HOSTED BY
ELSEVIER

Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage: www.elsevier.com/locate/apjtd

Parasitological research doi:10.1016/S2222-1808(16)61110-6

Parasitic diseases and heavy metal analysis in *Parachanna obscura* (Gunther 1861) and *Clarias gariepinus* (Burchell 1901) from Epe Lagoon, Lagos, Nigeria

Akinsanya Bamidele[1*], Minasu Pentho Kuton[2]

[1]*Department of Zoology, University of Lagos, Lagos, Nigeria*

[2]*Department of Marine Sciences, University of Lagos, Lagos, Nigeria*

ARTICLE INFO

Article history:
Received 28 Mar 2016
Received in revised form 9 Apr, 2nd revised form 18 Apr 2016
Accepted 20 May 2016
Available online 19 Aug 2016

Keywords:
Heavy metals
Parasites
Clarias
Parachanna
Procamallanus
Wenyonia

ABSTRACT

Objective: To evaluate the bioaccumulation of heavy metals in *Parachanna obscura* (*P. obscura*) and *Clarias gariepinus* (*C. gariepinus*) and the use of their parasites as accumulation indicators from Lekki Lagoon.

Methods: Samples of fish were procured from Oluwo market, a landing site of fish of artisanal fishermen in Epe. Metal accumulation, and intestinal parasites and protozoan of *P. obscura* and *C. gariepinus* were investigated. Sediment and water samples were examined for selected heavy metals (Cu, Cr, Ni, Pb and Fe) while nematode parasite from infected fish were also analysed for heavy metal content.

Results: Absolute morphometric parameters had low correlation with single independent morphometric index (total length and standard length) but increased when correlated with combined indices. The prevalence of parasitic infections in *P. obscura* and *C. gariepinus* were 35% and 36% respectively. The metal concentrations accumulated in the fish's liver were more than that found in the water and sediment. There was strong correlation in metal accumulated in the parasites relative to the water medium (r = 0.968 - 1.000, P < 0.01). *Procamallanus* spp., a nematode accumulated 2 times more Cu, Cr, Ni, Pb and Fe than *Wenyonia* sp. There was higher heavy metal level observed in intestinal nematode *Procamallanus* sp. than *wenyonia* sp. in the infected fish in this study.

Conclusions: This suggests that *Procamallanus* sp. may be used as a potential sink of metal pollution in an aquatic environment and also a good sentinel in the environment.

1. Introduction

The escalating contamination of the environment by toxic substances has perturbed many all over the world[1]. There are a lot of toxic substances that are poured into the aquatic environment as a result of increased technologies, over population, exploration and exploitation of oil, and agricultural and domestic activities[2].

Among these contaminants, the most dangerous of them is trace metals as a result of being non-biodegradable, poisonous, bioaccumulation and biomagnification potentials in organisms[3]. Heavy metal contaminants released from the industries are in soluble form which settle down at the bottom of the aquatic environment then ingested during feeding by the organisms which leads to bioaccumulation in aquatic organisms resulting into diseases as a result of long exposure because of their toxic nature, and these process affect the aquatic fauna and other organisms through biomagnifications[4,5]. Akinsanya and Otubanjo[6,7] reported several species of parasites from freshwater fishes of Lekki Lagoon, Lagos, Nigeria. Vincent *et al.*[8] on parasitic infections on some freshwater fishes reported different parasitofauna in a particular freshwater ecosystems in Nigeria.

The link between these toxic substances and parasitism in aquatic fauna as well as the ability of parasitic organisms acting as indicators of water quality have received rapt attention in the past twenty years[9]. The concentration of these metals should be monitored in water, sediment and aquatic fauna as well as in the different water level. Sediment most especially depicts the extent of pollutant in that water body as well as their sources[10,11].

Parasites are very important in the aquatic environment and represent a high proportion of aquatic biomass. Marcogliese *et al.*[12] indicated that parasites are found wherever life exist and that they provide information as a result of their bioaccumulation potentials on polluted ecosystems[8] and damaged food webs[12].

*Corresponding author: Akinsanya Bamidele, Department of Zoology, Parasitology Unit, University of Lagos, Lagos, Nigeria.
Tel: +2348079766494
E-mail: mpkuton@yahoo.com
The journal implements double-blind peer review practiced by specially invited international editorial board members.

Parasites respond quickly to environmental changes and they are more tolerant to these metals than their hosts and also increase in numbers in polluted conditions[13]. They are now regarded as a useful indicator of aquatic health. Intestinal parasites accumulate a number of metals than those found in host tissues[13-15], thus render parasites more sensitive metal accumulation biomonitors than their fish host. Parasites are affected by environmental changes in different ways, thus information on parasites can indicate anthropogenic impacts especially when the equilibrium between host and parasites is no longer available[16]. They often have an effect with other stressors in the same aquatic environment[17]. Pollution can reduce parasitic infections if infected host suffer as a result of bioaccumulation of contaminants rather leaving the uninfected hosts. There is variation on these effects which depend on the species of parasite and the magnitude and nature of the pollutant they interact with. Pollution can also increase parasitism if host is immunodeficient, thereby leading to their susceptibility to the particular disease linked to that contaminants. This could simply increase the population densities of suitable intermediate or final hosts in that water body. Svobodova *et al.*[18] reported that many fish species are also used as bioindicators of pollutant. Adams and Nowak[19] emphasised that the gills of many fish species are susceptible to accumulation of heavy metals due to the acidic nature of the aquatic environment which cause the movement of free divalent ions. Farkas *et al.*[20] also opined that heavy metals concentrations in fish organs like that in the parasite tissues is also an indication of pollution of the particular aquatic ecosystems. Ravera *et al*.[21] reported that availability of trace metals in the aquatic organisms in a particular water body is an indication that such contaminants have been there in the past and also currently. Parasites of fish are highly sensitive to contaminants as a result of their prompt physiological response to polluted ecosystems[22].

High concentrations of trace metals have been reported in acanthocephalans but also to a lesser degree in adult cestodes[23,24]. Vulnerability of parasites is as a result of their ability to accumulate metals[25]. Some spiny-headed worms were found to accumulate high levels of heavy metals than that found in their host. They can therefore provide information on the level and magnitude of pollution in the water body[26]. Parasites can also act as metal sinks for its fish host[27]. It is apparent that any changes to metal concentration in the fish tissues are likely to alter metal effects and presence in the hosts. Verrengia-Guerrero *et al*.[28] reported that prompt response of organism depends on the toxicokinetic and toxico-dynamic processes that occur once a metal toxicant has entered the organism. Similarly, Obodo[29] reported that catfish have the highest bioaccumulation potential as a result of the bioaccumulation factor of 350 for manganese and 219 for lead. Tilapia fishes, on the other hand, are more susceptible to accumulate lead and manganese as a result of the bioaccumulation factor of 224 for lead and 210 for manganese.

2. Materials and methods

2.1. Study area

Lekki Lagoon in Epe, Lagos State is centred on large fisheries activities. It lies between longitudes 4°00' and 4°15' E and latitudes 6°25' and 6°37' N. The surface area is about 247 km^2 with a depth of 6.4 m. There are some parts of the lagoon that are shallow and less than 3.0 m deep. This lagoon and creeks are along the coast of South Western Nigeria from the Dahomey border to the Niger Delta stretched through a distance of about 200 km. The Lagoon is connected with River Oni. The flora around the lagoon is characterized by shrubs and *Raphia sudanica* (raphia palms), and *Elais guineensis* (oil palms). Phytoplankton around the lagoon are found on its side. This includes: *Cocos nucifera* (coconut palms which are widespread in the surrounding villages. Both dry and rainy seasons are experienced in the lagoon. The fish fauna of the lagoon includes: *Heterotis niloticus, Gymnarchus niloticus, Clarias gariepinus* (*C. gariepinus*), *Malapterurus electricus, Synodontis clarias, Chrysichthys nigrodigitatus, Parachanna obscura* (*P. obscura*), *Mormyrus rume, Calamoichthys calabaricus, Tilapia zillii, Hemichromis fasciatus* and *Sarotherodon melanotheron*[30]. Figure 1 shows vividly the map of the study area indicating the Lagos Lagoon systems.

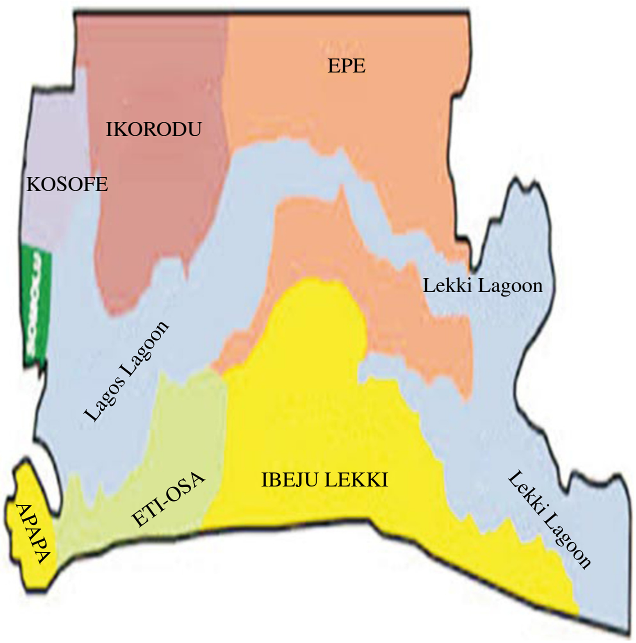

Figure 1. Typical map of Lekki Lagoon.

2.2. Collection of samples

The test organisms are *P. obscura* (snake head) and *C. gariepinus* (African mud catfish) which belong to the family Channidae and Clariidae respectively and which constitute important proportion of the catches by artisanal or subsistence fishermen and are of high economic importance.

Samples of fish were procured monthly between May to August 2015. A total of 50 randomly (n = 100) selected specimens of *P. obscura* and *C. gariepinus* respectively were obtained from Lekki Lagoon .

2.3. Examination of samples for parasite

The fresh specimens were dissected and the samples of intestine were obtained with the aid of stainless steel scissors and forceps which has been previously cleaned with physiological saline as recommended by Sures *et al.*[31].

The intestines were cut in physiological saline and were further carefully slit open longitudinally to aid the emergence of the