*BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA*, August 2014. Vol. **11**(2), 821-827

# Investigation of Some Serum Biochemical Factors in Sohal surgeonfish (*Acanthurussohal*) as Indicators of Aquatic Pollution

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doi: http://dx.doi.org/10.13005/bbra/1344

(Received: 18 April 2014; accepted: 23 May 2014)

**The present study was carried out on theSohal surgeon fish *Acanthurussohal* (family, Acanthuridae).Weight and length of each sample were recorded (Mean length 19.08 cm ± 1.69 SD and Mean weight 152.50 g± 12.94 SD).Transferase enzyme activities of fish*A. sohal*were determined to establish possible environmental impact of toxic effect on anthropogenic pollution on Red Sea. and Activities of aspartate transaminase (AST), alanine transaminase (ALT) and alkaline phosphates (ALP)in the blood of fish were chosen as bioindicators. Fish were sampled between December 2013 and April 2014 from locality Jeddah (Red Sea). After sacrificing the fishes freshly blood samples were collected and transported on ice. The all Serum samples were analyzed in laboratory.The results show that mean values of ALP, AST andALT in this fishes were equaled to198.07, 75.15 and 23.24 (IU/L) respectively.The relation between serumparameters value with biometric factor (TL) of fishes were also studied. The results showed statistical difference in factors between weight and length($P<0.01$).Fish have been proposed as indicators for monitoring land-based pollution because they may concentrate indicative pollutants in their tissue, directly from water through respiration and also through their diet. Fish are frequently subjected to prooxidant effects of different pollutants often present in the aquatic environment.**

**Key words:** Sohal surgeonfish, Red Sea, Indicator,Pollution .

Water pollution has become a worldwide problem during recent years, because they are indestructible and most of them have toxic effects on organisms (MacFarlane and Burchett, 2000). Fish is one of the major sources of proteins in the Kingdom of Saudi Arabia, its believed to be contaminated with heavy metals at Jeddah Coast due growing industry, shipping and human wastes, due to the strategic location as one of the shipping, industry, and urbanization centers of Saudi Arabia, a large number of toxic chemicals and effluent-producing industries are located in and around Jeddah City(Iman., *et al.* 2002). Biomarkers have been defined as "biological responses that can be related to an exposure to, or toxic effect of, an environmental chemical or chemicals", and considerable attention has been directed towards the application of them in environmental research. (Soi *et al.,* 2008).The blood serum parameters is one of the unique indicators in any fish species which differentiates it from other species, blood indicators are not only a way to determine species quality but also are useful in the study of the health of fish. The blood serum parameters are affected by many factors as Infectious Diseases (Bruno, 1986; Myner, 1993; Robert and Griffith 1981), Environmental factors (De Smet and Blust, 2001; De Pedro et al., 2005;Cicik, 2005;Loreki et al.,1386;Hrubec et al., 1997; Kubilay and Ulukoy,

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2002_), Fish species (Peyghanet al.,1386; Snieszko S. F., 1960).The measurement of enzymes activities in the serum is, therefore, frequently used as a diagnostic tool in human medicine (Adolph and Lorenz, 1978; Goetz, 1980, Duat and Arends 2003). Most research on the use of serum transaminase activities as main indicator of tissue damage has, therefore, been performed on humans, since both ALT and AST activities are of great clinical significance (Jyothi and Narayen, 2000).Enzyme activities are considered as sensitive biochemical indicators before hazardous effects occur in fish and so they are important parameters for testing water for the presence of toxicants (Casillas*et al*., 1983). Biochemical and physiological indicators such as enzymes, could be used (as biomarkers) to identify possible environmental contaminations before the health of aquatic organisms is seriously affected(Jiminez and Stegeman 1990; Barnhoorn, 1996) and to develop water quality indices(Powers 1989; Gayet*et al* 1993;Zollner 1993;Osman *et al* 2007; Mekkawy*et al* 2009).

The present study aims to determine some serum factors in *A. sohal* as biochemical indicators of marine pollution.

## MATERIALS AND METHODS

**Water sampling**

Were collected six samples of sea waterat depth of half meter from the water surface with clean polythene bottles containers three times with the site water prior to collection for *in situ* determinationsome of physicochemical parameters which including the electrical conductivity of the water samples (mS/cm), pH, water temperature (°C),Total Dissolved Solid (TDS), Dissolved Oxygen (DO) and Salinity (%) were measured by thekits of HACH Portable Meters device model HQ 40d. (Fig. 1).

**Biological sampling**

Sampling was conducted between December 2013 and April 2014.The fish were collected a livedby fishermanfrom the Red Sea, Jeddah region, weight and length of each sample were recorded .The fishe sampled was ***A. sohal*** .The fishe was identified and collected with the assistance of staff of the Department of Biology Sciences, University of KAU. Sampling location was identified with a hand-held Garmin-GPSMAP 76S-type global positioning system.

**Blood sampling**

Immediately after removing the fish from the sea, they are anesthetized with benzocaine (**0.1 g/L**), and blood samples are taken from the caudal vein by means of non-heparinized plastic syringes. Sera were taken in dry clean vials and immediately kept in deep freezer at -20°C for later biochemical analysis. Blood was then centrifuged for 5 min at 3000g and serum samples are stored frozen (-20 °C).

**Serum aspartate aminotransferase(AST) and alanine aminotransferase(ALT)**

The serum AST and ALT activities were determined colorimetrically by transaminases kits according to Reitman and Frankel (1957).

**Serum Alkaline phosphatase**

Serum alkaline-phosphatase (AP) was determined according to the method described in Bergmeyer (1972).

**Statistical analysis**

The software Statistical 6.0 is used for all analyses, followed by the tests of between-subjects effects, with significance level of 95%.

## RESULTS AND DISCUSSION

**The Weight and length**

Total length of individual fish was taken from the tip of the snout to the extended tip of the caudal fin using a measuring board. Body weight was taken to the nearest gram using electronic balance. The estimated parameters of the weight-length relationships are given in Table:(1)

**Ecological Results**

Water temperature at sampling area was 27.79± 0.58, pH meter was 8.31± 0.09,Specific Conductivity was 57.26± 0.46, Total Dissolved Solid was 36.49± 1.05, salinity was 39.56 ± 0 .64 and dissolved oxygen was 2.58 ± 0.21.All result in table (2).

**Biochemical results**

Determination of enzyme activity in plasma or serum and tissues has proven to have diagnostic application in fish health studies (Bouk*et al*., 1978). Many pollutants have been shown to act specifically by inhibiting certain enzymes, thus interfering with metabolic processes in development (Weis et al., 1981).

Transamination represents one of the principal

**Table 1.** Weight and length of the Sohal surgeonfish (*A. sohal*) Collected from Jeddah Coast, Red Sea

| Fish No. | Weight (g) | Length (cm) |
|---|---|---|
| 1 | 142 | 18.9 |
| 2 | 166 | 21.4 |
| 3 | 132 | 16.3 |
| 4 | 159 | 18.9 |
| 5 | 163 | 19.4 |
| 6 | 146 | 18.5 |
| 7 | 153 | 19.1 |
| 8 | 135 | 17.3 |
| 9 | 163 | 18.9 |
| 10 | 166 | 22.1 |
| Mean | 152.50 | 19.08 |
| Std. Deviation | 12.94 | 1.69 |
| Variance | 167.39 | 2.88 |
| Correlations | | |
| Weight | | |
| Pearson Correlation | 1 | 0.841** |
| Sig. (2 tailed) | | 0.002 |
| Length | | |
| Pearson Correlation | 0.841** | 1 |
| Sig. (2-tailed) | 0.002 | |

**. Correlation is significant at the 0.01 level (2-tailed).

pathways for the synthesis and deamination of amino acids, thereby allowing an interplay between carbohydrate, fat and protein metabolism during fluctuating energy demands of the organism in various adaptive relations (Waarde and Henegaurven, 1982). Therefore, attention has been focused on the changes in the aminotransferases, (AST) and (ALT) which promotegluconeogensis from amino acids and relate changes in their activities to the liver condition (Marie, 1994). AST and ALT are normally found by low concentrations in blood; so if liver cells are damaged, they may leak them into the plasma causing an increase in catalytic activity (Heath, 1987). However, liver cells are particularly rich in transaminases because this organ is the major site for interconversion of food stuff.

Increased levels of ALP enzyme have been detected in several samples (No. 1, 2, 4, 7, 9), AST in several samples (No. 2, 5, 6, 9, 10) and ALT in several samples (No. 1, 4, 5, 7, 9, 10). The present data in several samples (No. 3, 5, 6, 8, 10) show decrease of ALP activity whereasdecrease of level of AST enzyme in several samples (No. 1, 3, 4, 7, 8) and ALT in several samples (No. 2, 3, 6, 8) (Table 3).

**Table 2.** Hydrographic parameter values of the studying areas at Jeddah Coast, Red Sea, during (2013)

| Parameter | Temperature (°C) | pH | SpC(mS/cm) | TDS (g/L) | Salinity(%) | DOmg/l |
|---|---|---|---|---|---|---|
| Mean | 27.79 | 8.31 | 57.26 | 36.49 | 39.56 | 2.58 |
| Stnd. deviation | 0.58 | 0.09 | 0.46 | 1.05 | 0 .64 | 0.21 |
| Variance | 0.33 | 0.009 | 0.210 | 1.094 | 0.41 | 0.043 |
| Minimum | 27.35 | 8.20 | 56.67 | 34.78 | 38.71 | 2.37 |
| Maximum | 28.55 | 8.44 | 58.00 | 37.80 | 40.34 | 2.87 |
| Range | 1.20 | 0.24 | 1.33 | 3.02 | 1.63 | 0.50 |
| Stnd. skewness | 0.936 | 0.312 | 0.438 | -.724 | -0.303 | 0.517 |
| Stnd. kurtosis | -1.872 | -1.869 | 0.639 | 0.652 | -1.509 | -1.815 |

Specific Conductivity (SpC), Total Dissolved Solid (TDS), Dissolved Oxygen (DO)

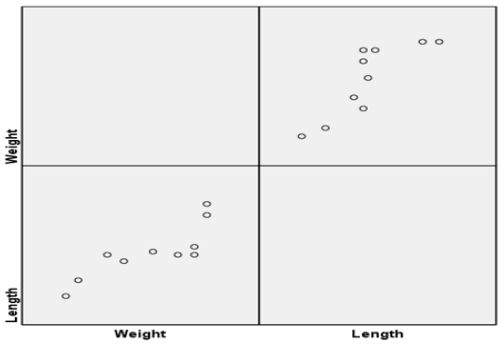
The response to environmental pollution and toxic impact of the pollutant in the aquatic environment represents one of the possible reasons. According some author (Jovanovich, 1993) antioxidant enzymes level depends of age, nutrition and spawning of the fish samples. According to Zikic (2001) cadmium induces the appearance of anemia and alters the metabolism of carbohydrates and proteins in goldfishes.

Their results also show the decreased activity of ALT in erythrocytes of goldfishes during acute exposure to cadmium, which indicates the presence of ROS-induced peroxidation, which leads to the destruction of RBC membrane (Table 1).

The caught individual samples were of a healthy appearance and solid health condition. Our early investigation study of the condition of fish population of Red Sea and histopathological analysis of the microscopic preparations, evidenced

**Table 3.** The quantitative concentrations of serum ALP, AST and ALT oftheSohal surgeonfish ( *A.sohal*). (Mean, S.D and V)

| samples | ALP(IU/L) | AST(IU/L) | ALT(IU/L) |
|---|---|---|---|
| 1 | 394.9 | 67.42 | 34.65 |
| 2 | 366.6 | 102.9 | 3.53 |
| 3 | 33.2 | 34.4 | 5.9 |
| 4 | 237.7 | 50.3 | 41.6 |
| 5 | 45.9 | 112.5 | 33.9 |
| 6 | 62.5 | 99.7 | 2.8 |
| 7 | 401.1 | 20.8 | 48.3 |
| 8 | 56.1 | 20.9 | 3.61 |
| 9 | 350.00 | 121.01 | 28.9 |
| 10 | 32.7 | 121.6 | 29.2 |
| Mean | 198.07 | 75.15 | 23.24 |
| Std. Deviation | 166.41268 | 41.18165 | 17.53968 |
| Variance | 2769 | 1696 | 307.640 |




presence of granulomatous inflammation at the level of hepatocellular parenchyma in liver of ***A. sohal***. Inflammatory processes were evidenced in some of the investigated individuals, but with even distribution in all investigated localities. The link between the environmental pollution and the stress


**Fig.1.** Map showing the sampling site at Jeddah Coast, Red Sea.

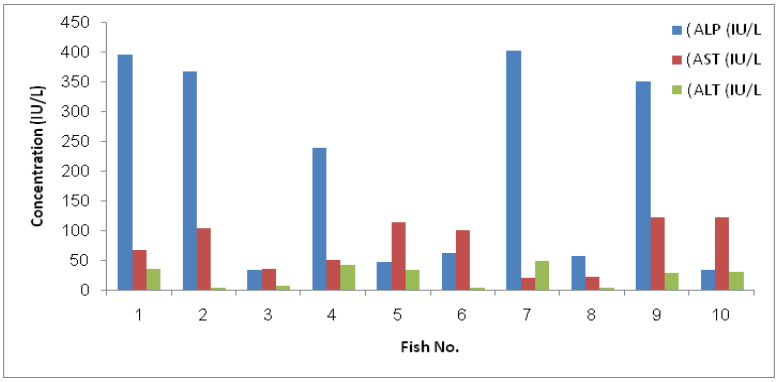



**Fig. 2.** The concentrations of serum ALP, AST and ALT oftheSohal surgeonfish ( *A.sohal*)

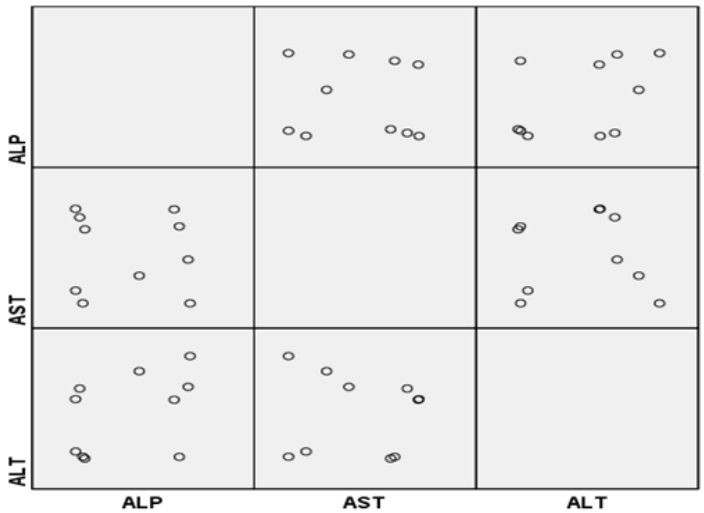
Tests of Between-Subjects Effects

| Source | Dependent Variable | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Corrected Model | ALP | .000[a] | 0 | . | . | . |
| | AST | .000[b] | 0 | . | . | . |
| | ALT | .000[c] | 0 | . | . | . |
| Intercept | ALP | 392317.249 | 1 | 392317.249 | 14.167 | .004 |
| | AST | 56479.734 | 1 | 56479.734 | 33.303 | .000 |
| | ALT | 5400.511 | 1 | 5400.511 | 17.555 | .002 |
| Error | ALP | 249238.621 | 9 | 27693.180 | | |
| | AST | 15263.352 | 9 | 1695.928 | | |
| | ALT | 2768.764 | 9 | 307.640 | | |
| Total | ALP | 641555.870 | 10 | | | |
| | AST | 71743.086 | 10 | | | |
| | ALT | 8169.276 | 10 | | | |
| Corrected Total | ALP | 249238.621 | 9 | | | |
| | AST | 15263.352 | 9 | | | |
| | ALT | 2768.764 | 9 | | | |

a. R Squared = .000 (Adjusted R Squared = .000)
b. R Squared = .000 (Adjusted R Squared = .000)
c. R Squared = .000 (Adjusted R Squared = .000)

Correlations

| | | ALP | AST | ALT |
|---|---|---|---|---|
| ALP | Pearson Correlation | 1 | -.068- | .434 |
| | Sig. (2-tailed) | | .853 | .210 |
| | N | 10 | 10 | 10 |
| AST | Pearson Correlation | -.068- | 1 | -.038- |
| | Sig. (2-tailed) | .853 | | .916 |
| | N | 10 | 10 | 10 |
| ALT | Pearson Correlation | .434 | -.038- | 1 |
| | Sig. (2-tailed) | .210 | .916 | |
| | N | 10 | 10 | 10 |



responsein fish indicates that infectious diseases arise when the host is exposed to certain conditions of environmental pollution. Faunal investigation of the fish ***A. sohal***., revealed a number of various pathological changes in the billiary tree including bile duct proliferation and holangiofibrosis.

The hepatic-toxic impact of the pollutants in the aquatic environment upon liver in barbel represents one of the possible reasons (Velkova-Jordanoska, 2003). Although Red Sea generally resists the negative influences of the anthropogenic factor for the time being, certain localities of the littoral region display loading with contaminants from the ground, especially in the course of the summer period. This implies the need of a greater seriousness in terms of protection of theRed Sea and more efforts towards eliminating the constant sources of pollution. Red Sea with its spring waters, its old age, the endemic species and its beauty deserves the utmost attention.

## CONCLUSIONS

Fish *A. sohal* were subject of activities of ALP, AST and ALT in the blood of fish, and marker toprooxidant effects of different pollutants present in theaquatic environment. The present data in our papershow decrease of ALP activity andincrease of level of ALT and AST enzyme in several samples. Our results display that it is needed much more investigationon pollution effectsin Red Sea, to resolvethe question, about pollution impact of this Sea.

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