**Morphometric and Gross Chemical Studies of Healthy and Infected Rabbit Fish, (Siganus rivulatus) by Helminthes Parasite in Red Sea Coast, Sudan.**

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**Abstract:** For this experiment the rabbit fishes (Siganus rivulatus) were collected from Abu Hashish Site, Port Sudan, Sudan, 2010. The study the external parasites particular the helminthes parasites. The rabbit fishes were divided into four groups: Group A (control male), Group B (male infected by helminthes), Group C (control female), and Group D (female infected by helminthes). Morphometric parameters (length; weight and age) were measured for each group. Edible proportion of flesh was prepared as dried powder and subject to gross bio chemical composition analysis. The findings were indicated that there was no changes in length or weight was recorded in group B and D. Edible proportion of the helminthes infected the group's flesh showed declined in protein, but the other biochemical parameters and gross revealed no significant change during the study experiment.

**Key words:** Helminthes, Parasite, Nematodes, Morphometric.

**INTRODUCTION**

The Red Sea is an inlet of the Indian Ocean between Africa and Asia. The connection to the ocean in the south is Bab el Mandeb and the Gulf of Aden in the north is the Sinai Peninsula, the Gulf of Aqaba or the Gulf of Eilat and the Gulf of Suez (leading to the Suez Canal). The Red Sea is a global 200 ecoregion and occupying a part of the Great Rift Valley, the Red Sea has a surface area of roughly 174,000 square miles (450,000 km²): being roughly 1,200 miles (1,900 km) long and, at its widest point, over 190 miles (300 km) wide. It has a maximum depth of 8,200 feet (2,500 m) in the central median trench and an average depth of 1,640 feet (500 m), but there are also extensive shallow shelves, noted for their marine life and corals. The Red Sea is the habitat of over 1,000 invertebrate species and 200 soft and hard corals and is the world's most northern tropical sea (Persga, 2001). The genus of family siganidae represented 0.68%, 1.03% and 0.93% by weight of catch along Sudanese Red Sea Coast for the year 2004, 2005 and 2006 respectively (Marine Fisheries Administration, 2006). The price of kilogram of "Sigan" ranged from 4 to 8 Sudanese Pounds.

Abu Hashish Area is one of the landing and/or fishing grounds along the Sudanese Coast. It's about 6 km long and extends to about 2 km north of the northern point of Port Sudan of plate. This situation enhanced the execution of a number of studies in the area such as the work of (Hamza, 1989) on impact of thermal pollution, (El Tayeb, 1999) on the abundance of Trochus spp., (Ali, 2000) on Environmental impact assessment and (Ali, 2001) on the diversity of Echinoderms, (Persga, 2001). The order Perciforms (perch-like) which belong to the class of Actinopterygii (ray-finned fishes) comprise over 70% of the fishes caught at Suakin (Abu Gideiri, 1968).

There are 27 species of genus Siganus recorded in the family Siganidae, all occurred in the Indo-Pacific Region, Western Indo-Pacific Ocean, Several coastal areas in East Africa, the Red Sea and the Mediterranean Sea (Randall, 1983; WWW.fishbase Org. 2006). The discrepancy in the number of siganid species in the Sudanese Red Sea Coast apparent from previous studies.

Two species of Siganus rivulatus and S.stellatus Red Sea was reported by (Reed, 1964). Rabbit fishes are fishes with a compressed oval body covered with minute, thin cycloid scales.

The mouth is small with a raw of a close set of teeth in each jaw and their body colours are variable. In Siganus rivulatus, the body is grey-green to brown on back and silvery below fins, faded yellow-gold stripes on lower half of the body all spines of Siganidae are venomous (Dzikowski et al, 2003). *Siganus rivulatus* inhabits shallow sandy areas often covered by along and sea grass, lagoons, around rocks and coral reefs. It is found in schools of 50 to several hundred. It can be found at depth down to 20m. *Siganus rivulatus*
has the ability to change its body colouration very rapidly. This phenomenon is known as mottled pattern which is camouflage behaviors, (Golani, 1998). Every species of fish is adapted to feeding in a particular food or a wide spectrum of food items, during the process of development of the fish changes take place in its food (Lagler, 1977). The feeding behavior is influence by hormones, temperature and the abundance of food (Abdel Hamed, 1994; Bariche, 2005). Siganus rivulatus begin their life as a phytoplankton feeder on many small cycloid and diatoms, then ingest zooplankton consisting of copepods species (Crompton, 1985). Siganus spp are a herbivorous fishes of shallow coastal water (Fish, 2006). The type and amount of food influence significant the body composition and its nutritional value (Papoutsoglou, 1978). Studied the biochemical content of some Red Sea algae of the genera Ulva, Halimeda, Gracilaria, Cystoseria, Padina, Sargassum, Laurencia concluded that green algae and the red algae have the highest protein percentage (17.8 - 25.29%) followed by the brown algae with a low protein percentage (6.37 - 8.9%), but the ash content gave the highest percent in the brown algae and there was no variation in the lipids content (Khafaji, 1992). The food value of a fish species is determined by the relative abundance of the main components of the flesh: protein, fat and water (Mahmoud, 1977). The flavor is often due to the presence of specific amino acids and oil characteristic of each fish species (Kirk, 1991). The chemical composition of the fish for moisture, protein, ash and fat is ranged from 64 - 84%, 15 - 30%, 0.08 - 2% and 0.1 - 24%, respectively, which largely depends on its food and habitat (Hamed, 1994). The composition of the edible proportion of the flesh of fish (50-60% of the total) differs only slightly in different species except for the content of fats which normally varies considerably even in the same fish depending on its reproductive cycle (Sevensson, 2004).

The concentration of heavy metals such as cadmium, lead, nickel, vanadium and arsenic in many species (Emperors, Rabbit fishes, Doublebar-breem and Greasy -groupers) were observed that the highest concentrations of cadmium, vanadium, lead and nickel were found in rabbit fish Siganus canaliculatus, while arsenic was low (Al-saleh, 2002). Nematodes, also called roundworms, occur worldwide in all animals. It can infect all organs of the host, causing loss of function of the damaged area. Signs of nematodiases included anemia, emaciation, unthrift ness and reduced vitality. Three common nematodes affecting fish are described by (Klinger, 2002). Nematodes infection is widespread in wild eels (Peters, 1986) and occasionally occurs in earth ponds, but it is unlikely to spread in hyperintensive systems where copepods, the intermediate hosts, cannot usually survive (Hirose, 1976). Pathological effects vary with growth conditions and cell species. Heavy infection causes hemorrhagic inflammation of the swim bladder, but it may not necessarily always disrupt fish growth. It may, however, decrease the cell's tolerance to transport stresses (Paggi, et al., 1982).

Heavy nematode infection, especially in small and young fish may more serious. However, as the intensity of infection usually increases with age; young fish are seldom heavy infected (Moravec, 1987). Acanthocephalans is known as thorny-headed worms or spiny-headed worms, characterized by the presence of an evertable proboscis, armed with spines, which use to pierce and hold the gut wall of their gnathostome definitive host. Acanthocephalans are obligate endoparasites which infected in hosts' intestines (Taraschewski, 1989). Typically it has complex life cycles, involving a number of hosts, including arthropods as the intermediated hosts, fishes, amphibians, birds, and mammals as the definitive hosts.

Roughly 1150 species have been described. Acanthocephalans have received little attention in the fields of human and veterinary medicine. Human cases of acanthocephalosis are only common in certain parts of Mainland China and remain sporadic elsewhere (Taraschewski, 1989). Cases of serious illness or high mortality induced by acanthocephalan infections in fish were seldom reported due to the much lower infection intensity compared with other helminthes parasites. Epizootiological data of acanthocephalan are limited to natural infections: In the Sudan White and Blue Nile, 5-27 Tenuiselis niloticus occurred in 93% of Heterotis niloticus, 6-43 Neocochinorhynchus sp. in 26% of Citherinus citherus and 2-5 unidentified acanthocephala in 60% of Synodontis batensoda (Taraschewski, 1989). Similarly abundant infections were found in the same fish in Lake of Chad (Troncy, 1974).

Acanthocephalans, particularly those parasitizing fish, are known to selectively accumulate toxic heavy metals, such as lead and cadmium, in extremely high proportion relative to their surrounding host tissues and host environment. Consequently, their potential use in monitoring. Polluted environments are an active avenue of research (Muller, 2002).

The parasitological data from Siganus rivulatus in the Gulf of Aqaba indicated that Siganus rivulatus has a heteroxenous and mono xenous parasite for species Opisthognoporidae sp. and Gyellaunch sp (Dzikowski, 2003). The prevalence of other gut helminthes namely Hexangium sigani, the nematodes Procamallanus elatensis and Cucullanus sigani was also noticed by (Dzikowski, 2003). The main objectives of this study are to assessment the effect of the alimentary tract parasite on morphometric and gross chemical composition.
MATERIAL AND METHODS

The Collection of Fish Sample:

*Siganus rivulatus* used for this study was collected from Abu Hashish area using a cast net 3× 3 cm mesh size plate (2). Collections were performed during early morning. The fishes were divided into 4 groups on the basis of sex and infection, fifteen fishes are confined each group as follow: control male and female, infected male and female. The study period was extended for four weeks continuously from February to March 2010. The specimens were rapidly taken to the Research laboratory of the Faculty of Marine Science and Fisheries to perform the biological studies enlisted below. Fish identification followed (Barchie, 2005 and Troncy, 1974).

Morphometric Measurement:

A total of 60 species *Siganus rivulatus* were collected during the period from February to March 2010. The body morphometric measurement was done according to method described by (Mohamed, 1987). The total length (TL), standard length (SL) was measured to nearest 0.1cm and body weight (BW) were weighted to the nearest 0.01grams in electronic balance.

Age Determination:

Bony structure of fish such as operculum bones and vertebrae are commonly used in age determination (El Mahy, 2003). In this study the operculum bone was applied for *Siganus rivulatus*.

The Collection of Helminthes Parasites:

First of all the skin, fins, gills, and opercula were examined for parasites. A ventral incision was made from the anus to the pectoral fin. General cavity wall was cut at the level of the superior part of stomach and the level of the rectum, the digestive tract was cut and deposited into a Petri dish. The gut is carefully dissected through out its length with scissors (direct the interior scissors tip on the interior superiors wall of the gut in the goal not to cut the parasites present in the intestinal tube).The worm was removed from the hosts intestine into a Petri dish in saline water, gently washed and placed into marked bottle with very small amount of hot 4% formalin. Using light microscope for identification of the worms according to (Yamaguti, 1961) (Kabata, 1985) plate (3) and (4).

Gross Chemical Composition:

Sixty fish samples from *Siganus rivulatus* prepared as dried powder in oven at 70°C for 24h and then determined moisture, proteins, lipids, and ash content according to (A.O.A.C., 1990).

Statistical Analysis:

Statistical Package for Social Science (SPSS) program was used to run the data analysis with each test being conducted at 0.05% level of probability by t-test.
Results:

Results (Table 1) indicate total length of *Siganus rivulatus* for group A, B, C and D were 19.16, 18.19, 19.37 and 19.19 cm, respectively. Standard length of *Siganus rivulatus* for group A, B, C and D were 15.91, 15.02, 15.88 and 16.20 cm, respectively. Body weight of *Siganus rivulatus* for group A, B, C and D were 98.58, 94.05, 194.51 and 89.30 g, respectively, while age of *Siganus rivulatus* for group A, B, C and D were 2.20, 2.13, 2.06 and 2.20 years, respectively.

Table 1: Means of morphometric parameters of healthy and helminthes infected male and female *Siganus rivulatus*.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total length (cm)</th>
<th>Standard length (cm)</th>
<th>Body weight (g)</th>
<th>Age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>19.16 (±0.63)</td>
<td>15.91 (±0.57)</td>
<td>98.58 (±7.86)</td>
<td>2.20 (±0.22)</td>
</tr>
<tr>
<td>B</td>
<td>18.19 (±0.42)</td>
<td>15.02 (±0.34)</td>
<td>94.05 (±9.44)</td>
<td>2.13 (±0.25)</td>
</tr>
<tr>
<td>C</td>
<td>19.37 (±0.62)</td>
<td>15.88 (±0.65)</td>
<td>104.51 (±7.19)</td>
<td>2.06 (±0.15)</td>
</tr>
<tr>
<td>D</td>
<td>19.19 (±0.60)</td>
<td>16.20 (±0.50)</td>
<td>89.30 (±8.73)</td>
<td>2.20 (±0.26)</td>
</tr>
</tbody>
</table>

Means ± (SE) within same column followed by different superscript small letters are significantly different at (P<0.05) based on t-test. *Group A = Control male *Group B = Infected male *Group C = Control female *Group D = Infected female.

Results (Table 2) show lipid content of *Siganus rivulatus* for group A, B, C and D were 7.99, 8.21, 8.89 and 8.61 %, respectively. The protein content of *Siganus rivulatus* for group A, B, C and D were 81.58, 76.39, 83.45 and 75.04 %, respectively. The ash content of *Siganus rivulatus* for group A, B, C and D were 7.32, 7.52, 7.29 and 6.88 %, respectively, while moisture content of *Siganus rivulatus* for group A, B, C and D were 5.94, 5.52, 6.33 and 6.30 %, respectively.

Table 2: Means of gross chemical composition of healthy and infected male and female *Siganus rivulatus*.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Lipid (%)</th>
<th>Protein (%)</th>
<th>Ash (%)</th>
<th>Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.99 (±0.65)</td>
<td>81.58 (±0.97)</td>
<td>7.32 (±0.13)</td>
<td>5.94 (±0.97)</td>
</tr>
<tr>
<td>B</td>
<td>8.21 (±0.79)</td>
<td>76.39 (±0.91)</td>
<td>7.52 (±0.11)</td>
<td>5.52 (±0.52)</td>
</tr>
<tr>
<td>C</td>
<td>89.88 (±0.73)</td>
<td>83.45 (±1.00)</td>
<td>7.29 (±0.14)</td>
<td>6.33 (±0.61)</td>
</tr>
<tr>
<td>D</td>
<td>8.61 (±0.65)</td>
<td>75.04 (±1.46)</td>
<td>6.88 (±0.33)</td>
<td>6.30 (±0.69)</td>
</tr>
</tbody>
</table>

Means ± (SE) within same column followed by different superscript small letters are significantly different at (P<0.05) based on t-test. *Group A = Control male *Group B = Infected male *Group C = Control female *Group D = Infected female.

Discussion:

Morphometric Parameter:

Statistically there were no significant differences between four collection groups in total length, standard length, weight and age at (P ≤ 0.05). Helminthes parasites were effect on morphometric parameters become markedly unclear this due to complex of marine environment and effect of other factors like salinity, temperature, spawning season. In this study we recorded two families of helminth parasites acanthocephalans and nematodes in one fish but majority of fish has got one kind of parasites families. Nematodes have been reported from a large fish in Africa, 40 species of adult nematodes representatives 9 families the majority of them found in alimentary system (Khalil, 1971). Particulary in marine fishes (Sindermann, 1966). The study showed that nematode use fish as final host and the injuries were not great. The adult nematode rarely causes...
serious injuries because it causes local lesions of no great significance to the host general health (Moravec, 1973), this report confirmed the findings. Generally helminth parasites did not decrease *Siganus rivulatus* growth. The pathological effect of nematode is not necessarily always disrupting fish growth (Paggi, et al., 1982). Current study could not regard any visual encysted larvae in body cavity or intestinal tract. Adult Thorny head worm- Acanthocephalan found in intestinal tract of *Siganus rivulatus* (Definitive host) only without appearing in body cavity. Crompton (1985) reported that adult acanchocephalans found in intestines of vertebrates, larvae found in hemocoel of arthropods and some time in body cavity of vertebrates. Acanthogyrus tilapiae in Sudan Nile. Golvan (1994) reported that adult acanchocephala are parasites of mammals, birds, fishes and amphibians (Crompton, 1985). Study showed there is inflammation surrounding intestines walls this could be due to helminth parasites effect. The acanchocephalans attach them-selves to the intestinal walls; they may induce pathology such as inflammation of surrounding tissues in their host (Khalil, 1969). Data on infection among fish in Africa is very limited and none of conditions described above have ever been reported. Epizootiological information are limited to natural infection, Khalil (1969) reported in Sudan white and blue Nile found species of acanchocephalans infection in *Heterotis niloticus*, *Citharinus citharus* and *Synodontis batensoda* (Wassef, 1991).

**Gross Chemical Composition:**

The high protein content and low lipid content increases the food value from digestive stand point. The gross chemical composition of *Siganus rivulatus* was more or less similar to that finding recorded in a number of marine species by (Mohamed, 1987) except for protein content which is lower in group B (infected male) and group D (infected female). This value is lower as compared with studies of (Kirk, 1991). This decreased of protein content may be due to effect of gut parasites which feed on gut content of host fish , this results are same as that finding by (Yamaguti, 1961) who found the fish were in poor condition (emaciated) and their digestive tract exhibited signs of atrophy. In general the effect of helminth parasites may not always disrupts fish growth and gross chemical compositions. It may, decreased the fish tolerances to other diseases, these findings are as same results reported by (Paggi, 1940) who found that heavy infection causes hemorrhagic inflammation of swim bladder, but it may not always disrupt fish growth.

**Conclusions:**

The findings of this study on morphometric of healthy and infected *Siganus rivulatus* by helminthes are:

No significant difference (P $\geq$ 0.05) were found in morphometric between healthy and infected *S. rivulatus*, males and females infected by helminthes showed decrease in protein content of edible proportion of flesh. and two families of helminthes parasites acanthocephalans and nematodes are reported.

**REFERENCES**


WWW. Fish base. Org., 2006. Fish base web site, key word is Siganidae.