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Organochlorine Pesticides Analysis of Okumesi River Amai for Pen Aquaculture in Schools: A Road Map for Youths Entrepreneurship in Nigeria

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Abstract: *Economic growth and stability of a country is predicated on the population of its citizens that are gainfully employed. Entrepreneurship is a viable means of ensuring youths empowerment wealth creation and hunger eradication especially entrepreneurshipin aquaculture. Pollutants free water is a necessity in aquaculture hence this study. This study is an ex post facto research with three research questions answered and a hypothesis tested. In carrying out the study,Okumesi River was mapped out into research blocks; water samples were randomly collected from 5 spots, in each research block, bulked and a composite drawn for analysis. The analytical standards adopted were Chemical Analysis of Ecological Matters (CEAEM), American Public Health Association (APHA), American Environmental Protection Agency (USEPA) 3570 and the analytical instrument employed for organochlorine pesticides determination is Agilent 7820A. The results obtained are as follows: alpha lindane; 1.37±0.34µg/l, beta lindane 0.67±0.15 µg/l, delta lindane 2.38±0.21 µg/l; gamma lindane; 1.62±0.23 µg/l and heptachlor; 2.14±0.12 µg/l. The results of the selected organochlorine pesticides investigated in Okumesi River Amai were subjected to tests of significance with ANOVA withnumerator 4 and denominator 20 at 0.05 level of significance. The F ratio calculated is 3.53 while the F ratio critical is 2.87 thus rejecting Ho. The study recommends that pen aquaculture should not be implemented in Okumesi River in the current pollution status; the pollution source points should be identified, and plugged.Decontamination of Okumesi River Amai should be commissioned forthwith.*

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I. Introduction

The persistent global crisis of unemployment which poses threat to the sustainable Development goals of no poverty and zero hunger has necessitated global calls for entrepreneurship among the youths and adults.Entrepreneurship, according to Stallion (2018) is the art of designing, organising, launching and running a business. It is the willingness and capacity to initiate, develop, organise and manage a business venture from risk point to profit level (Jacobson 2019, Jawaal, 2017, Davidson 2019). Baldwin (2016) Hann (2018) Sunil (2019) defined entrepreneurship as the process of organising and operating a business taking it from above normal or greater than normal financial point to a profitable position, while Nicole (2020), Samuelson (2020) surmised that entrepreneurship is the act of creating a business or businesses and administering it to profit level. For Suzzanne (2020), Stone (2017), Bill (2018) entrepreneurship is the study of how businesses are created as well as the actual running of a business. It is the ability to generate ideas or strive to create a new idea or product that people will want to buy and then put organisation in place to support the sales of the products and services (Boris 2018, Fatz, 2019).Abbort (2019) reiterated that entrepreneurship is the process of creating a new business, bearing the risk therein and reaping the profit. It is the concept of initiating,developing,organising and managing a business venture in order to gain profit (Kuz, 2020), Liz (2018) corroborated this standpoint that entrepreneurship is the ability to identify an innovation, goods or services, developing and managing the business goods and services from cradle to profit.

In the ideas of Miller (2018) Waston (2018), Brown (2020) the primary objective of entrepreneurship are to create jobs, reduce unemployment and generate wealth to achieve poverty and hunger eradication. Succinctly put by Howard (2015), Bedford (2018), Paulson (2019) the rationale of entrepreneurship is to reduce unemployment in both youths and adult population, generate wealth and eradicate poverty which arethe mandates of sustainable Development goals 1 and 2.

Okonkwo (2010), Abubakar (2012), Babajide (2013) enjoined the Federal Government of Nigeria to curb youths unemployment by inclusion of vocational technical and entrepreneurship education in the secondary schools curriculum. This was also canvased by Adeyemi (2013), Osugo (2012), Osaze (2013) that youths entrepreneurship through agriculture will be the viable option for job creation and poverty eradication in Nigeria. Osemede (2013), Tondo (2013), Okeme (2012) admonished that youths entrepreneurship in aquaculture agripreneur will reduce youths unemployment, create jobs and eradicate hunger.

The Federal Government of Nigeria in effort at checking unemployment among youths introduced entrepreneurship education in both secondary and tertiary education curricular in 2007 and 2013 respectively. According to Nigeria Universities Commission (2007) the objective of entrepreneurship education is for the graduates of universities to acquire knowledge, skill and attitude that would enable them become self-reliant and adapt to changing needs of the society due to globalisation and integration processes. Nigeria Educational Research and Development Council (NERDC) (2013) stated that the philosophy of trade and entrepreneurship curriculum is that at completion of three years of senior secondary school education every graduate/recipient should have been well prepared for higher education as well as acquire relevant functional trade/entrepreneurship skills needed for poverty eradication, job and wealth creation. The entrepreneurship Education in the universities covered all areas including animal husbandry, poultry production and aquaculture while trade/entrepreneurship curriculum in senior secondary schools centred in 34 skill areas such as block making, GSM repair, paint and dressmaking, animal husbandry, aquaculture and so on.

Mbanugo (2015), Odua (2016), Akpofure (2017) advised youths to venture into aquaculture adopting pen aquaculture because of its low capital outlay. Pen aquaculture is the act of raising fish in a pen/net built in a natural body of water with the floor of the river, sea or lake taken as the floor of the pen (Taylor 2016). It is a closed fish culture system where the pen is covered in three sides with the bottom formed by the lake, sea or river bed (Salim 2013), Adeleye (2013), Okundaye (2015), Olajupo&Mutiu (2018) advised that water analysis be conducted in a natural water before the deployment of pen aquaculture for the presence of pollutants to prevent bioaccumulation and biomagnification. Possible water pollutants as listed by Afolabi (2015), Adeyinka (2012), Abu &Umoru (2016) are microplastics, polychlorinated biphenyls (PCBs), polybrominateddiphenyls ethers (PBDEs), petroleum tar, heavy metals, dioxins, pesticides such as carbamate, organophosphorus and organochlorines and so on. Bioaccumulation is the tendency of toxicants to get into the tissues of organisms while biomagnification is the ability of the substance to increase or multiply in geometry from one trophic level to the other (United States Environmental Protection Agency, 2012). Organochlorine according to the Agency for Toxic Substances and Disease Regulatory (ATSDR) (2012), United States Environmental Protection Agency (USEPA) (2012) are compounds containing chlorine and carbon atoms that are used in pesticides formulation. Human exposure to organochlorinepesticides according to Atshana and Atshana (2013), USEPA (2012), ATSDR (2012) will lead to cancer, infertility and reproductive problems in male and female, endometriosis and so on..

Fish is an important source of protein carbohydrate, mineral, vitamin and fat (Ikolo, 2018, Omokhai, 2015). Fish is the means through which the rural population can achieve their daily protein requirement of 56g for male and 46g for female as recommended by (World Health Organisation, WHO, 2014). Nigeria annual fish demand is 2.7 million metric tons, but the domestic production is 750,000 metric tons (Adesina, 2014, Audu, 2015). Nigeria according to the United States Agency for International Development (USAID) (2013) spends 625 million US Dollar in fish importation, while the National Bureau of statistics puts the amount Nigeria spends in fish importation at over 100 billion Naira. Fish and other importations create unemployment in Nigeria (Badru, 2017, Tahil, 2018).The unemployment rate in Nigeria stands at 30.1 percent (National Bureau of Statistics (NBS), (2020), International LabourOrganisation (ILO), 2019) puts the rates of unemployment in Nigeria at 20.1 percent. It is against this backdrop that this study became germane. The purpose of this study is the determination of the organochlorine pesticides content of Okumesi River Amai for its suitability for pen aquaculture in schools for youths' empowerment for wealth creation poverty and hunger eradication in Nigeria.
This study is guided by the following research questions:

1. What arethe concentration of a-lindane, beta lindane, delta lindane, gamalindane and heptachlor in Okumesi River Amai.
2. Are the concentrations of the organochlorine pesticides within the limits stipulated by WHO 2014?
3. Can pen aquaculture be deployed in Okumesi River Amai?

II. Study Area

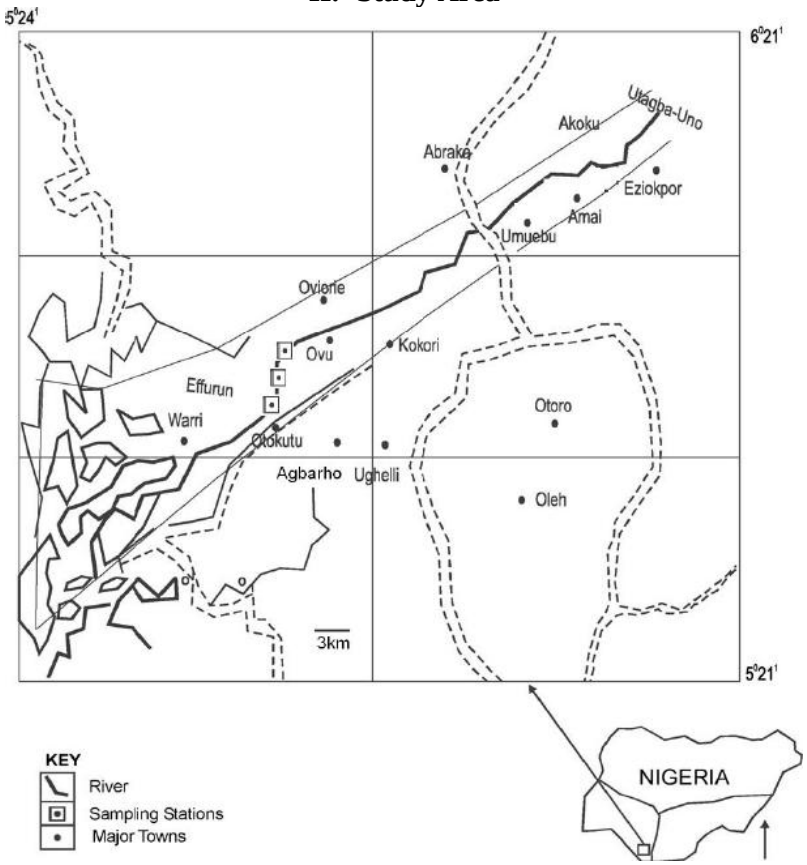


Figure 1: map of Amai

Amai is in Ukwani Local Government Area Delta State. It lies within the geographical coordinates of 5.7529° N, 6.2044° E. It is an agrarian community with few of the inhabitants as Petty traders while some are artisans. Okumesi River Amai runs at northwest of Amai and it is the recipients of agrarian wastes principally pesticides (insecticides and herbicides) and fertilizers through flash floods, erosion and runoffs.

III. Materials and Methods

The research designfor this study is an ex post facto. Okumesi River Amai was mapped out into 5 research blocks designated A B C D E (Edmunds 2015, Abdulfatai 2012). From each of the research blocks, water samples were collected from five spots with a clean plastic sampling bottle tied to a graduated string at 10 cm depth 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 procedures EPA 3570, and Steindwandter and Shutler (1978) with slight modifications were used. Approximately 10.0 grams of anhydrous sodium sulfate was added to a pre-cleaned motar and 5grams of fresh wet sediment was added to the motar and homogenized to a complete mixture with a pistle. The mixture was carefully transferred to a pre-cleaned PTFE extraction tube which has a PTFE screw cap. 5 to 10 pre-cleaned glass beads were added. 25 ml of a mixture of acetone and petroleum spirit (1:1) was added to the 100 ml PTFE extraction tube; the extraction tube was tightly capped and allowed to stand for minimum of 20 minutes. This allows complete permeation of solvent to the matrix. 20 tg/1 of the internal standard decaflourobiphenyl in iso-octane directly was added to the sediment and sodium sulphate mixture. The tube was shaken vigorously until the slurry is free-flowing. Any chunks were broken manually with the glass rod, working quickly but gently. The cap was replaced immediately after the breaking of the chunks. More sodium sulfate was added and manually mixed as necessary to produce free-flowing, finely divided slurry. The samples were extracted by rotating end-over-end for at least 30 minutes. Care was taken to release pressure by opening and closing the flasks at intervals. The solids were allowed to settle for one to two minutes. The solvent layer was filtered through a small glass funnel containing a layer of anhydrous sodium sulfate over a plug of glass wool into a receiving comical flask. The sodium sulfate was thoroughly pre-wetted with acetone before sample filtration. The sodium sulfate was rinsed with 2 to 3 mL of acetone as soon as the surface is exposed. The top of the sodium sulfate layer was not allowed to go dry. The sediment sample was extracted twice more by adding

approximately 15 mL of acetone/petroleum spirit mixture to the sample, capping the extraction tube tightly, and shaking vigorously by hand for 2 minutes. All the extracts are combined and poured into the round bottom flask of the rotary evaporator. The round bottom flask of the rotary evaporator is placed in a constant temperature hot water bath so that the concentrator flask is partially, but not completely, immersed. The temperature of the bath was adjusted and the position of the apparatus s that, the solvent heat evenly. The sample volume was reduced to approximately 1.0 ml.

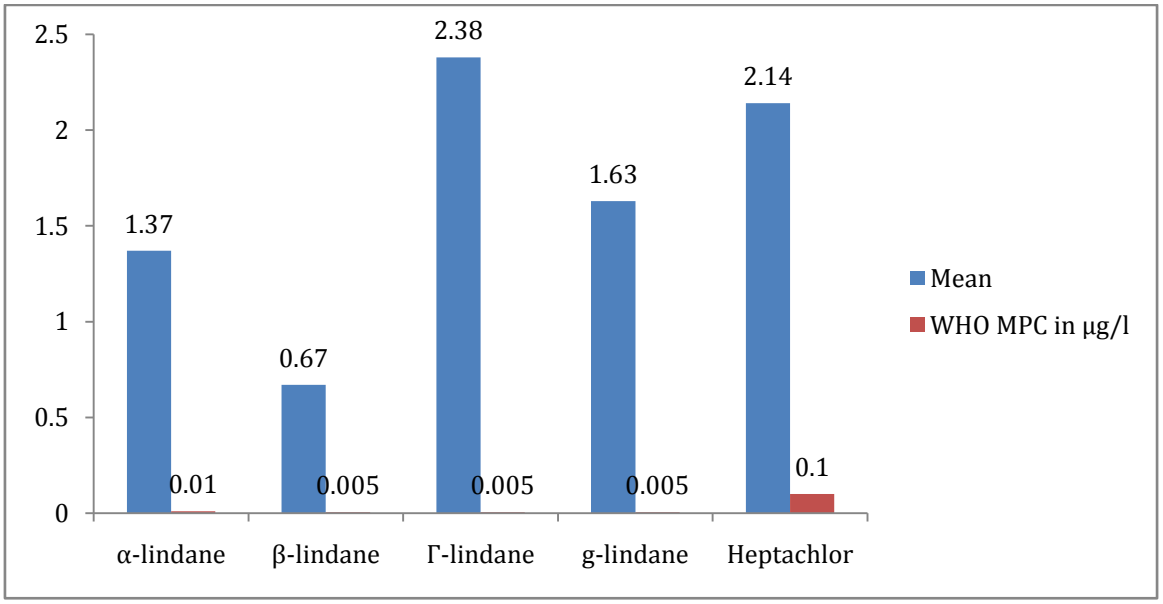
The analytical standards adopted where United States Environmental Protection Agency (USEPA) 3750,Chemical Analysis of Ecological Matter (CEAM). American Public Health Association (APHA). The analytical instrument diployed for determination is Agilent 7820.

IV. Result

The result of the organochlorine pesticide content of Okumesi River Amai is as in Table 1.

Table 1: Organochlorinepesticides content of Okumesi River Amaimean standard deviation and WHO MPC in µg/l

Parameters	**Research stations**					**Mean**	**WHO MPC in µg/l**
	A	B	C	D	E		
α-lindane	1.22	1.98	1.21	1.20	1.26	1.37	0.01
β-lindane	0.68	0.43	0.82	0.74	0.69	0.67	0.005
δ-lindane	2.35	2.90	2.21	2.23	2.22	2.38	0.005
γ -lindane	1.24	1.67	1.66	1.84	1.72	1.63	0.005
Heptachlor	2.00	2.32	2.04	2.12	2.21	2.14	0.1



The mean concentration of the organochlorine pesticide content of Okumesi RiverAmai was presented graphically is as in Figure 2.

The results of the organochlorine pesticides content of Okumesi River were further subjected to a test of significance with analysis of variance with 20 denominator 20 and numerator of four at 0.05 level of significance. The F ratio calculated is 3.53 while the F ratio critical is 2.87., thus, rejecting Ho. This means that the concentration of these selected organochlorines investigated are higher than the allowable limit for the organochlorines in water.

Source of variation	**SS**	**df**	**MS**	**F**	**P-value**	**F-crit**
Between Groups	586.380664	4	146.595166	35341.16827	3.52869E-38	2.866081
Within Groups	0.08296	20	0.004148			
Total	586.463624	24				

V. Discussion

The global youth unemployment crises has necessitated the inclusion of trade/entrepreneurship curricularin both secondary schools and universities curricular. Aquaculture which is a highly recommended entrepreneur in both levels of education required good quality water hence this study.

The analysis of Okumesi River Amai revealed varying concentrations of the selected organochlorine pesticides investigated. The concentration of alpha lindane, the analysis revealed isbetween 1.2 µg/l to 1.98µg/l with a mean of 1.37±0.34 µg/l. The maximum permissible concentration of alpha lindane by WHO is 0.01 µg/l. The concentration of alpha lindane is higher than the maximum limit recommended by WHO for alpha lindane in water. A similar result of increased alpha lindane concentration has been reported by Ozah&Ukpor, (2017) in Ase creek Delta State and Oghenerume (2018) in Igbide wetlands, Isoko, Delta. The beta lindane concentration in Okumesi River Amai is between 0.82 µg/l and 0.69µg/l with a mean concentration of 0.67±0.15µg/l. The World Health Organisation acceptable limit for betalindane in water is 0.05µg/l. Beta lindane concentration in Okumesi River Amai is higher than WHO maximum permissible concentration. Higher concentration of beta lindane has been reported by Omorodion and Omokhigbe (2016) in Gelegele wetlands Benin City, Omede&Ojieh (2017) also reported high beta lindane in Iselegu River, Ndokwaeast Delta State. The analysis of the water in Okumesi River, Amai revealed thatdeltalindane concentration is 2.38±0.21µg/l. The WHO maximum allowable concentration for delta lindane in water is 0.005µg/l. The concentration of delta lindane in Okumesi River is higher than the allowable limit. Elevated concentration of delta lindane in water was reported by Nwachukwu&Okeke (2016) in Ogutalake,Umoru&Usman (2019) also reported high concentration of delta lindane in Kaduna River, Kaduna State. Gamma lindane concentration in OkumsiRiverAmai as the analysis revealed is 1.62±0.23µg/l. The WHO maximum allowable limit for gamma lindane in water is 0.005mg/l. The concentration of gamma lindane in Okumsi River Amai is higher than the limit recommended by WHO. This result is at variance with the reports of Adeyinka&Olubode (2016) who reported low gamma lindane in Ogun River Ogun State but in tandem with the reports of Ogundele (2018) who recorded high gamma lindane in Erinle River in Osun State. Heptachlor analysis in Okumesi River Amai revealed that heptachlor concentration is 2.14±0.13µg/l. The WHO maximum allowable concentration for heptachlor in water is 0.10µg/l. The concentration of heptachlor in Okumesi River in Amaihigher than the allowable limit. This increased contamination of heptachlor report is similar to the reports of Clarke and Alani (2013) in Olomoge lagoon Badagry, Lagos,Olayinka&Babajide (2018) who also reported high heptachlor in Ogbese River in Ondo State.

VI. Conclusion

The critical issue of youths unemployment has called for concerted efforts to surmount the seemingly intractable problem and this led to the introduction of entrepreneurship education in both secondary and University curricular. Aquaculture has been highly favoured in the country comity of skills foryouths entrepreneurship for wealth creation, poverty and hunger. The study revealed a polluted status of Okumesi River by the selected organochlorine pesticides investigated which will be antithesis for aquaculture to avoid the health disorders hitherto highlighted. It is advised that the pollution source be located contained and plugged for deployment of pen aquaculture in schools for youths entrepreneurship for wealth creation and hunger eradication in Nigeria.

VII. Recommendations

Consequent upon the result of the investigation, the study recommends as follows:

1. Pen aquaculture should not be deployed in Okumesi River Amai because of organochlorine pesticides contamination.
2. The pollution source point should be identified and plugged.
3. There should be decontamination and remediation of Okumesi River Amai to allow for the deployment of pen aquaculture for youths entrepreneurship for wealth creation, poverty and hunger eradication in Nigeria.

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