WASOT West Africa Society Of Toxicology Journal

Toxicology Digest

Toxicology Digest Vol. 1 (1) (2016) 91-99

Assessment of Human Health Hazard Due to Consumption of Trace Metal in Selected Sea Foods and Vegetables from Port Harcourt Markets, Rivers State, Nigeria.

[*a]Babatunde, B.B, [b]Patrick-Iwanyanwu, K.C and [a]Dike, Chinyere J.R

[a]Department of Animal and Environmental Biology, Faculty of Science, University of Port Harcourt.

[b]Department of Biochemistry, Faculty of Science, University of Port Harcourt

Abstract

Sea foods and vegetables are important in human diet and are consumed at very high rate and by majority of the population in Port Harcourt. Sea foods and vegetables contaminated with excess trace metals can cause health problems for humans and the ecosystem. Estimated the daily intake of selected metals were used to assess the health related risks of consuming sea foods and vegetables sold in two Port Harcourt major markets. Samples were collected randomly from the two markets and analyzed for Copper, Lead, Zinc, Cadmium and Chromium concentration (mg/kg) using Atomic absorption spectrometer, the results was used to estimate the daily intakes of the metals analysed and the Target Hazard Quotient (THQ) was determined. Some of the metals analysed showed levels higher than maximum permissible limits by regulatory agencies with estimated daily intake (EDI) exceeding the tolerable daily intake (TDI) stipulated by regulatory bodies. Recommendations are made for a coordinated approach to monitoring sources of these foods to abate any potential public health impact on the populations.

Keywords: *EDI, TDI, WHO MPL, THQ, sea foods, vegetables*

1. Introduction

Any metal may be considered a “contaminant” if it occurs where it is unwanted, or in a form or concentration that causes a detrimental human or environmental effect. Many metals are extremely toxic because of their solubility in water and even in low concentrations. They are found naturally in the environment as a result of soil forming processes of disintegration of parent resources at rare levels (<1000 mg kg−1) and infrequently poisonous and became concentrated as a result of anthropogenic activities such as mineral extraction, smelting, refining, mining, vehicle emissions, industrial wastes discharge, agricultural operations, domestic waste, Leaded gasoline and paints that are Lead based, discarding high metal wastes in inappropriately protected landfills, animal manures, bio solids (sewage sludge), coal combustion remainders, compost, petrochemicals, and deposition from atmosphere burning of fossil fuels. The concentration of heavy metal contaminants in foods have been the focus of various studies due to its non-biodegradative, persistent, toxic, long biological half-lives and bioaccumulating traits, trace metals like Zinc, Manganese, Copper and Iron are essential to the human body base on their role as metallo-enzymes and cofactor of large number of enzymes but are needed in trace concentration adequate for the body, they become toxic to the human body when they exceed the required limit while exposure to Lead, Cadmium, Mercury and Arsenic are the main threat to human health they are toxic and non beneficial even in trace amount. Aquatic organisms living in polluted waters tend to accumulate trace metals in their body and so trace metal

Correspondence
bolaji.babatunde@uniport.edu.ng

contamination of foodstuffs cannot be underestimated as these are important components of human diet. Vegetables and sea foods are rich sources of essential vitamins, minerals, proteins and fibers and also have beneficial antioxidative effects. However, intake of trace metal contaminated vegetables and sea foods may pose a risk to the human health.

Iwegbue *et al*., (2008) reported that the concentrations of Cadmium, Nickel, Chromium and Lead in chicken meat, chicken gizzard and turkey meat consumed in southern Nigeria were above the permissible limits. Therefore, the estimated daily intakes of Lead and Cadmium in this region slightly exceeded the normal reported daily intakes of Lead and Cadmium from eggs in some other countries. Lead and Cadmium have also been reported to be above the permissible limit of 0.3mg/kg and 0.01 mg/kg respectively for meat samples.

Asegbeloyin *et al*., (2010) assessed toxic trace metals in selected fish species and parts of domestic animals and reported mean Lead concentrations (mg/kg) in fishes species as (3.5 ± 0.06), (3.43 ± 0.02), (4.6±0.43) and (4.78 ± 0.045*)* which exceeded the recommended limits specified by most of food regulatory bodies. The high levels of Lead and Chromium with a concentration range of 0.01-6.03 and 0.04 -4.68µg/g in the flesh of the fauna, fruit of Okra and leaves of bitter leaf are of public health concern, the levels from the samples collected from the Ijaw area of Niger Delta are far beyond the tolerable level of 0.00lµg/g set by WHO (Gbaruko and Friday, 2007). Dahunsi *et al*., (2012) also reported high levels of Manganese, Magnesium and Copper in the gut, liver, gills and kidney of African catfish, *Clarias gariepinus* in Ota, Ogun State. They concluded that bioaccumulation of trace metals in fish must have emanated from a polluted environment. Sireli *et al*., (2006) evaluated the concentrations of Cadmium and Lead in vacuum packaged smoked fish spices commercially sold in Turkey and reported Cadmium concentration were below 0.05 $mgkg^{-1}$ (the limit specified by Turkish and EU legislation) whereas Lead levels in 36.9% fish samples exceeded their acceptance limit of $0.2mgkg^{-1}$. However at even the highest trace metal concentrations measured the estimated weekly intakes of Cadmium and Lead for a 60kg adult consuming 400g of fish per week would be below the permissible limit by joint FAO/WHO.

Pb, Cd, Cr, Cu and Zn were chosen for risk assessment because of comparatively high levels in samples of previous studies in this region (Babatunde *et al.,* 2013; Vincent-Akpu and Babatunde 2013; Onojake and Okonkwo, 2011; Ubalua *et al.,* 2007). Lead has shown to be associated with damnification of central nervous system, adverse behavioural, physiological, and biochemical effects on humans, memory deterioration, prolonged reaction time and reduced ability to understand (Bradl, 2005). The most bioavailable and therefore most toxic form of Cadmium is the divalent ion (Cd^{2+}). Cadmium effects on human health include skeletal deformities and bone loss, kidney damage and generalized pain (Jarup, 2003). The International Agency for Research on Cancer has classified Cadmium as a Category I (human) carcinogen (Bradl, 2005).Copper is an essential nutrient required by the body in very small amounts.

According to Solomon, (2008), USA Environmental Protection Agency has found Copper to potentially cause the following health effects when people are exposed to it at levels above the Action Level, gastrointestinal disturbance, including nausea and vomiting; headache, febrile reactions, prostration. Zinc is an essential element in trace amounts for plants and animals. In mammals, it plays a vital role in the biosynthesis of nucleic acids, RNA polymerases, and DNA polymerases and, thus, is involved in the healing processes of tissues in the body, physiological processes such as hormone metabolism, immune response, and stabilization of ribosome and membranes also require Zinc. The health hazards associated with exposure to Chromium are dependent on its oxidation state. Chromium (III) occurs naturally in many vegetables, fruits, meats, yeasts and grains. But the uptake of too much chromium (III) can cause health effects as well, for instance skin rashes. Chromium (VI) is toxic and its adverse effects may include ulcerations, dermatitis, and allergic skin reactions and perforation of the mucous membranes of the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasms and edema depending on the route of intake.

Investigation of trace metal contamination of food is one of the most important aspects of food quality assurance with respect to both nature management and human health, it provides important information on the impacts of the use of chemical products in crops and on levels of environmental pollution in farms and water bodies. It is therefore necessary to determine the dose level for human which is considered to be taken daily over a lifetime without adverse effect.

Furthermore, such a survey may indicate local foodstuffs that are important to supply essential metals for population groups. Information on these topics is scarce or disjointed, especially in developing countries. Thus, a study on trace metal concentration in the most frequently consumed foods by inhabitants of Port Harcourt was performed, aiming to verify metal levels and variations, and to make a preliminary estimate on intake doses of micronutrients and toxic metals for this population. The Estimated Daily Intakes (EDI) of the trace metal studied were compared with the tolerable daily intake and used to assess the human health risk using Target Hazard Quotient (THQ) Sea foods were used in this study because they are the major animal protein consumed at a very high rate among the inhabitants of Port Harcourt city due to its readily availability, affordability by even the lower class and nutritive content.

2. Materials and methods

2.1. Study areas

Two major and largest open air markets of Port Harcourt; Mile one market Diobu and Creek road market Borokiri in Rivers state Nigeria, where most consumed sea foods and vegetables are sold was used for this study for acquiring samples randomly according to the buying habits of different social classes in Port Harcourt. Diobu is between the following coordinates 004°47'24"N and 4°77'21.52" N, 06°59'36"E and 6°99'45.14" while Borokiri lies at latitude 4.749° N and longitude 7.035° E.

2.2. Sample Collections

Fresh samples of selected seafood popularly consumed in Port Harcourt were collected from two major food markets (Diobu and Borokiri). *Crassostrea virginica* (Oyster), *Lottorina littorea* (periwinkle), *Procambarus clarkii* (Crayfish), *Penaeus monodon* (giant tiger shrimp), *Thais coronata* (Rock Snail), *Chrysichthys nigrodigitatus* (Cat fish), *Lutjanus campechnus* (Red snapper), *Sarotherodon melanotheron* (Black chin Tilapia) *Telfairia occidentalis* (pumpkin leaves) and *Gnetum africanum* (Okazi leaves) were collected at random from Borokiri market. While *Crassostrea gasar* (Oyster), *Penaeus notialis* (Shrimp*)* *Cardiosoma armatum* (Crab) *Thais coronata* (Rock snail) were collected from mile 1 market Diobu. All samples were collected randomly at the market, transported to the laboratory the same day and stored in the freezer for further analysis

2.3. Sample Preparation

Samples collected were washed and dried in the oven. Each dried samples were grounded using a mortar and sieved through a 600µm-mesh. Each of the samples were labeled and stored in a polyethene bag until digestion.

2.4. Peroxide Digestion

A sensitive weighing balance was used to measure 3 grams of each of the samples and digested using 10 ml of hydrogen peroxide set on a hot plate for about 10 minutes until there were no longer fumes and allowed to cool. Hydrogen peroxide was added to digest organic content of the samples and to facilitate clear sample digestion.

2.5. Acid Digestion

Measuring cylinder was used to deliver 10 ml of HCl into 250 ml beakers containing each of the samples and 30 ml of HNO_3 was also added to the sample mixture, set on a hot plate to boil until there were no longer fumes and a clear solution was obtained. The digested solutions were cooled at room temperature, filtered using 11mm filter paper, transferred to a conical flask, made up to 100 ml with distilled water, labeled and kept in clean plastic vials before metal analysis. The total metal concentrations were determined by flame atomic absorption spectrometer type A 200 AA.

2.6. Quality Assurance and Quality Control:

Samples were collected randomly in a representative manner and stored in polyethylene bags and transported to the laboratory the same day where they were stored in the freezer for further analysis. All representative samples were analysed to allow for statistical variation if any. The sampling and processes of analysed samples was carried out as described by American Public Health Association (APHA). Standards and blanks were used to calibrate the equipment and ensure accurate and comparative analysis.

2.7. Estimated Daily Intake

In Nigeria there are few data available for individual, household or city consumption rate for various foods such as vegetables, fish, legumes, cereals, fruit, meat, dairy product and staple food as compared to developed countries. Instead estimation was made using the procedure described by (Omojowo *et al.,* 2010)

Estimated Daily Intake (EDI) is the amount of a substance in food expressed on a body mass basis (usually in mg/kg body weight), which can be ingested daily over a lifetime by humans without appreciable health risk. For calculation of the daily intake per person, a standard body mass of 60 kg was used. The daily intake of metals depends on both the metal concentration in food and the daily food consumption. In addition, the body weight of the human can influence the tolerance of contaminants. The EDI are a concept introduced to take into account these factors. The acceptable daily intake is normally used for food additives (tolerable daily intake is used for contaminants). The Estimated Daily Intakes (EDI) of trace metals were estimated from the average concentrations of trace metals in the samples studied and estimated daily average consumption rate of 104 g and 176 g per day for Sea food and vegetables respectively was used for an adult with average body weight of 60 kg as reported by (Omojowo *et al.,* 2010)

$$EDI = \frac{C X\ Cons}{Bw} \quad \text{……………………………………………………………….Eqn 1}$$

Where:

Bw = body weight estimated as 60kg for an adult

C = concentration of heavy metals in the sampled food in µg/kg

Cons = daily average consumption rate of the sample of the study area

2.8. Health Risk Assessment

The Estimated Daily Intake (EDI) was used to determine the Target Hazard Quotient (THQ) whose bench mark is 1 using equation 2

$$\textbf{THQ} = \frac{EF \times ED \times FIR \times Cf \times Cm}{WAB \times TA\ (EF \times ED)} \times 10^{-3} \quad \text{……………………….Eqn 2}$$

Where;
EF = The exposure frequency 365 days/year
ED = The exposure duration, equivalent to average life time (65 years)
FIR = The fresh food ingestion rate (g/person/day) which is considered to be 104g/person/day.
Cf = The conversion factor = 0.208
Cm = The trace metal concentration in food stuffs mg/kg d-w)
WAB = average body weight (bw) (average body weight to be 60kg)
TA = Is the average exposure of time for non carcinogens (It is equal to (EF×ED) as used by in many previous studies.
Target hazard quotient = Rfd: Oral reference dose (mg/kg bw/day)
A THQ below 1 means the exposed population is unlikely to experience obviously adverse effects, whereas a THQ above means that there is a chance of non-carcinogenic effects, with an increasing probability as the value increases

3.Results

The average trace metals concentrations (mean ± S.E.M, mg/kg dry wt.) in all the samples from Creek road Market Borokiri analysed in this study are presented in Table 1. The concentrations of Pb and Cd were below detection limit in all samples except for *Crassostrea virginica* and *Thais coronata* which had 0.258±0.12 and 1.226±0.05respectively for Cd. Concentrations of trace metals in *Lutjanus campechanus* were 2.37±0.03, 22.615±0.60, 2.920±0.01 mg/Kg (dry wt.) for Cr, Zn and Cu respectively. In *Chrysichthys nigrodigitaus*, Chromium recorded 3.016±0.02 mg/Kg (dry wt.), Zn 58.626±0.10 mg/Kg and Cu 10.935± 0.10. *Procambarus clarkii* (Crayfish) recorded 2.290±0.01, 32.063±0.03, 38.180±0.32 mg/kg (dry wt.) for Cr, Zn and Cu respectively. *Penaeus monodon* (giant tiger shrimp) recorded 1.20±0.01, 11.58±1.20 and 9.43±1.05 for Cr, Zn and Cu respectively. In *Crassostrea virginica* Cr was 1.097 ± 0.06mg/kg (dry wt.), Zn 62.880±0.80mg/kg (dry wt.) and Cu 13.160±0.20mg/kg (dry wt.). *Littorina littorea* recorded 1.516±0.52, 32.940±0.13 and 53.580±0.60 mg/kg (dry wt.) for Cr, Zn and Cu respectively. *Thais coronata* recorded 1.370±0.40, 46.435 ± 0.50 and 33.030 ± 0.30 for Cr, Zn and Cu respectively. In *Sarotherodon melanotheron* Cr was 2.20±0.02 mg/Kg (dry wt.), while Zn was 20.953±0.42 mg/kg (dry wt.) and Cu 1.870± 0.90 mg/kg (dry wt.). *Gnetum africanum* recorded 1.43±0.15, 15.52±1.58 and 3.94±1.10 mg/kg (dry wt.) for Cr, Zn and Cu respectively. In *Telfairia occidentalis* Cr was 0.93±0.01, Zn was 10.65±1.20 and Cu recorded 5.19±1.05 mg/kg (dry wt.).

Table 1: Trace metal concentrations in selected sea foods and leafy vegetables from Creek Market, Borokiri in mg/kg

SAMPLES	Common name	Pb	Cr	Cu	Cd	Zn
Lutjanus campechanus	Red snapper	≤0.001	2.37	2.92	0.001	22.62
Chrysichthys nigrodigitatus	Silver Cat fish	≤0.001	3.02	10.94	0.001	58.63
Procambarus clarkii	Cray Fish	≤0.001	2.29	38.18	0.001	32.06
Penaeus monodon	Giant tiger shrimp	0.001	1.20	9.43	0.001	11.58
Crassostrea virginica	Oyster	≤0.001	1.10	13.16	0.258	62.88
Littorina littoria	Periwinkle	≤0.001	1.52	53.58	0.001	32.94
Thais coronata	Rock snail	≤0.001	1.37	33.03	1.226	46.44
Sarotherodon melanotheron	Black chin Tilapia	≤0.001	2.20	1.87	0.001	20.95
Gnetum africanum	Okazi leaves	0.001	1.43	3.94	0.001	15.52
Telfairia occidentalis	Pumpkin leaves	0.001	0.93	5.19	0.001	10.65
WHO-ML		0.30	0.05	10	0.10	50.00

The detection of Cd were below detection limit in samples from mile 1 Diobu market except in *Crassosrea gasar* which had a concentration of 0.019 mg/kg (dry wt.); concentration of trace metals in *Crassostrea gasar* was 5.782 mg/kg (dry wt.) for Zn, 0.020 mg/kg (dry wt.) for Cr, 2.634 mg/kg (dry wt.) for Cu and 0.570 mg/kg (dry wt.) for Pb; *Penaeus notialis* had 0.930 mg/kg (dry wt.) for Zn, 0.072 mg/kg (dry wt.) for Cr, 0.390 mg/kg (dry wt.) for Cu and 0.600 mg/kg (dry wt.) for Pb; *Thais coronata* had 4.866 mg/kg (dry wt.) for Zn, 0.053 mg/kg (dry wt.) for Cr, 4.432 mg/kg (dry wt.) for Cu and 0.690 mg/kg (dry wt.) for Pb; *Cardiosoma armatum* had 1.538 mg/kg (dry wt.) of Zn, 0.205 mg/kg (dry wt.) of Cr, 1.158 mg/kg (dry wt.) of Cu, Pb was below detection limit in *Cardiosoma armatum*

Table 2: Trace metal concentration in selected sea foods from mile 1 market Diobu

Samples	Common Names	Pb mg/kg	Cr mg/kg	Cu mg/kg	Cd mg/kg	Zn Mg/kg
Crasstrostrea gasar	Oyster	0.570	0.020	2.634	0.019	5.782
Peneaus notialis	shrimp	0.600	0.072	0.390	<0.001	0.930
Thais coronata	Rock snail	0.690	0.053	4.432	<0.001	4.866
Cardiosoma armatum	Crab	<0.001	0.205	1.158	<0.001	1.538
WHO-ML*		0.30	0.05	10	0.10	50.00

Estimated Daily Intake (EDI) of samples from Creek market, Borokiri recorded Pb range of 0.002 to 0.003 µg/g/day bw in all the samples while the EDI of Cd ranged from 0.002 to 0.003 except in *Crassostrea virginica* and *Thais coronata* where Cd recorded EDI of 0.451 µg/g/day bw and 2.144 µg/g/day bw respectively; Cr ranged from 1.92 to 5.28 µg/g/day bw with the lowest in *Crassostrea virginica* and the highest EDI in *Chrysichthys nigrodigitatus*; the EDI of Cu ranged from 3.27 to 93.70 µg/g/day bw with the lowest EDI in *Sarotherodon melanotheron* and the highest EDI in *Littorina littoria;* EDI of Zn ranged from 20.25 to 109.97 µg/g/day bw with the lowest in *Penaeus monodon* and the highest in *Crassostrea virginica.*

Table 3: Estimated Daily Intake of trace metals in selected seafood and vegetables from Creek market, Borikiri, Port Harcourt.

Samples	Pb	Cr	Cu	Cd	Zn	THQ
Lutjanus campechanus	0.002	4.14	5.11	0.002	39.56	**0.720**
Chrysichthys nigrodigitaus)	0.002	5.28	19.13	0.002	102.54	**1.655**
Procambarus clarkii	0.002	4.00	66.77	0.002	56.07	**1.437**
Penaeus monodon	0.003	2.10	16.49	0.002	20.25	**1.253**
Crassostrea virginica	0.002	1.92	23.01	0.451	109.97	**1.101**
Littorina littoria	0.002	2.66	93.70	0.002	57.61	**1.010**
Thais coronata	0.002	2.40	57.76	2.144	81.22	**1.060**
Sarotherodon melanotheron	0.002	3.85	3.27	0.002	36.64	**0.434**
Gnetum africanum	0.003	4.22	11.54	0.003	45.55	**0.477**
Telfairia occindentalis	0.003	2.76	15.24	0.003	31.24	**0.998**
TDI	3.6	1	167	1	667	**1**

Estimated Daily Intake (EDI) of samples from Mile 1 market Diobu had an EDI range of 0.002 to 1.21 µg/g/day bw for Pb, with the least in *Cardiosoma armatum* and the highest EDI in *Thais coronata*; EDI of Cr ranged from 0.03 to 0.36 µg/g/day bw with the least in *Crassostrea gasar* and the highest in *Cardiosoma armatum*; EDI of Cu ranged from 0.68 to 7.75 µg/g/day bw with the least in *Penaeus notialis* and the highest in *Thais coronata*; EDI of Cd was 0.002 µg/g/day bw in all the samples except in *Crassostrea gasar* which had 0.03 µg/g/day bw: EDI of Zn ranged from 1.63 to 10.11 µg/g/day bw with the least in *Penaeus notialis* and the highest in *Crassostrea gasar*.

Table 4 Estimated daily intake of selected Sea foods from mile 1 market Diobu Port Harcourt

Samples	Pb	Cr	Cu	Cd	Zn	THQ
Crassostrea gasar	1.00	0.03	4.61	0.03	10.11	**0.033**
Penaeus notialis	1.05	0.13	0.68	0.002	1.63	**0.007**
Thais coronata	1.21	0.09	7.75	0.002	8.51	**0.036**
Cardiosoma armatum	0.002	0.36	2.03	0.002	2.69	**0.010**
TDI	3.6	1	167	1	667	**1**

4. Discussion

The trend of the levels of the heavy metals investigated in *Lutjanus campechanus, Chrysichthys nigrodigitatus, Procambarus clarkia, Penaeus monodon, Crassostrea virginica, Thais coronata, Gnetum africanum* and *Telfairia occidentalis* from Creek market were in decreasing order Zn>Cu>Cr>Cd>Pb having a higher retention capacity for Zn followed by Cu, Cr, Cd and Pb. While the trend in *Sarotherodon melanotheron* is Zn>Cr>Cu>Cd>Pb; the trend in *Littorina littoria* is Cu>Zn>Cr>Cd>Pb having a high retention capacity for Cu followed by Zn, Cr, Cd then Pb; While *Crassostrea gasar* and *Thais coronata* from Mile 1 market showed a trend of Zn > Cu > Pb > Cr > Cd; and suggests the highest retention capacity of Zn followed by Cu, Pb, Cr and Cd; *Penaeus notialis* from Mile 1 market showed Zn > Pb > Cu > Cr > Cd; suggesting a high retention capacity for Zn followed by Pb, Cu, Cr and Cd; *Cardiosoma armatum* from Mile 1 market showed a trend of Zn > Cu > Cr > Pb > Cd suggesting a high retention capacity for Zn followed by Cu, Cr, Pb and Cd.

The results of trace metal concentrations in *crassostrea virginica*, *Penaeus monodon* and *Thais coronata* from Creek market Borokiri were compared *Crassostrea gasar, Penaeus notialis* and *Thais coronata* from Mile 1 market Diobu and it indicated that Lead (Pb) was below detection limit in all samples from Creek Market, Borokiri but was detected in samples from Mile 1 market Diobu at levels higher than the WHO permissible limit of 0.3 mg/kg with a fold range of 0.270 to 0.390 mg/kg. Therefore, populations who consumed sea food from Mile market Diobu may be exposed to Pb contamination. The EDI of Pb from the two areas were much below the TDI of 3.6 µg/g/day bw which is a reference value established by the Food and Agriculture Organization (FAO)/WHO (World Health Organization, 1993). It is important to note that the calculated EDI in this study for Pb which is less than TDI was only obtained through sea food consumption, therefore, including Pb intake through other dietary means would probably increase the EDI values. In addition, some individuals in this area may consume more than twice of the average amount of sea food estimated here and their daily dietary intakes of Pb would further exceed the TDI. Chamannejadian *et al*., 2013 reported the dietary intakes of rice for Pb for populations in Khuzestan province, Southwest Iran, ranged from 0.22 to 0.47 µg/day kg bw with a mean value of 0.26 ± 0.03 µg/day kg bw. The maximum daily intake of Pb from rice was 0.47 µg/day kg bw which is higher than EDI of sea food calculated in this study.

Chromium (Cr) concentrations were above the WHO MPL of 0.05 mg/kg in samples from both markets except in *Crassostrea gasar* from Mile 1 market which has a concentration of 0.020 mg/kg. Therefore, populations from the two areas are exposed to Cr contamination. The EDI of Samples from Creek market were above the TDI of 1 µg/g/day bw when compared with samples from Mile 1 market which were below the TDI of 1 µg/g/day bw it indicated that population who consumed sea foods from Creek market are exposed to health risk of Cr contamination effects than those who consumed sea foods from Mile 1 market.

Cadmium (Cd) concentrations were above the WHO MPL of 0.1 mg/kg in *Crassostrea virginica* and *Thais coronata* from Creek market and below detection limit in *Penaeus monodon* from Creek market, *Penaeus notialis* and *Thais coronata* from Mile 1 market while the concentration in *Crassostrea gasar* was below WHO MPL. The EDI of samples from both market were below the TDI of 1 µg/g/day bw except in *Thais Coronata* from Creek market which had 1.144 fold range greater than the TDI and indicating Cd contamination and related health risk when *Thais coronata* from Creek market is consumed, Iwegbue *et al*., (2008) reported exceed levels of EDI of Pb and Cd in meats and eggs consumed in southern part of Nigeria Chamannejadian *et al*., 2013 reported the maximum dietary intakes of Cd in rice for populations in Khuzestan province, Southwest Iran, to be 1.13 µg/day kg bw, which was 0.13-fold greater than TDI.

Copper (Cu) concentration was above the WHO MPL of 10mg/kg in *Crassostrea virginica* and *Thais coronata* from Creek market with 3.16mg/kg and 23.03 mg/kg fold range respectively greater than WHO MPL while Cu concentration in *Penaeus notialis* and samples from Mile 1 market were below the MPL. The EDI of samples from both areas was below the TDI which indicated that the samples may be contaminated with Cu but may not have any health risk because is less than the human body tolerable intake

Zinc (Zn) concentration was below the WHO MPL of 50mg/kg in all samples from both areas except in *Crassostrea virginica* which had a 12.88 mg/kg fold range greater than the WHO MPL. The EDI of samples from both areas were below the TDI indicating no likely appreciable health risks if this sea foods are consumed.

5. Conclusion

The result of this study showed trace metal contamination of sea food and the estimated daily intake an average adult could consume daily. Sea food from Creek market has a lower concentration of Pb than those from Mile 1 market, while Cr contamination was found in only *crasstrostrea virginica* from creek market, it was found that eating sea foods from mile 1 market was void of Cr contamination; Cu and Zn contamination was lesser in samples from Mile 1 market than those from creek market. However, Pb was the most serious contamination in samples from Mile 1 market and exceeded the WHO MPL while Cu, Zn, Cr and Cd contamination are more in samples from Creek market. The Estimated Daily Intake of Pb, Zn, Cu in the studied samples was below the TDI of Pb, Zn and Cu respectively. The EDI of Cd in *Thais coronata* was above the TDI levels, the EDI of Cr in samples from Creek market was above TDI levels and greater than the EDI of samples from Mile 1 market. However, consuming sea food from Creek market exposes the population to trace metal contamination than sea foods from Mile 1, the calculated Target Hazard Quotient (THQ) was above 1 in samples from Creek market which means the exposed population are obviously to adverse non carcinogenic health effects while samples from mile 1 having a THQ less than 1 may not likely cause an immediate adverse effects but has an increasing probability of non-carcinogenic effects as the value gets closer to 1, though the human body can tolerate certain levels of these metals having a TDI and THQ above it threshold poses health risk due to excess intake of metals and sea food consumption from this areas may induce excessive metal intakes.

6. References

Asegbeloyin, J.N., Ujam, O.T., Ukwueze, N.N and Ukoha, P.O., (2010). Assessment of toxic trace metals in selected fish species and parts of Domestic Animals. *Pakistan Journal of Nutrition*. 9(3): 213- 215.

Babatunde, B.B., F.D. Sikoki. M.C. Onojake, R.U. Akpiri and D Akpuluma (2013). Heavy metal profiles in various matrices of the Bonny/New Calabar River Estuary, Niger Delta, Nigeria. *Global journal of Environmental Sciences* Vol. 12, 1-11

Bradl, Heike (2005). Heavy metals in the environment: origin, interaction and remediation. Elsevier/ Academic press. London.

Chamannejadian A., Sayyada G., Moezzi A. & Jahangrin A. (2013). Evaluation of Estimated Daily Intake (EDI) of Cadmium and Lead for Rice (*Oryza sativa L.)* in Calcareous Soils. *Journal of Environmental Health Science and Engineering.*10:28

Dahunsi, S.O., Oranusi, S.U and Ishola, R.O., (2012). Differential bioaccumulation of heavy metals in selected Biomakers of *Clarias gariepinus* exposed to chemical additive effluents. *Journal of Research in Environmental Science and Toxicology*. 1(5): 100-106.

Gbaruko, B. C and Friday, O. U. (2007). Bioaccumulation of Heavy metals in some fauna and flora. *International Journal of Environmental Science and technology*. 4(2): 197-202

Iwegbue, C.M.A., Nwajei, G.E and Iyoha, E.N., (2008). Heavy metal residues of Chicken meat and Gizzard and Turkey meat consumed in Southern Nigeria. *Journal of Veterinary Medicine*.11 (4): 275-280.

Jarup, L (2003). Hazards of heavy metal contamination, *British Medical bulletin*, 68, 167-182

Omojowo F. S., Olowosegun T. & Omojowo T.M. (2010) Fish Consumption Pattern in Kainji Lake Area. *World Rural Observation.* Vol 2(1); 75-79

Onojake, M.C and Okonkwo, V (2011). Trace Metals Associated with Oil Spillage: A case study. Journal of Chemistry and Pharmaceutical Research. 3(6):742-751

Solomon, F (2009). Impacts of copper on aquatic ecosystems and human health http://go.mining.com/apr08-a3

Ubalua, A.O., Chijioke, U.C and Ezeronye, O.U (2007). Determination and assessment of heavy metal content in fish and shellfish in Aba River, Abia state, Nigeria KMITL Science and Technology Journal. 7 (1):31-45

Vincent-Akpu I.F. and B.B. Babatunde (2013). Trace metals in water, fish and sediments from Elechi Creek, Port Harcourt, Rivers State, Nigeria**.** *Tropical Freshwater Biology, **22*** 13 – 21

Wagar, A., (2004). Levels of selected heavy metals in tuna fish. *The Abrabian Journal of Science and Engineering.* 31(1): 89-92.