WHO stipulated limit for endrin ketone in water is 0.10µg/l. The endrin ketone in Okumesi River is higher than acceptable limit forendrin

ketone in water. This increased level of ketone is at variance with the report of Ogodo and Ubienu (2015) who reported low level of edrin ketone in Otogor wetlandsUghelli, Delta Statehowever; it is in tandem with report of Olokor (2014) who recorded high concentration of edrin ketone in Ubeji wetlands Warri South Delta State. The concentration of methoxychlor in Okumesi River is between 0.81µg/l and 0.26µg/l with a mean concentration of 0.69±0.24µg/l. The World Health Organisation (2014) stipulated limit for methoxychlor in water is 0.10µg/l. The concentration of methoxychlor in Okumesi River is higher than the acceptable concentration for methoxychlor in water. Elevated methoxychlorin water was reported by Odia & Ojo (2016) in Ogbese RiverOndo. Osuagwu & Nwangwuna (2019) also reported high concentration of methoxychlor in Njaaba River in Imo State.

CONCLUSIONS

The failure of our educational systems dependence on paper qualification with its concomitant effect of heightened youths unemployment, demands a paradigm shift in our pedagogy bythe inculcation of lifelong learning in the youths for job and wealth creation. Aquaculture as lifelong learning requires good quality water to avoid bioaccumulation and biomagnification of pollutants in the produce and the attendant health implications and this mandated this study. The results of the analysis revealed that Okumesi River Ebedei Uno is polluted with organochlorine and cage aquaculture cannot be implemented at the present pollution status so as to avoid health disorders hitherto highlighted.

RECOMMENDATIONS

Sequel to the Outcome of This Investigation, the Study Recommends Thus:

- The concentration of endrin aldehyde, endosulfansulphate, Pp DDT, endrin, ketone and methoxychlor are high in Okumesi River so cage aquaculture cannot be deployed to Okumesi River at its present pollution loadings.
- The source of the organochlorine pesticides pollution should be identified and plugged to check further pollution of Okumesi River.
- Remediation and decontamination of Okumesi River should be commissioned forthwith so as to allow the deployment of cage aquaculture lifelong learning in schools.

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