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QUANTIFICATION OF THE ORGANOCHLORINE PESTICIDES CONTENT OF OROGODO RIVER AGBOR, DELTA – NIGERIA FOR CAGE AQUACULTURE IN SECONDARY SCHOOLS: A RECIPE FOR YOUTHS EMPOWERMENT AND FOOD SECURITY

Ogwu Chukwudi, PhD
Department of Vocational Education
Agricultural Science Unit
Delta State University, Abraka, Nigeria

Abstract

Food is a basic necessity of life. Health and economic growth of a nation is predicated on its ability to provide its citizens access to good quality food at all times as enshrined in Millenium Development Goal. I. One of such is Youths involvement in aquaculture. Good quality water is a factor in aquaculture especially cage aquaculture. The focus of this study therefore is on the analysis of the organochlorinepesticides content of Orogodo River Agbor Boji Boji for its suitability for cage aquaculture in secondary schools. The design of this study was ex-post facto. Three research questions were answered and a hypothesis tested. To achieve this, Orogodo River was mapped out into 5 research stations. Water samples were collected from 10 sampling spots in each of the research stations, bulked and composite samples drawn and fixed with HNO_3 for analysis. The analytical methods employed were Liquid Chromatography (LC) and Mass Spectroscopy (MS) adopting APHA, CAEM and ATI standards. The mean results of the organochlorine pesticides in Orogodo River were; α-lindane 4.39±0.79, adrin, 27.03±5.03, diedrin, 11.89±1.10, endrin, 53.17±5.77 and DDT, 11.76±0.82. The mean results of the organochlorine pesticides concentrations in Orogodo River were subjected to test of significance with ANOVA at 0.05 level of significance with numerator 4 and denominator 20. The F-ratio calculated value was 4.08 while F-ratio critical value was 2.87, thus accepting H_O and rejecting H_A which means that the organochlorine pesticides concentration in Orogodo River are higher than the WHO maximum allowable concentration. The study thus recommended that cage culture should not be carried out in Orogodo River. It was also recommended that remediation should be carried out to decontaminate Orogodo River of organochlorine pesticides and a study of the pollutant sources be commissioned.

Keywords: *Quantification, organochlorines pesticides, cage aquaculture, bioaccumulation and biomagnification.*

Introduction

Food shortage is a global issue with different countries experiencing food security in varying severity. Food and Agricultural Organisation (2016) established that 750 million people out of 7.3 billion representing 12.9 per cent of the population of the world are underfed. According to World Bank (2009), International Food Policy Research Institute (IFPRI) (2012) and Braun (2012), food prices rose by 40 per cent between March 2007 and March 2008, by 50 per cent between January 2007 and June 2008 and by 83 per cent in July 2008. Roggers (2009) posits that the price of wheat rose globally by 181 per cent in June 2008.

America Department of Agriculture (2016) revealed that 5.0 percent of American population representing 6.3 million household are experiencing food crisis. World Bank (2015) posited that in Latin America, 34.3 million representing 5.5 percent of the population are without food and in Africa, 232.5 million people representing 23.2percent of African population are facing starvation. John (2016) surmised that 12 million people in Kenya, 6 million South Sudanese and 2 million Mozambicans are experiencing severe food shortage. Mungai (2016); Anyadike (2016) reported that 29 million people representing 20 per cent of the population of South Africa are undernourished, Ghana according to Jomo (2012) could not provide food for 30 per cent of its citizens. Global Hunger Index (GHI) (2015) stated that 24.2 per cent population of Cameroon are facing food insecurity.

In Nigeria, Olaniyi (2011); United Nations International Children's Emergency Fund (UNICEF, 2014) reported that 65 per cent of Nigerian are undernourished. FAO (2016) also revealed that the area experiencing the worst food crisis is the North Eastern States where over five million Nigerians are facing acute food shortage. The Millennium Development Goal I, according to World Health Organisation (2015), FAO (2008) has as its mandate to reduce between 1990-2015 the number of undernourished people by half, while Molley (2015) opined that the MDG 1 has as its prime objective: to reduce food scarcity and ensure that greater percentage of the world population are food secured.

Food security, according to FAO (2005), exists when all people at all times have physical, social and economic access to sufficient safe and nutritious food to meet their dietary needs and food preference for healthy life. The World Food Summit (2011) stated that people are considered food secured when they have availability and adequate access at all times to sufficient and safe food. Jone (2015) sees food security as everybody being able to get enough healthy food to be well and active. Randle (2015) surmised that one of the major elements of development and poverty alleviation is global food security. Ofurum (2013) reported that there is a direct correlation between skills acquisition, productivity, employment and food security. This is in line with the idea conversed by Awaranti (2014), that the world has embraced a paradigm shift in the quest for sustainable technological development and food security. Consequently, the need for all school leavers to be equipped with survival skills in various vacations should be emphasized. Equipping school leavers with relevant skills and various vocations on agriculture, auto mechanic, furniture and photography is very germane (Ogwu, 2015; Osokogwu, 2015; Omolu, 2016; Adepite, 2016).

Akpeke (2015) advised that youths should be trained in agriculture, such as in fish farming, piggery, poultry and vegetable farming to ensure wealth creation and food security. Olamide (2015) counsels that the only way to ensure youths employment and food security in Nigeria is through engaging the youths in agriculture. Youths' involvement in agriculture is a solution to food insecurity (Ajaguna, 2015; Osunde, 2016; Ona & Osunde, 2016).

The Federal Government of Nigeria and its effort in addressing youths

unemployment, ensuring job creation, wealth generation and food security, introduced Trade and Entrepreneurship Curriculum in various skill areas, including Aquaculture. The rationale for the trade curriculum, according to National Education Development and Research Council (NARDC) (2013), is that at graduation from senior secondary school, a Nigerian child would have been prepared for higher education and have acquired skills to be job creators for food security. Crops and animal production, especially aquaculture, are the prime enterprises for youths empowerment, job creation and food security (Adesina, 2014; Ogbe, 2015).

Fish is an important component of everyday diet. According to Onwucheta (2014), fish provides protein, fats and essential oil–omega 3. It also contains mineral and carbohydrates for healthy living. Obuzome (2015) stated that fish is the only means of achieving the WHO minimum protein requirement of 56 g per person per day. Ebuka (2010) also posited that fish is a very rich source of protein, vitamin, mineral and fats for a healthy living for both children and adults. Uzo (2015); Obe (2016) separately reported that Nigerian fish demand is 2.1 million but local production is 90,000 tons. Oyedeji (2015) puts the fish demand in Nigeria at 2.5 million while the local output is paltry 750,000 tons. Adesina (2014) revealed that Nigeria spends over 126 billion naira in fish importation. According to United States International Development Agency (USAID) (2013), Nigeria spends over 625 million USD in fish importation, in the process create job loss and youths unemployment.

Abegule (2013) advised that youths in aquaculture could adopt cage culture because the culture method eliminates water supply problems. A cage culture, according to Salami (2004), is the process of rearing fish and other aquatic organisms in cages built and suspended in naturally existing body of water. Ioyorm (2006), and Aku (2013) recommended that water analysis should be carried out before deploying cage culture to rule out problems of contamination and pollution by Polyaromatic Hydrocarbons (PAHs), persistent organic pollutants (POPs), furams, dioxins, polychlorinated biphenyls (PCBs), heavy metals, pesticides such as organophosphate and organochlorine to avoid bio-magnification and bio-accumulation. Organochlorines, according to United State Environmental Protection Agency (USEPA) (2010)are compounds containing chlorine and carbon atoms that are used for pesticides formulation. Tedds (2009) revealed that organochlorines persist in the environment, are toxic and have bio-accumulation and bio-magnification properties. Fredrich (2010) describes bio-accumulation as the process through which pollutants enter the food chain while bio-magnification refers to the tendency of pollutants to concentration as they move from one trophic level to the next. Molley (2016) sees bio-accumulation as tendency of elements or compound to be absorbed by biological organisms while bio-magnifications also called bio-amplication or biological magnification, is the increasing concentration of a substance such as toxic chemicals in the tissues of organism at successively higher levels in a food chain. Human exposure to organochlorine pesticides according to Agency for Toxic Substances and Disease Registry (ATSDR 2018) leads to cancer, endometriosis, infertility, leukaemia and so on. The focus of this study therefore is the determination of organochlorine pesticides content of Orogodo River, Agbor to ascertain its suitability for deployment of cage Aquaculture by the secondary schools in Agbor BojiBoji for youths empowerment and food security

Research Questions

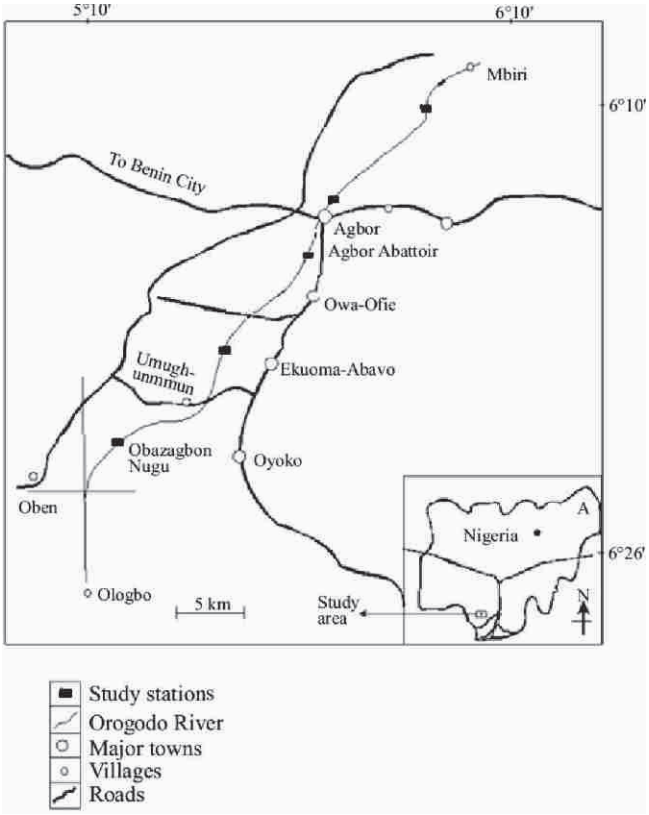
In carrying out the study, the following research questions were raised and answered:

1. What are the concentrationsof organochlorines pesticides (α-lindane, adrin, diedrine,

dichlorodiphynltrichloroethane (DDT), endrin in Orojodo River?

2. Are the concentrations of the organochlorine pesticide in Orogodo River within the WHO maximum permissible concentration for organochlorine? Can schools in Agbor carry out cage aquaculture in Orogodo River at the organochlorine concentration revealed?

Study Area



Adopted: Iwegbue and Arimoro (2008).

Boji BojiAgbor lies within latitude 6.29°N and 6.20°E and longitude 6.25°N and 6.199°E. Agbor is an urban town in Delta State with high commercial activities. Orogodo River in BojiBojiAgbor is a typical urban stream flowing through Agbor town with about ten thousand inhabitants (Ikomi & Uwabor, 1997). The stream is the main drainage system of the town accounting for most of the total runoffs.

Research Method

This study adopted ex-post facto design. Orogodo River was divided into 5 research stations tagged stations A, B, C, D and E (Abdulfatai, 2015). From each of the research stations, water samples were collected from 5 sampling spots with clean plastic sampling bottles at the depth of 10 cm and covered subsurface. The samples were bulked and composites were drawn, fixed with nitric acid (HNO_3) and stored in ice cool boxes for analysis. The analytical methods deployed were Liquid chromatograph (LC) and Mass Spectroscopy (MS) adopting chemical analysis of Ecological Matters (CAEM) and America Public Health Analysis (APHA) and America Testing Institute (ATI) standards.

Results

The results of the analysis of organochlorine pesticide contents of Orogodo River are as in Table 1.

Table 1: Organochlorine pesticide content of Orogodo River inμg/l

Parameters	A	B	C	D	E
a-lindane (a-HCH)	4.23	3.56	5.60	4.72	3.88
Adrin	24.54	20.58	33.56	26.25	30.22
Diedrin	10.58	11.34	13.54	12.22	11.81
Endrin	50.54	45.28	60.55	56.32	53.18
DDT	11.56	10.58	12.33	11.62	12.74

The results of the organochlorine pesticides contents of Orogodo River subjected to further treatment with statistical instruments of mean and standard deviation and the results are as shown below.

Table 2: The mean standard deviation and variance of the organochlorine pesticides content of Orogodo River and WHO maximum permissible concentration in μg/l

Parameters	N	Mean	Standard deviation	Variance	WHO MPC μg/l
α-lindane	5	4.39	0.79	0.637	0.1
Adrin	5	27.03	5.03	25.30	0.03
Diedrin	5	11.89	1.10	0.82	0.005
Edrin	5	53.17	5.77	3.38	0.05
DDT	5	11.76	0.82	0.68	1.10

The result of the organochlorine pesticides contents of Orogodo River, Agbor, BojiBoji were then presented graphically with bar chart as in the Figure 2.

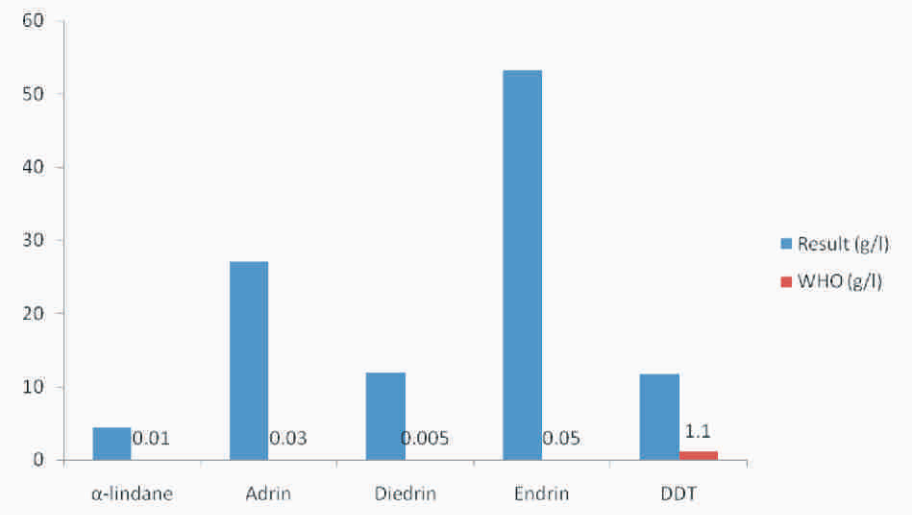


Fig. 2: Mean concentration of the organochlorine pesticides concentration of Orogodo River and the World Health Organisation maximum permissible concentration of the parameters investigated

The results of the analysis were subjected to test of significance with analysis of variance as in Table 3.

Table 3: Analysis of variance of the organochlorine pesticides content of Orogodo River

Source of variation	SS	df	MS	F	p-value	F crit
Between Group	13686.16058	4	3421.540145	17456837.48	4.08729E-65	2.866081
Within Groups	0.00392	20	0.000196			
Total	13686.1645	24				

Discussion of Findings

The impact of food shortage, higher food prices and lower access to food by many people in world is rather dramatic and traumatic. The Federal Government and various state governments in Nigeria in effort at reducing food insecurity introduced several youths empowerment programme deploying different Agricultural programme, including Aquaculture. According to Ibezim and Omego (2014), Aquaculture especially cage, requires good quality water free from pollution and contaminants and this underpinned this study.

The reports of the organochlorine pesticides analysis of Orogodo River revealed varying concentrations of the parameters measured (Table1).The mean concentrations of organochlorine pesticides in Orogodo River exceeded the WHO maximum permissible limit (Fig1).This result is similar to the reports of Anyakora and Coker (2011) and Ogwu (2016) who reported high organochlorine pesticides concentration in the Epe Lagoon, Olomogo lagoon, Lagos and Ethiope River, Abraka, Delta respectively. Mani (2013) also recorded high organochlorine pesticides in the sediments of Lagos lagoon. Ogunzie (2015) also reported high concentration of organochlorine pesticides in Ikpobo River, Benin. The study is, however, in disagreement with Obadare (2013) who recorded low organochlorines pesticides residue in Okunum River, Ekiti State and Ayila (2014) who also reported low concentration of organochlorine pesticides residue in Ose River in Ondo State. .

The mean results of the organochlorine pesticides content of Orogodo River were further subjected to test of significance with Analysis of Variance at 0.05 significance level, numerator 4 and denominator 20 (Table 3). The F-ratio calculated was 6.21, while the F-ratio table value was 3.51.This shows that the null hypothesis HO is rejected. This means that there is significant difference in the mean concentration of the organochlorine pesticides investigated and the WHO maximum permissible concentration and HA accepted which states that there is significant difference between the organochlorines concentration in Orogodo River and WHO maximum permissible limits. This makes it clear that River Orogodo is not suitable for cage aquaculture. Since good quality water is imperative in aquaculture, hence this study became germane.This study had brough to the fore that Orogodo River is highly polluted and contaminated with organochlorine pesticide residue much more higher than the recommended; carrying out cage culture in such medium will result in Bio-accumulation and bio-magnification of these toxicants by the fish and this will ultimately harm the consumers or cage culture is therefore not encouraged. It should not be practiced in Orogodo River by secondary schools in Agbor BojiBoji.

Conclusion

Food security is imperative for a healthy population. The country will only achieve its growth potentials if the citizens are food secured. Aquaculture has been tipped in various fora as a viable and plausible option for youth's empowerment, job and wealth creation and food security. Therefore, there is need to put measures in place to decontaminate River Orogodo to enhance its suitability for youth involvement in cage aquaculture for job creation and food security in Nigeria.

Recommendations

Against the backdrop of results of the organochlorine pesticides being higher than the WHO maximum permissible concentrations, the study therefore recommended that:

1. Cage aquaculture should not be embarked upon by schools BojiBoji in Orogodo River.
2. It is pertinent that a study of the sources of organochlorine pollutants be commissioned.
3. Remediation of Orogodo River should be implemented by the appropriate authority to pave way for future deployment of cage aquaculture for youths empowerment and food security in Nigeria.

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