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Determination of some heavy metals in Cultured Catfish (*Clarias brachysoma*) in Western Kordofan State, Sudan

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Abstract
The current study was conducted in two localities have been selected in Western Kordofan State (Elsonout and Abu-zabad) to evaluate the similarities and differences in Heavy Metals Concentrations (Copper, Cadmium, Zinc, and Lead) in three parts (Liver, Gills and Muscles) of Catfish cultured in Dams. Moreover, the study was intended to evaluate the similarities and differences in Heavy Metals Concentrations in Dams water where Fish are cultured. The Correlation of Heavy Metals Accumulation between fish organs and water samples were compared. Finally, the evaluation was done for the comparison of these Heavy Metals levels with recommended levels by FAO, WHO and other international organizations. A total of 54 samples has been taken from marketable size Catfish (Gills; Livers and Muscles) cultured in Dams (Elsonout and Abu-zabad localities) were subjected to analysis Heavy Metals accumulations (Copper, Cadmium, Zinc, and Lead. Moreover, A total of 18 water samples were taken from Dams (shallow, middle and deep water) where fish samples has been taken. The data was subjected to SPSS by using factorial design. These findings were revealed that, There were a highly significant differences ($p \leq 0.01$) in all Heavy Metals among Gills, Liver and Muscles of *Clarias brachysoma* cultured in Dams (Elsonout and Abu-zabad localities). Anyway, Gills were recorded the maximum figures in all Heavy Metals followed by Livers and the minimum figures were recorded by muscles. These results were in the permissible levels recommended by international organizations. According to the findings.

Keywords: Abu-zabad, Elsonout, Heavy Metals, Catfish

Introduction
The content of heavy metals in fish can enhance or counteract the positive benefits of the omega-3andproteinin fish (Mary and Adeniyi, 2012) [10]. At the same time, the levels of contaminants in fish are of particular interest because of the potential effects of such substances on the fish itself and on the organisms that consume them, including humans (Burger and Gochfeld, 2005) [3]. Some heavy metals are essential elements for human beings, which means that they must be a part of our diet (Celik and Oehlenschläger, 2004) [4]. The contamination of fish from such rivers and lakes will surely affect humans as consumers of those fish. Fish that occupy high levels in the aquatic food we are known for their tendency to concentrate heavy metals in their body parts, thus, it is important to study the capacities of different fish body parts to accumulate metals because fish plays an essential role in the human diet; such information will help ensure that high levels of heavy metals are not being transferred to humans via fish consumption (Nor Hasyimah *et al*., 2011) [11].

This type of assessment is based largely on measuring the accumulated levels of heavy metals in different parts of tilapia fish, such as the liver, gills, and muscle. The gills and liver were chosen as target organs to evaluate the heavy metal accumulation in the studied fish, the levels of metals in the gills can represent the immediate levels of heavy metals in the water where the fish lives; mean- while, the levels in the liver reflect the longer-term accumulation of heavy metals in the fish (Ayse, 2003) [1]. In recent decades, food safety has become a widespread public concern worldwide due to the increasing demand for food safety; this has stimulated research work regarding certain threats associated with the consumption of food stuffs contaminated with heavy metals, pesticides or toxins (Salwa and Shuhaimi, 2011) [12]. The consumption of fish has been revealed to have benefits as well as risks, low levels of fish intake appear to reduce chronic heart diseases and mortality, at the same time, eating contaminated fish may pose a risk of heavy metal poisoning (as noted by these authors) (Tengku *et al*., 2010) [14]. The metals of most interest in bioavailability studies, as listed by the USEPA, are aluminum, beryllium, arsenic, cadmium, chromium, copper, mercury, nickel, lead, selenium, antimony, Other metals that are presently of minor interest to the EPA are barium, silver, cobalt, manganese, sodium, thallium, iron and zinc (Birungi *et al*., 2007) [2].

Justifications

1. West Korfofan Tordas (Dams) are fresh closed Tordas playing an important role in the lives of many people in the region, they are the aquacultural areas, they serve for recreation purpose and also they are used for drinking water supply by the communities surrounding it.
2. The importance of Catfish (*Clarias brachysoma*) as source of protein and polyunsaturated fatty acids which decrease the risk of cardiovascular diseases for humans.
3. The Catfish (*Clarias brachysoma*) is one of the aquatic organisms affected by heavy metals as the same time people are partially dependent on the catfish in their diet, so in many cases was used as metal biological marker in toxicological studies, these fish are cultured into the still water bodies (dams).

Statement of Problems

The hazards of heavy metal contamination and if it in acceptable levels, and how to avoid the levels above the acceptable levels which are recommended by FAO, WHO and other international organizations.

The objectives

1. To determine the distribution of selected heavy metal concentrations (copper (Cu), cadmium (Cd), Zinc (Zn), and lead (Pb)) in fish liver, gills and muscles for Catfish (*Clarias brachysoma*) cultured in Dams, Western Kordofan State.
2. To estimate the distribution of selected heavy metal concentrations (copper (Cu), cadmium (Cd), Zinc (Zn), and lead (Pb)) in water of Dams were Catfish (*Clarias brachysoma*) are cultured, Western Kordofan State.
3. To check the level of these Heavy Metals levels so as to be compared with recommended levels by FAO, WHO and other international organizations.

Materials and Methods

Area of study

In the current investigation, two different localities have been selected in Western Kordofan State (Elsonout and Abu-zabad). For easy interpretation of results, samples were analyzed depending on general experimental strategy as follows:

- The similarities and differences in Heavy Metals Concentrations (Copper (Cu), Cadmium (Cd), Zinc (Zn), and Lead (Pb)) in three parts (Liver, Gills and Muscles) of Catfish (*Clarias brachysoma*) cultured in Dams, Western Kordofan State, were investigated via laboratory analysis through this study.
- The similarities and differences in Heavy Metals Concentrations (Copper (Cu), Cadmium (Cd), Zinc (Zn), and Lead (Pb)) in Dams water where Fish are cultured, Western Kordofan State, were investigated via laboratory analysis through this study.
- The Correlation of Heavy Metals Accumulation fish organs and water samples were compared.
- Comparison of these Heavy Metals levels with recommended levels by FAO, WHO and other international organizations.

Experimental Design: (1x2x3)

Fish Sampling

A total of 54 samples has been taken from two marketable size Catfish (*Clarias brachysoma*) cultured in Dams, 27 representative samples per fish were randomly collected, 3 samples per fish (Gills, Liver and Muscles) were taken.

Sample preparation

Collected fish were gutted, scaled, fins removed and washed with clean, cold potable water, after that, Gills, Liver and Muscles were taken. Then, 5 grams per part were taken and transferred into special sags and all sags were transferred to sterilized container (100 ml size).

Preservation of Samples

All collected samples were put into sterilized containers and preserved immediately in minced ice preservative container by means of layers (first minced ice layer then samples layer and ice layer and so on).

Water Sampling

A total of 18 water samples were taken from Dams where fish samples has been taken, 9 representative water samples per dam were randomly collected, 3 water samples per deep (shallow, middle and deep water). The samples were collected into sterilized water containers (100 ml size) and transferred imxmediately to the laboratory.

Heavy metals analysis

The fish samples were thawed to room temperature. All water and Fish samples were taken for the Heavy Metal analysis by both; furnace atomic absorption spectrometry and flame atomic absorption spectrometry according to (Olaifa *et al*., 2004).

Statistical analysis

The data were analysed using statistical package for Social Studies (SPSS version 14.0). One way analysis of variance (ANOVA) was used for means separation between localities, fish organs and water. A P-value of ≤ 0.05 will be considered indicative of a statistically significant difference.

Results and Discussion

Results

This study was conducted, two different localities has been selected in Western Kordofan State (Elsonout and Abu-zabad) to determine the distribution of selected heavy metal concentrations (copper (Cu), cadmium (Cd), Zinc (Zn), and lead (Pb)) in fish liver, gills and muscles Catfish (*Clarias brachysoma*) cultured in Dams, Western Kordofan State. Also the investigation was intended to estimate the distribution of selected heavy metal concentrations (copper (Cu), cadmium (Cd), Zinc (Zn), and lead (Pb)) in water of Dams were Catfish (*Clarias brachysoma*) are cultured, Western Kordofan State. In addition, the study was intended to check the level of these Heavy Metals levels so as to be compared with recommended levels by FAO and WHO.

Table 1: Heavy Metals Profile (µg/g) of Catfish according to Fish parts and Locality

Localities	Heavy Metals												
	Zn ± (SE = 0.01)			Cu ± (SE = 0.01)			Cd ±(SE = 0.001)			Pb ±(SE = 0.002)			
	Gills	Liver	Muscles	Gills	Liver	Muscles	Gills	Liver	Muscles	Gills	Liver	Muscles	LS
Elsonout	0.131^{a}	0.109^{b}	0.079^{c}	0.153^{a}	0.142^{b}	0.126^{c}	0.015^{a}	0.013^{b}	0.011^{c}	0.281^{a}	0.265^{b}	0.251^{c}	
Abu-zabad	0.124^{a}	0.96^{b}	0.069^{c}	0.152^{a}	0.141^{b}	0.126^{c}	0.015^{a}	0.014^{b}	0.012^{c}	0.280^{a}	0.269^{b}	0.259^{c}	
Overall	0.130^{a}	0.109^{b}	0.079^{c}	o.150^{a}	0.138^{b}	0.125^{c}	0.150^{a}	0.139^{b}	0.123^{c}	0.0149^{a}	0.012^{b}	0.11^{c}	NS
LS	**			**			**			**			

^{abc} ≡ means for each independent having different manuscript are significantly different.
^{NS} ≡ no significant difference at ($p > 0.05$).
** ≡ highly significant difference at ($p \leq 0.01$).
^{LS} ≡ level of significant.
^{SE} ≡ Standard Error.

Table 2: Heavy Metals Profile (µg /ml) of Water according to Locality and Water Depth, (SE = 0.0005)

Localities	Heavy Metals												
	Zn			Cu			Cd			Pb			
	Shallow	Medium	Deep	Shallow	Medium	Deep	Shallow	Medium	Deep	Shallow	Medium	Deep	LS
Elsonout	0.059^{c}	0.063^{b}	0.069^{a}	0.116	0.104	0.118	0.008^{b}	0.009^{a}	0.010^{a}	0.151^{c}	0.159^{b}	0.166^{a}	
Abu-zabad	0.051^{c}	0.061^{b}	0.065^{a}	0.114	0.117	0.120	0.006^{b}	0.008^{a}	0.009^{a}	0.149^{c}	0.155^{b}	0.160^{a}	**
Overall	0.055^{c}	0.062^{b}	0.067^{a}	0.110	0.110	0.119	0.007^{b}	0.008^{a}	0.009^{a}	0.150^{c}	0.157^{b}	0.163^{a}	
LS	**			NS			**			**			

^{abc} ≡ means for each independent having different manuscript are significantly different.
^{NS} ≡ no significant difference at ($p > 0.05$).
** ≡ highly significant difference at ($p \leq 0.01$).
^{LS} ≡ level of significant.
^{SE} ≡ Standard Error

Discussion

Due to the toxicity of heavy metals and their accumulation in fish body, the assessment and determination of the concentration levels of heavy metals in freshwater fish species have not reached a considerable level of attention in different developing countries. This interesting study was aimed to assess some heavy metals as (copper (Cu), cadmium (Cd), Zinc (Zn), and lead (Pb)) in fish liver, gills and muscles for Catfish (*Clarias brachysoma*) cultured in Dams, Western Kordofan State. Also the investigation was intended to estimate the distribution of selected heavy metal concentrations (copper (Cu), cadmium (Cd), Zinc (Zn), and lead (Pb)) in water of Dams were Catfish (*Clarias brachysoma*) are cultured, Western Kordofan State. In addition, the study was intended to check the level of these Heavy Metals levels so as to be compared with recommended levels by FAO and WHO.

Heavy Metals Profile (µg/g) of *Catfish* Organs at Elsonout and Abu-zabad Localities

Zinc (Zn)

The results showed in table (1) that, the level of Zn (µg/g) of *Catfish* at Elsonout locality was: (0.131, 0.109 and 0.079) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($p \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*. Gills were recorded a highest value of Zn whereas Muscles recorded the lowest value. However, it is clear that, the Gills are the preference part for Zinc accumulation, Liver is become as second part preferred for Zinc accumulation, and Muscle is unlike for Zinc accumulation. Concerning Abu-zabad locality, as shows in table (1) that, the level of Zn (µg/g) of *Catfish* at Abu-zabad locality was: (0.124, 0.96 and 0.069) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*. Gills were recorded a highest value of Zn whereas Muscles recorded the lowest value.

However, according to localities; the levels of Zn (µg/g) of *Catfish* at Elsonout and Abu-zabad localities were: (0.130, 0.109 and 0.079) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Zn among Gills, Liver and Muscles of Catfish. This findings agreed with who were Studied Bioaccumulation of Heavy Metals in Clarias Gariepinus Organs from River Benue, North Central Nigeria; they were stated-out that; Zn rages from 0.071, 0.068 and 0.038 (µg/g) for Gills, Intestine and Tissues of Clarias Gariepinus, respectively.

Copper (Cu)

The results showed in table (1) that, the level of Cu (µg/g) of *Catfish* at Elsonout locality was: (0.153, 0.142 and 0.126) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($p \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*. Also, as shows in table (1) that, the level of Cu (µg/g) of *Catfish* at Abu-zabad locality was: (0.152, 0.141 and 0.126) for Gills, Liver and Muscles, respectively.

There was a highly significant difference ($P \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*. According to localities; the level of Cu (µg/g) of *Catfish* at Elsonout and Abu-zabad localities were: (0.150, 0.138 and 0.125) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($p \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*.

Gills were recorded a highest value of Cu whereas Muscles recorded the lowest value.

This findings greater than who were Studied Bioaccumulation of Heavy Metals in Clarias Gariepinus Organs from River Benue, North Central Nigeria; they were stated-out that; Cu rages from 0.020, 0.022 and 0.028 (µg/g) for Gills, Intestine and Tissues of Clarias Gariepinus, respectively.

Cadmium (Cd)

The results showed in table (1) that, the level of Cd (µg/g) of *Catfish* at Elsonout locality was: (0.015, 0.013 and 0.011) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Cd among Gills, Liver and Muscles of *Catfish*. Also, as shows in table (1) that, the level of Cd (µg/g) of *Catfish* at Abu-zabad locality was: (0.015, 0.014 and 0.012) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Cd among Gills, Liver and Muscles of *Catfish*. According to localities; the level of Cd (µg/g) of *Catfish* at Elsonout and Abu-zabad localities was: (0.150, 0.139 and 0.123) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*.

This findings were greater than who were Studied Bioaccumulation of Heavy Metals in Clarias Gariepinus Organs from River Benue, North Central Nigeria; they were stated-out that; Cd rages from 0.003, 0.003 and 0.002 (µg/g) for Gills, Intestine and Tissues of Clarias Gariepinus, respectively.

Gills were recorded a highest value of Cd whereas Muscles recorded the lowest value.

Lead (Pb)

The results showed in table (1) that, the level of Pb (µg/g) of *Catfish* at Elsonout locality was: (0.281, 0.265 and 0.251) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Pb among Gills, Liver and Muscles of *Catfish*. Also as shows in table (1) that, the level of Pb (µg/g) of *Catfish* at Abu-zabad locality was: (0.280, 0.269 and 0.259) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Pb among Gills, Liver and Muscles of *Catfish*. According to localities; the level of Pb (µg/g) of *Catfish* at Elsonout and Abu-zabad localities was: (0.0149, 0.012 and 0.11) for Gills, Liver and Muscles, respectively. There was a highly significant difference ($P \leq 0.01$) in Zn among Gills, Liver and Muscles of *Catfish*. This findings were greater than who were Studied Bioaccumulation of Heavy Metals in Clarias Gariepinus Organs from River Benue, North Central Nigeria; they were stated-out that; Pb rages from 0.012, 0.006 and 0.008 (µg/g) for Gills, Intestine and Tissues of Clarias Gariepinus, respectively.

Gills were recorded a highest value of Pb whereas Muscles recorded the lowest value. The results showed that, there were no significant difference (P>0.05) in all Heavy metals levels among organs in two localities.

The findings shown in table (1) that, there was a highly significant difference ($p \leq 0.01$) in all heavy metals according to organs.

However**,** when we were compared the overall findings were figured-out that, Gill were accumulated Heavy Metals more than Liver and Muscles in *Catfish* cultured in Elsonout and Abu-zabad localities Dams.

In this research, we observed the trend that different metals are accumulated at different concentration in various organs in each catfish (Table 1). The difference in the levels of accumulation in different organs of a fish can primarily be attributed to the differences in the physiological role of each organ. Other factors such as regulatory ability, behaviour and feeding habits may play a significant role in the accumulation differences in the different organs. Also the chemical nature of the metals ionic strength and pH tends to be a master variable in the accumulation process. In acidic conditions, there are enough hydrogen ions to occupy many of the negatively charged surfaces and little space is left to bind heavy metals, hence more heavy metals remain in the soluble phase. The soluble form of heavy metals is thought to be more harmful because it is more easily transported and more readily available to aquatic organism. *Clarias gariepinus* (Catfish) gills contained the highest concentration of all the detected heavy metals, followed by liver, while the muscle tissue was the lowest (Table 1). The general order of heavy metals concentrations in various organs of the two catfish used in this research can represented (table 1) as follows: Gills > Livers > muscle tissues. Higher metal concentrations in the gills could be due to the element complexion with the mucus that is virtually impossible to completely remove from the gill lamellae before prepared for analysis. Furthermore, the adsorption of metals onto the gills surface as the first target for pollutants in water could be a significant influence in the total metal levels of the gill. Target organs such as gills and livers are metabolically active parts that can accumulate heavy metals in higher levels, as shown in various fish species.

Heavy Metals Profile (µg/ml) of Water according to Locality and Water Depth

Zinc (Zn)

The results showed in table (2) that, the levels of Zn (µg/ml) of Water Depth at Elsonout locality were: (0.059, 0.063 and 0.069) for Shallow, Medium and Deep, respectively. There was a highly significant difference ($P \leq 0.01$) in Zn among Water Depth (Shallow, Medium and Deep). Deep was recorded a highest value of Zn, whereas Shallow recorded the lowest value.

Also, table (2) shows that, the levels of Zn (µg/ml) of Water Depth at Abu-zabad locality were: (0.051, 0.062 and 0.065) for Shallow, Medium and Deep, respectively. There was a highly significant difference ($P \leq 0.01$) in Zn among Water Depth (Shallow, Medium and Deep). Deep was recorded a highest value of Zn, whereas Shallow recorded the lowest value. However, it is clear that, the Zinc accumulation is increase from shallow to the depth. The overall mean of Zn in two localities are 0.055, 0.062 and 0.067 (µg/ml) for Shallow, Medium and Deep, respectively.

The results of this work is in the range of Tole and Jenipher (2003) [15] and Kisamo (2003) [9] who were found the concentrations of Zn in water of Lake Victoria were range from 0.01-5.62 mg/L.

However, these findings is the range of USEPA (2006), who

was presented the levels of Heavy Metals in Water and mentioned that, Zn was 0.50 mg/L. and less than WHO (1993) who was Figured-out that, the Heavy Metals in water and stated that, Zn were 2.00, 0.05 and 5.00 mg/L. Furthermore, the current results is less than FAO (1985) assessed the trace metals in lakes water and pointed-out that, Zn was 2.00 mg/L.

Copper (Cu)

The results showed in table (2) that, the levels of Cu (µg/ml) of Water Depth at Elsonout locality were: (0.116, 0.104 and 0.118) for Shallow, Medium and Deep, respectively. There was no significant difference (P>0.05) in Zn among Water Depth (Shallow, Medium and Deep). However, Deep was recorded a highest value of Cu, whereas Medium recorded the lowest value.

Also, table (2) shows that, the levels of Cu (µg/ml) of Water Depth at Abu-zabad locality were: (0.114, 0.117 and 0.120) for Shallow, Medium and Deep, respectively. There was no significant difference (P>0.05) in Cu among Water Depth (Shallow, Medium and Deep). Anyway, Deep was recorded a highest value of Cu, whereas Shallow recorded the lowest value. The overall mean of Cu in two localities are 0.110, 0.110 and 0.119 (µg/ml) for Shallow, Medium and Deep, respectively.

The findings of the work are greater than Tole and Jenipher (2003) and Kisamo (2003) [16, 9] who were found the concentrations of Cu in water of Lake Victoria were 0.01 mg/L. however, the findings are in range of USEPA (2006), who were stated-out that, the permissible level of Cu in Water was 1.50 mg/L. WHO (1993) Figured-out that, the permissible level of Cu in water was 2.00 mg/L. Furthermore, these results are greater than FAO (1985) who was assessed the trace metals in lakes water and pointed-out that, means of Cu and was mg/l.

Cadmium (Cd)

The results showed in table (2) that, the levels of Cd (µg/ml) of Water Depth at Elsonout locality were: (0.008, 0.009 and 0.010) for Shallow, Medium and Deep, respectively. There was a highly significant difference ($P \leq 0.01$) in Cu among Water Depth (Shallow, Medium and Deep). However, Deep was recorded a highest value of Cd, whereas Medium recorded the lowest value.

Also, table (2) shows that, the levels of Cd (µg/ml) of Water Depth at Abu-zabad locality were: (0.006, 0.008 and 0.009) for Shallow, Medium and Deep, respectively. There was a highly significant difference ($p \leq 0.01$) in Cd among Water Depth (Shallow, Medium and Deep). The overall mean of Cd in two localities are 0.007, 0.008 and 0.009 (µg/ml) for Shallow, Medium and Deep, respectively.

The findings were agreed with Hussien (2015) [7] who were studied Some Heavy Metals Concentration in Water, Muscles and Gills of Tilapia Niloticus as Biological Indicator of Manzala Lake Pollution in Egypt; he was figured out that; Cd in water 0.070 to 0.140 mg/L. however, the results of the current research were in the permissible limits which were figured-out by FAO/WHO (2011) who were represented the permissible limits of Heavy Metals for water was Cd 0.003 mg/L. Also, represented the permissible limits of Heavy Metals in Soil was Cd 0.3 mg/kg.

Lead (Pd)

The results showed in table (2) that, the levels of Pd (µg/ml) of Water Depth at Elsonout locality were: (0.151, 0.159 and 0.166) for Shallow, Medium and Deep, respectively. There was no significant difference (P>0.05) in Zn among Water Depth (Shallow, Medium and Deep). However, Deep was recorded a highest value of Pb, whereas Medium recorded the lowest value.

Also, table (2) shows that, the levels of Pd (µg/ml) of Water Depth at Abu-zabad locality were: (0.149, 0.155 and 0.160) for Shallow, Medium and Deep, respectively. There was no significant difference (P>0.05) in Cu among Water Depth (Shallow, Medium and Deep). Anyway, Deep was recorded a highest value of Pb, whereas Shallow recorded the lowest value. The overall mean of Pb in two localities are 0.150, 0.157 and 0.163 (µg/ml) for Shallow, Medium and Deep, respectively.

The findings were in agreement with Tole and Jenipher (2003) [15] and Kisamo (2003) [9] who were found the concentrations of Pb in water of Lake Victoria were in range of 0.35- 0.36-0.63 mg/L. however, the results were so greater than USEPA (2006) and WHO (1993), who were represented the levels of Heavy Metals in Water and figured out that, Pb was 0.05 and 0.05 mg/L, respectively.

Furthermore, these findings were agreed with Hussien (2015) [7] who were studied Some Heavy Metals Concentration in Water, Muscles and Gills of Tilapia Niloticus as Biological Indicator of Manzala Lake Pollution in Egypt; he was figured out that Pb in water were ranged from: 0.050 to 0.310 mg/L. In addition that, the results were in the range of FAO/WHO (2011) who were represented the permissible limits of Pb for water was Pb 0.010 mg/L. Also, represented the permissible limits of Pb in Soil was Pb 0.2 mg/kg.

Conclusion and Recommendations

Conclusion

current study was conducted in two different localities have been selected in Western Kordofan State (Elsonout and Abu-zabad) to evaluate the similarities and differences in Heavy Metals Concentrations Cu, Cd, Zn, and Pb in three parts (Liver, Gills and Muscles) of Catfish (*Clarias brachysoma*) cultured in Dams, Western. Moreover, the study was intended to evaluate Heavy Metals Concentrations in Dams water where Fish Species are cultured. Furthermore the Correlations of Heavy Metals Accumulation between fish organs and water samples were compared. Finally, Heavy Metals levels were compared with recommended levels by FAO, WHO and other international organizations. A total of 54 samples has been taken from two marketable size fish (Gills; Livers and Muscles) Catfish (*Clarias brachysoma*): cultured in Dams (Elsonout and Abu-zabad localities) were subjected to analysis Heavy Metals accumulations Cu, Cd, Zn, and Pb. Moreover, A total of 18 water samples were taken from Dams (shallow, middle and deep water) where fish samples has been taken. The data was subjected to SPSS by using factorial design. The findings of this work were revealed that, There were a highly significant differences ($p \leq 0.01$) in all Heavy Metals among Gills, Liver and Muscles of *Clarias brachysoma* cultured in Dams (Elsonout and Abu-zabad localities).. Anyway, when compared fish organs; we found that, Gills were recorded the maximum figures in all

Heavy Metals followed by Livers and the minimum figures were recorded by muscles.

Recommendations

1. According to the findings, we recommend that, People of western Kordofan State should eat *Clarias brachysoma* and there was no Heavy Metal hazards found in these fish.
2. Further researches are needed for other cultured fish in Western Kordofan Dams to check the Heavy Metals levels.

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