

Heavy Metals Concentration Levels in some Fish Species in the Red Sea and Gulf of Aden-Yemen

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دراسات دقيقة لتحديد تراكيز العناصر الثقيلة في بعض أنواع أسماك منطقة البحر الأحمر اليمني وخليج عدن نبيل عبده أحمد الشوافي

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تم تحديد مستوى العناصر الثقيلة (الزنك، والنحاس، والرصاص والكاديوم) والتي بعضها سامة ومسرطنة في أربعة أنواع من أسماك بيئة البحر الأحمر وخليج عدن وهي سمك الديرك، الجحش، الباعة والثمد. أظهرت النتائج بأن الاختلاف بين التراكيز التي تم الحصول عليها في أنسجة عضلات الأسماك يرجع إلى سبب الاختلاف في الطبيعة الجيوكيميائية للترسبات الشاطئية أكثر من المصادر الغير طبيعية، وتظهر نتائج هذا البحث بأن تراكيز العناصر الثقيلة قد لا تمثل خطر على البيئة البحرية للوقت الحالي. أوصت الدراسة بأهمية الاستمرار في برنامج الرصد والمراقبة للمياه الإقليمية ولضمان بقاء هذه الملوثات ضمن المستويات المسموح بها دولياً وكما هو موضح في مناقشة النتائج وأن تكون هذه النتائج دراسة أولية للعناصر الثقيلة المتبقية في الأسماك الاقتصادية خلال هذه الدراسة.

Key Words: Heavy metals, atomic Absorption, Red Sea, Gulf of Aden, Fish.

ABSTRACT

Level of heavy metals (Zn, Cu, Pb, and Cd) in four species of fish; manly, fish, Crenidens Crenidens, Scomberomorus Commerson, Rastrelliger Kanagurta, Thunnus Albacares were studied in the Red Sea of Yemen and the Gulf of Aden.

The results show that, the variations within the muscle tissues of fish were mainly attributed due to the geochemical nature of beach deposits rather than anthropogenic input. Thus it was concluded that the investigated heavy metals do not present an environmental hazards for the present time. Cd, Pb are harmful and causing the cancer diseases.

Introduction

Pollution in the world has received considerable attention from forty years ago, Abdoelmoneim, (1996). In the recent years, it becomes a great problem with increasing the human activity. Heavy metals are among of the pollutants, which receive attention in various countries.

In addition to the natural content of metals in the sea water from the geochemical background, the oceans and seas are considered a major receiver, industrial, a agriculture and sewage wastes (El-Moselhy, 1993).

Some of these metals are classified biochemically as essential elements. They are present in trace quantities in the bodies of living organisms. Among of these elements Fe, Cu, Zn and Mn are cited. Copper and Zinc play an important role in different physiological processes. On the other hand, lead and cadmium are non-essential elements and considered to be very toxic to the environment (No vital role for them) (Abdelmoneim *et al.*, 1994; Shakweer and Abbas, 1997).

The Red Sea of Yemen and Gulf of Aden are characterized by fish productivity and along it, there are industries, which dispose their wastes into the marine environment. In addition huge amounts of drainage waters mixed with pesticides and environmental of Yemen.

It is recommended that a continuous monitoring for the Red Sea of Yemen and Gulf of Aden should be formulated and conducted to ensure that the concentrations of heavy metals remain within the baseline levels established during the present study.

Aim of the present investigation

The aim of the study was to perform a baseline study on the state of pollution in the muscle tissues of the common fish species, which were surveying in the Red Sea of Yemen and Gulf of Aden. The objectives of the present study were to:

1. Determine residue levels of potential pollutants, heavy metals in the flesh of the four fish species collected from the red Sea of Yemen and The Gulf of Aden, and attempt to identify the most important source/s of contamination to the region.
2. Shed some light on the sub-lethal effects of the most prominent contaminants upon the marine resources in the area, as well as its possible implications with human health who consumes them.
3. Collect and review relevant existing data and arrange the results that obtained during the study in a manner thus to serve as a baseline data for further follow-up study in the region.

Material and Methods

Four species of fish "*Crenidens Crenidens*, *Scomberomorus Commerson*, *Rastrelliger Kanagurta*, *Thunnus Albacares*" were collected from the local commercial fishermen of Aden city and Hodiedah city during summer 1998. All samples were weighted and measured (Table 1,2). The samples were taken from the fish flesh for the determination of heavy metals concentrations. A part of the fish flesh samples

(approximately 3g) were taken then dried in the oven at 70 C° and stored until digestion. Soft samples were digested with concentrated HNO₃ and HClO₄ acids. The digested samples were diluted with deionized distilled water. The determination of heavy metals residue were carried out following they flame atomic absorption Spectrophotometer (AAS) method that approved by Standard Methods Committee, 1985 (APHA, 1985)(Perkin-Elmer Model 2380) instrument, following the manufacturer's recommendations with only slight modifications. Calibration curves were constructed from commercial standards. Various dilutions were made on the clear digest solution to bring them within the calibration of the ASS. Standard reference materials and blanks were digested and analyzed within every batch of samples.

Results and Discussion

Under natural conditions, the most important inputs of metals to coastal regions are the mechanical and chemical weathering of rocks (Bryan, 1984).

Table 1
The weight and length of fish collected during summer 1998
From Red Sea of Yemen.

Fish Species	No. of fish	Total Weight (g)	Total length (cm)	Standard length (cm)
<i>Scomberomorus Commerson</i>	5	250-500	80-100	60-85
<i>Crenidens Crenidens</i>	15	500-600	30-50	20-35
<i>Rastrelliger Kanagurta</i>	20	50-65	22-30	15-23
<i>Thunnus Albacares</i>	7	500-770	70-90	55-74

Table 2
The weight and length of fish collected during summer 1998
from Gulf of Aden

Fish Species	No. of fish	Total Weight (g)	Total length (cm)	Standard length (cm)
<i>Scomberomorus Commerson</i>	5	270-450	80-90	55-80
<i>Crenidens Crenidens</i>	15	620-650	33-54	23-38
<i>Rastrelliger Kanagurta</i>	20	70-80	32-37	22-27
<i>Thunnus Albacares</i>	7	453-720	60-89	50-71

Table 3
Mean Concentration of Zn, Cu, Pb and Cd in different, fish species in the Red Sea of Yemen (ppm dry Wt.)

<i>Metal</i>	<i>Scomberomorous Commerson</i>	<i>Crenidens Crenidens</i>	<i>Rastrelliger Kanagurta</i>	<i>Thunnus Albacares</i>
Zn	2.23 ± 0.10	2.71 ± 0.07	0.75 ± 0.08	3.17 ± 0.07
Cu	0.32 ± 0.09	0.40 ± 0.08	0.11 ± 0.03	0.35 ± 0.07
Pb	0.23 ± 0.04	0.18 ± 0.09	0.03 ± 0.01	0.25 ± 0.09
Cd	0.09 ± 0.01	0.13 ± 0.04	0.03 ± 0.02	0.11 ± 0.02

Table 4
Mean Concentration of Zn, Cu, Pb and Cd in different, fish species in the Gulf of Aden (ppm dry Wt.)

<i>Metal</i>	<i>Scomberomorus Commerson</i>	<i>Crenidens Crenidens</i>	<i>Rastrelliger Kanagurta</i>	<i>Thunnus Albacares</i>
Zn	2.10 ± 0.09	2.33 ± 0.07	0.55 ± 0.05	3.00 ± 0.05
Cu	0.30 ± 0.08	0.30 ± 0.08	0.09 ± 0.04	0.32 ± 0.08
Pb	0.27 ± 0.05	0.22 ± 0.08	0.05 ± 0.03	0.31 ± 0.04
Cd	1.07 ± 0.02	0.25 ± 0.02	0.07 ± 0.01	0.27 ± 0.03

The weight, length of fish and heavy metal concentrations measured in muscles fish collected from the Red Sea of Yemen and Gulf of Aden during the present study are presented in Table (1,2,3 and 4) respectively. These variations are mainly due to the geochemical nature of beach deposits rather than anthropogenic source/s. Heavy minerals are usually common and represent 50% or more of the beach deposits in some places along the Red Sea coast of Yemen (El-Anbaawy And Al-Awah, 1993). These beach deposits are mainly derived from mountainous region, which drain from the Yemen highlands to the sea through numerous rivers.

The marine environment may also be polluted with effluent waste containing trace elements from both anthropogenic and natural processes. Such input could results from treated and/ or untreated municipal and industrial wastes, agricultural runoff, and input from the atmosphere (Abaychi and DouAbul, 1985) and may quantitatively alter the natural biochemical cycle (Grimanis *et al.*, 1987; EPC, 1996). However, due to the physicochemical properties of most metals, the concentrations in sea water very rarely reach level which, are in polluted waters may accumulate toxic trace elements via their food chains. This agrees with,

abubaker, *et al.*, (1999); Al-Shwafi,(2001), Ba-Isa, *et al.*,(2001); Shriadah,(1999). The heavy metals are considered to be potentially harmful to the marine environment. In some cases (e.g. Cu, Pb and Cd) serious dumping have occurred with harmful effect on marine life (fish kills, green oysters, etc.). In the Red Sea and Gulf of Aden, industrial, agricultural, economic and social change occurred recently, in addition to an increase in population growth, thereby increasing environmental pollution year by year.

In Australia, the recommendations of the National Health and Medical Research Council (NHMRC) specify that the concentrations of Zn, Cu, Pb and Cd in the edible parts of fish should not exceed 1000.0,30.0,2.0 and 2.0 ppm wet weight respectively (Bebbington et al ., 1977). In our study, all the muscle samples analysed had concentrations of Zn, Cu, Pb, and Cd below the NHMRC standards.

Conclusions and Recommendations

It can be concluded from the present investigation that the light of the above reasoning author may thus conclude that the impact of human a activities on the marine environment is relatively low. Beach deposits are the main source of heavy metals in Red Sea of Yemen/Gulf of Aden environment.

It is recommended that a continuos monitoring programme for the Red Sea and Gulf of Aden region should be formulated and conducted to ensure that the concentrations of heavy metals is within the base-line levels established in the present study.

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