# ROLE OF FISH MARKETED AT DAKAHLIA GOVERNORATE IN TRANSMITTING OF AEROMONAS SPECIES TO MAN

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## ABSTRACT

*This study was carried out to clarify the role of fish in transmission of Aeromonas species to man. A total of 187 samples including 102 fish (36 iced freshwater fish, 18 each of Oreochromis niloticus and Mugil cephalus, 36 frozen marine fish 18 each of Mackerel and Sardine, 15 salted Sardine and 15 smoked Herring) and 85 human (30 hand swabs and 20 stools of fish-sellers, 35 stool specimens of diarrheic patients, of which 20 adults and 15 children) were collected. Fish samples were obtained from different fish markets at Dakahlia Governorate, whereas, stool specimens were taken from patients of Mansoura university hospitals. The results showed that the overall percentages of Aeromonas species isolated from surface swabs and fish homogenate were 17.65 and 16.66, respectively. The incidence of Aeromonas species of surface swabs and fish homogenate among different fish species were 16.66% and 27.77% of Oreochromis niloticus, 27.77% and 16.66% of Mugil cephalus, 16.66% and 11.11% of Mackerel, 33.33% and 22.22 of Sardine, zero and 16.67% of salted Sardine and 6.66% and 13.33% of smoked Herring. The 35 Aeromonas species strains isolated from fish surface and homogenate were identified as A. hydrophila (44.44% and 58.82%), A. caviae (44.44% and 41.17%)) and A. sobria (11.11% and zero). Concerning human samples, Aeromonas species were isolated from 16.66% of fish-sellers hand swabs and were allocated to A. hydrophila (60%) and A. caviae (40%). On the other hand, Aeromonas species were not isolated from fish-sellers stool samples. However, A. caviae was isolated only from 6.66% of children diarrheic patients stool samples. Furthermore, A. hydrophila was isolated only from 15% of adults patients stool specimens. The results revealed that non-suicidal strains of A. hydrophila were recovered from 54.17% of total fish samples and 100% of total human samples. The virulence and pathogenicity of some no-suicidal A. hydrophila strains was assessed by intraperitoneal inoculation of mice. The zoonotic importance, public health safety and preventive measures to avoid Aeromonas infection in man was fully discussed.*

## INTRODUCTION

In the past it was reported that fish are of minor importance as vectors of food-borne disease in humans **(Bernoth, 1990)**. Nowadays there is substantial evidence that fish and seafood are high on the list of outbreaks of food borne diseases **(Huss, 1997)**. Fish and seafood may also be a vehicle for many bacte-

rial pathogens **(Davies et al., 2001)**. Food safety issues associated with aquaculture products and the microbial status of fish and seafood after catch is closely related to environmental conditions and microbiological quality of water **(Feldhusen, 2000)**, and differ from region to region and from habitat to habitat and vary according to the method of production, management practices and environmental conditions **(Reilly, 1998)**.

Aeromonas spp. are ubiquitous inhabitants of aquatic ecosystems such as freshwater, coastal water, and sewage **(Araoju et al., 1991)**. Organisms of the A. hydrophila group (A. hydrophila, A. caviae and A. sobria) are becoming recognized as important pathogens of humans, in whom they can cause various extra-intestinal diseases **(Daily et al., 1981 and Ellison and Mostow, 1984)** and have been associated with human gastrointestinal disease **(Deodhar et al., 1991 and Rahouma et al., 2011)**. The pathogenesis, and virulence factors responsible for Aeromonas infection in different species are not well understood. Strains isolated from the environment don't seem to differ from strains isolated from cases of infection with respect to the prevalence of virulence factors **(Krovacek, et al., 1994)**. However, it has been shown that certain species are more frequently isolated from patients with diarrhea as well as from diseased fish than from the environment **(Kirov et al., 1994)**. on account the zoonotic importance of Aeromonas species and the role of fish in transmitting this pathogen to man, this study was planned to clarify the incidence, virulence and pathogenicity of Aeromonas species isolated from fish and human specimens.

## *MATERIALS AND METHODS*

**A) Samples collection:-**

**A.1) Fish samples:**

A total of 102 fish, including iced freshwater fish (18 Oreochromis niloticus and 18 Mugil cephalus), frozen marine fish (18 Mackerel and 18 Sardine), salted fish (15 Salted Sardine) and smoked fish (15 Smoked Herring) were collected from fish market in Dakahlia Governorate and were packed in polyethylene bags and placed in ice box then transferred directly to the laboratory.

**A.2) Human samples:**

A total of 85 human specimens represented 30 hand swabs from fish-seller and 20 stool specimens obtained from apparently healthy fish-sellers. Moreover, 35 stool specimens were collected from patients (20 adults and 15 children with gastrointestinal disturbance and attending Mansoura University Children's Hospital and Mansoura University Specialized Medical hospital. Meantime, some stool samples were collected from Meet-Fares Health unit, Ministry of Health and Population, Egypt.

**B) Samples preparation:-**

**B.1) Fish samples:**

Fish samples were prepared as previously described by ICMSF (1986). Samples from the surface were taken using the swab technique. Moistened sterile cotton swab was rubbed over the fish surface (2x5cm) by the help of sterile wire in two direction horizontal and vertical, then the tip of each swab was aseptically placed into tube containing 10 ml of sterile alkaline peptone water as enrichment broth.

For fish homogenate, each fish was immersed in ethyl alcohol (70%). After dryness, the body surface of each fish was sterilized by hot spatula; the skin was removed by sterile scissors and forceps. Under complete aseptic condition, 25g of fish sample (containing parts from gills, muscles and abdominal contents), was taken and homogenized for 2.5 minutes with 225 ml of sterile peptone water in a sterile laboratory blender. The samples were allowed to stand for 15 minutes at room temperature and become readily for isolation and identification of Aeromonas species.

**B.2) Human samples:**

Human hand swabs samples were collected from fish-sellers prepared as previously described by **Sadoma (1997).** Sterile swab was moistened with enrichment broth, rolled all over the palm and then immersed under aseptic conditions into test tubes containing enrichment broth.

Concerning stool specimens, the collected Stool cups were ice-packed and transferred directly to the laboratory, with minimum time of delay. In the laboratory swab was taken from each stool sample using sterile moistened swabs and then inserted into sterile tube containing enrichment broth.

**C) Bacterial isolation and identification:-**

One ml of prepared fish homogenate was added to 9 ml of enrichment broth. Fish surface swabs and prepared human samples were directly added to 10 ml of enrichment broth. All inoculated broths were incubated at 37°C for 24 h **(Shread et al., 1981)**. After incubation a loopful from enriched broth was streaked onto Starch Ampicillin Agar **(Palumbo et al., 1985)** and incubated at 28°C for 24 h. After incubation period, characteristic colonies were selected, picked up and streaked into nutrient agar and incubated for 24 h at 37°C for purification. The isolated strains were subjected for further identification according to **Abbott et al. (2003).**

**D) Virulence and pathogencity of some isolated Aeromonas hydrophila strains in mice:-**

To assess the virulence and pathogenicity of Aeromonas hydrophila, white mice were challenged by the intraperitoneal route with representative Aeromonas hydrophila non-suicidal strains isolated from fish, hand swabs and adults stool as described previously by **Namdari and Bottone (1988).**

The suicidal activity of each isolate was determined by inoculation of duplicate tubes of Nutrient Broth containing 0.5% glucose followed by incubation of individual tubes at 37°C for 24 h. Strains showing the suicide phenomenon they had spontaneously pelleted, while those lacking this characteristic showed uniform broth turbidity are non suicide.

Four groups (each group contain 3 white mice) were used in this study. Three groups (1st for fish isolate, 2nd for hand swab isolate and 3rd for stool isolate) were individual injected intraperitoneally with individual 0.1ml saline suspensions containing $10^8$ CFU/ml of A. hydrophila, whereas the mice of 4th group were inoculated with 0.1 ml of sterile saline sever as a control. Mice were clinically observed for 14 days. Animals that died were subjected to post-mortem analysis, and the

cultures of various organs (spleen, intestine and liver) were aseptically prepared.

## *RESULTS AND DISCUSSION*

The incidence of Aeromonas species from surface swabs and fish homogenate of different fish species are shown in Tables (1&2). The overall percentages of Aeromonas species isolated from surface and fish homogenate were 17.65 and 16.66 respectively. The frequency distribution of Aeromonas species of surface swabs and fish homogenate among different fish species were 16.66% and 27.77% of Oreochromis niloticus, 27.77% and 16.66% of Mugil cephalus, 16.66% and 11.11% of Mackerel, 33.33% and 22.22 of Sardine, zero and 16.67% of salted Sardine and 6.66% and 13.33% of smoked Herring, respectively. Lower incidence of Aeromonas species were previously recorded from fresh water fish surface and higher Aeromonas species were recorded from marine water fish surface by **Yücel and Balci (2010)**. Moreover, higher of Aeromonas species isolation rate from fresh water fish and marine water fish were detected by **Fukuyama et al. (1989) and Bastawrows and Mohammed (1999)**. However, no Aeromonas species were isolated from canned fish **(Yaun and Lin, 1993)** or from fresh water fish **(Topic-popvic et al., 2000)**. The present study pointed that Aeromonas species from smoked Herring were within the same range previously isolated from smoked fish **(Gobat and Jemmi, 1993)**.

In present study, A. hydrophila was isolated from surface swabs of Oreochromis niloticus (33.33%), Mugil cephalus (60%), Mackerel (66.67%), Sardine (16.67%) and smoked Herring (100%). On the other hand, A. hydrophila was not isolated from surface swabs of salted Sardine. Furthermore A. hydrophila was isolated from fish homogenate of Oreochromis niloticus (100%). Mugil cephalus (33.33%), Sardine (75%) and salted Sardine (100%). However, A. hydrophila was not isolated from fish homogenate of Mackerel or smoked Herring. Nearly similar results of A. hydrophila recovered from surface and from muscle were cited by **Dorho (1998)**. Lower A. hydrophila incidence of fresh water fish were previously reported **(El-Kelish, 1995 and Gharib et al., 2003)**. On the other hand, higher Aeromonas hydrophila percentage of smoked herring was recorded by **Abo-El-Alla (2000)**. Furthermore, A. hydrophila was detected in 33.58% of collected flesh fishes included Sardine, Mackerel and Mugil **(Vivekanandhan et al., 2005)**.

A. caviae was isolated from surface swabs of Oreochromis niloticus (66.67%), Mugil cephalus (40%) and Sardine (66.67%). On the other hand, A. caviae was not isolated from surface swabs of Mackerel, salted Sardine or smoked Herring. Furthermore, A. caviae was isolated from fish homogenate of Mugil cephalus (66.67%), Mackerel (100%) and Sardine (25%). **El-Kelish, (1995)** found higher isolation rate (20%) of A. caviae in muscle of Oreochromis niloticus; however **El-Atabany (1995)** detected lower A. caviae from Mugil cephalus. The recovery of A. caviae from marine water fish (Mackerel and Sardine) homogenate was higher than previously found in marine shellfish homogenate by **Mohamed et al. (2001)**.

A. sobria was only isolated from surface swabs of Mackerel (33.33%) and Sardine (16.67%) table (1). These results agreed with

results of **Ottaviani et al. (2006)** who did not isolate A. sobria from mussels. Higher frequencies of isolation rates of A. sobria were previously recorded by many authors as from Oreochromis niloticus **(El-Kelish, 1995)**, Mugil cephalus **(El-Atabany, 1995)**, channel cat fish **(Wang and Silva, 1999)**, and shellfish **(Mohamed et al., 2001)**.

Incidence of Aeromonas species from man are shown in tables (3). Aeromonas species were isolated from 16.66% of fish-seller hand swabs. The isolated species were allocated as: A. hydrophila (60%) and A. caviae (40%). Higher incidence (60%) of Aeromonas species in hand swabs was previously recorded by **Mohamed et al. (2001)**. They also isolated A. hydrophila (83.3) and A. sobria (16.7%): however they could not isolate A. caviae.

Tables (3) verify that Aeromonas species were not isolated from fish-seller stool specimens. This result was in agreement with **Deodhar et al. (1991)** and **Gharib et al. (2003)**; as they could not isolated Aeromonas species from control human stool. On the other hand, Aeromonas species were isolated from control stool with low frequencies **(Figura et al., 1986 and Yamada et al., 1997)**. In the present study, A. caviae was the only Aeromonas species isolated from 6.66% of children patients stool samples. Furthermore the only Aeromonas species isolated from adults patients stool samples was A. hydrophila. It was recovered from 15% of adults patients stool samples (table, 3). Lower A. caviae incidence from children patients stool specimens was previously recorded by **Figura et al, (1986) and Nojimoto et al. (1997)**. However, lower A. hydrophila incidence from adults patients stool samples was previously detected by **Deodhar et al. (1991), Yamada et al. (1997), and Gharib et al. (2003)**; as they isolated A. hydrophila with percentage of 1.4, 1.4 and 5.3, respectively. On the other hand, A. sobria and A. caviae were previously isolated with the percentages of 0.28 and 0.12 by **Deodhar et al. (1991)**, 0.18 and 3.8 by **Yamada et al. (1997)**, and 2.44 and 0.97 by **Hofer (2006)**, from adults patients stool samples, respectively.

The suicidal activity of 31 A. hydrophila strains recovered from fish and man are shown in table (4). Non suicide strains were recovered from 43.75% of fresh water fish, 83.34% of marine water fish and 100% of salted Sardine. Moreover, 100 % of each fish-seller hand swabs and adults patients stools were non-suicide strains. **Ottaviani et al. (2006)** found that 68.75 % of isolated A. hydrophila mussels showed non suicidal activity. In the present work, the observed clinical signs of inoculated mice with non-suicidal strains of Aeromonas hydrophila, were dull, roughly hair, isolated in the corner of the boxes, and had bloody diarrhea (Photograph 1: A). The death of mice was recorded from one day till 8 days post-inoculation. A. hydrophila was isolated from all liver, spleen and intestine of necropsied mice (table, 5). Postmortem lesions of dead mice including, liver and spleen congestion and inflammation and exudates accumulation in intestine (Photograph 1: B-D). On the other hand, control group mice were still alive for 14 day. They were scarified, and the organs were subjected for isolation of Aeromonas species. All mice of control group were negative. Similar findings on virulence and pathogenicity of Aeromonas

in mice were previously recorded by **Namdari** and **Bottone (1988)** and **Ottaviani et al. (2006)**.

From the aforementioned results, we could concluded that Aeromonas species were isolated from fish. This indicates that these fish species were considered as potential source of Aeromonas species for human infection in the examined areas. Also, Aeromonas species could be isolated from hand swabs of fish-sellers. This indicated that the contaminated hands of fish- seller may constitute a potential hazard for themselves and for other fish consumers. In the other hand, Aeromonas species could not be isolated from fish-sellers stool. This might be attributed to all fish-sellers were apparently healthy. Furthermore, A. caviae and A. hydrophila were isolated from stools of diarrheic children and adults. These suggest the role of A. caviae and A. hydrophila in human diarrhea gastroenteritis. Higher percentages of isolated A. hydrophila strains showed non suicidal activity, and inoculated representative strains were morbid and lethal for mice. These indicate that these isolated strains were virulent and pathogenic. Human enteropathogenicity and animal virulence properties of Aeromonas spp. are correlated with their non-suicidal activity at 37ºC **(Namdari and Bottone, 1988)**. So, for public health safety it is important to protect both fish sellers and consumers from bacterial infection through (1) improvement of handling and processing of fish, (2) provide hygienic educational programmes to fish handlers, (3) prevention of sewage drainage in ecosystem, (4) periodical examination of ecosystem, and (5) proper cooking of fish.

Table (1): Fraction of un-ionized ammonia in aqueous solution at different pH values and temperatures. Calculated from data in Emmerson, et al. (1975)

| pH | Temperature | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 42.0 (°F) | 46.4 | 50.0 | 53.6 | 57.2 | 60.8 | 64.4 | 68.0 | 71.6 | 75.2 | 78.8 | 82.4 | 86.0 | 89.6 |
| | 6 (°C) | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 |
| 7.0 | .0013 | .0016 | .0018 | .0022 | .0026 | .0029 | .0034 | .0039 | .0046 | .0052 | .0060 | .0069 | .0080 | .0093 |
| 7.2 | .0021 | .0025 | .0029 | .0034 | .0040 | .0046 | .0054 | .0062 | .0072 | .0083 | .0098 | .0110 | .0126 | .0150 |
| 7.4 | .0034 | .0040 | .0046 | .0054 | .0063 | .0073 | .0085 | .0098 | .0114 | .0131 | .0150 | .0173 | .0198 | .0238 |
| 7.6 | .0053 | .0063 | .0073 | .0086 | .0100 | .0110 | .0134 | .0155 | .0179 | .0206 | .0236 | .0271 | .0310 | .0369 |
| 7.8 | .0084 | .0099 | .0116 | .0135 | .0167 | .0182 | .0211 | .0244 | .0281 | .0322 | .0370 | .0423 | .0482 | .0572 |
| 8.0 | .0133 | .0156 | .0182 | .0212 | .0247 | .0286 | .0330 | .0381 | .0438 | .0502 | .0574 | .0654 | .0743 | .0877 |
| 8.2 | .0210 | .0245 | .0286 | .0332 | .0385 | .0446 | .0514 | .0590 | .0676 | .0772 | .0880 | .0998 | .1129 | .1322 |
| 8.4 | .0328 | .0383 | .0445 | .0517 | .0597 | .0688 | .0790 | .0904 | .1031 | .1171 | .1326 | .1495 | .1678 | .1948 |
| 8.6 | .0510 | .0593 | .0688 | .0795 | .0914 | .1048 | .1197 | .1361 | .1541 | .1737 | .1950 | .2178 | .2422 | .2768 |
| 8.8 | .0785 | .0909 | .1048 | .1204 | .1376 | .1566 | .1773 | .1998 | .2241 | .2500 | .2774 | .3062 | .3362 | .3776 |
| 9.0 | .1190 | .1368 | .1565 | .1782 | .2018 | .2273 | .2546 | .2836 | .3140 | .3456 | .3783 | .4116 | .4453 | .4902 |
| 9.2 | .1763 | .2008 | .2273 | .2658 | .2861 | .3180 | .3512 | .3865 | .4204 | .4557 | .4909 | .5258 | .6599 | .6038 |
| 9.4 | .2533 | .2847 | .3180 | .3528 | .3884 | .4249 | .4618 | .4985 | .5348 | .5702 | .6045 | .6373 | .6685 | .7072 |
| 9.6 | .3498 | .3868 | .4249 | .4633 | .5016 | .5394 | .5762 | .6117 | .6456 | .6777 | .7078 | .7358 | .7617 | .7929 |
| 9.8 | .4600 | .5000 | .5394 | .5778 | .6147 | .6498 | .6831 | .7140 | .7428 | .7692 | .7933 | .8153 | .8361 | .8585 |
| 10.0 | .5746 | .6131 | .6498 | .6844 | .7166 | .7463 | .7735 | .7980 | .8207 | .8408 | .8588 | .8749 | .8892 | .9058 |
| 10.2 | .6815 | .7162 | .7463 | .7748 | .8003 | .8234 | .8441 | .8623 | .8788 | .8933 | .9060 | .9173 | .9271 | .9389 |

Table (2): Biochemical parameters of examined adults *O.niloticus* (n=28) after 0, 7 14, 21 and 28 days of exposure to 0.1 mg/L unionized ammonia concentration.

| Parameter / Days | Total Protein (g/dL) | Albumin (g/dL) | Globulins (g/dL) | ALT (U/L) | AST (U/L) |
|---|---|---|---|---|---|
| 0 | 3.9 ± 0.21 | 1.8 ± 0.1 | 2.1 ± 0.18 | 22 ± 1.8 | 26 ± 1.8 |
| 7 | 4.1 ± 0.31 | 1.7 ± 0.9 | 2.4 ± 0.2 | 28 ± 1.9 | 35 ± 2.1 |
| 14 | 4.9 ± 0.33 | 1.8 ± 0.12 | 3.1 ± 0.22 | 35 ± 2.5 | 37 ± 2.6 |
| 21 | 5.5 ± 0.39* | 2.0 ± 0.18 | 3.5 ± 0.21* | 36 ± 3.0* | 59 ± 3.9** |
| 28 | 5.0 ± 0.4* | 1.6 ± 0.1 | 3.4 ± 0.2 | 45 ± 3.1* | 76 ± 5.8** |

Results are mean values ± standard error of three replicates.

* Statistically significant ($p < 0.05$) differences.

** Highly statistically significant ($p < 0.005$) differences.

**Table (3):** Biochemical parameters of examined adults *O.niloticus* (n=28) after 0, 7 14, 21 and 28 days of exposure to 0.5 mg/L unionized ammonia concentration.

| Parameter / Days | Total Protein (g/dL) | Albumin (g/dL) | Globulins (g/dL) | ALT (U/L) | AST (U/L) |
|---|---|---|---|---|---|
| 0 | 5.4 ± 0.35 | 1.9 ± 0.11 | 3.5 ± 0.19 | 18 ± 1.2 | 35 ± 0.22 |
| 7 | 6.4 ± 0.42* | 1.5 ± 0.1 * | 4.9 ± 0.28 | 56 ± 3.9* | 98 ± 0.75* |
| 14 | 6.2 ± 0.43* | 0.9 ± 0.05 * | 5.3 ± 0.37* | 59 ± 5.0* | 105 ± 0.88** |
| 21 | 6.8 ± 0.48* | 1.0 ± 0.06 * | 5.8 ± 0.42* | 58 ± 4.7* | 112 ± 9.8** |
| 28 | 6.3 ± 0.49* | 1.01 ± 0.08 * | 5.3 ± 0.41* | 56 ± 4.9* | 123 ± 10.2** |

Results are mean values ± standard error of three replicates.

* Statistically significant ($p < 0.05$) differences.

** Highly statistically significant ($p < 0.005$) differences.

**Table (4):** Biochemical parameters of examined adults *O.niloticus* (n=28) after 0, 7 14, 21 and 28 days of exposure to 1.0 mg/L unionized ammonia concentration.

| Parameter / Days | Total Protein (g/dL) | Albumin (g/dL) | Globulins (g/dL) | ALT (U/L) | AST (U/L) |
|---|---|---|---|---|---|
| 0 | 4.5 ± 0.33 | 2.0 ± 0.17 | 2.5 ± 0.15 | 30 ± 2.4 | 48 ± 3.1 |
| 7 | 8.0 ± 0.56* | 0.9 ± 0.07 * | 7.1 ± 0.54* | 59 ± 4.7* | 129 ± 10.2** |
| 14 | 8.3 ± 0.6* | 0.7 ± 0.04 ** | 7.6 ± 0.6* | 78 ± 6.1* | 148 ± 11.2** |
| 21 | 4.4 ± 0.33 | 0.3 ± 0.011 ** | 4.1 ± 0.28* | 86 ± 5.4* | 170 ± 15** |
| 28 | --[d] | -- | --[d] | --[d] | --[d] |

Results are mean values ± standard error of three replicates.

* Statistically significant ($p < 0.05$) differences.

** Highly statistically significant ($p < 0.005$) differences.

[d] Fishes did not survived to this point

Table (5): Biochemical parameters of examined adults *O.niloticus* (n=28) after 0, 7 14, 21 and 28 days of exposure to 2.0 mg/L unionized ammonia concentration.

| Parameter / Days | Total Protein (g/dL) | Albumin (g/dL) | Globulins (g/dL) | ALT (U/L) | AST (U/L) |
|---|---|---|---|---|---|
| 0 | 4.3 ± 0.32 | 1.9 ± 0.1 | 2.4 ± 0.17 | 26 ± 2.0 | 45 ± 3.3 |
| 7 | 8.2 ± 0.7** | 0.3 ± 0.02** | 7.9 ± 0.52** | 95 ± 8.0** | 165 ± 11** |
| 14 | 8.6 ± 0.72** | 0.2 ± 0.01** | 8.4 ± 0.61** | 104 ± 8.7** | 187 ± 14.5** |
| 21 | --[d] | --[d] | --[d] | --[d] | --[d] |
| 28 | --[d] | --[d] | --[d] | --[d] | --[d] |

Results are mean values ± standard error of three replicates.

* Statistically significant ($p < 0.05$) differences.

** Highly statistically significant ($p < 0.005$) differences.

[d] Fishes did not survived to this point

Table (6): Histopathologic observations for both control and different sublethal UIA conc. (mg/L) exposed *O.niloticus*:

| | Tissue and histopathology | Control | 0.1 | 0.5 | 1.0 | 2.0 |
|---|---|---|---|---|---|---|
| Gills | Hyperemia | - | - | + | ++ | ++ |
| | proliferation of secondary lamellae | - | - | - | + | ++ |
| | Congestion of branchial branches | - | - | - | + | +++ |
| Liver | hydropic degeneration | - | - | + | ++ | +++ |
| | necrotic hepatocyted | - | - | - | + | ++ |
| Kidney | necrotic renal tubular epithelium | - | - | - | + | ++ |
| | hypercellularity in mesangial cells | - | - | + | ++ | +++ |

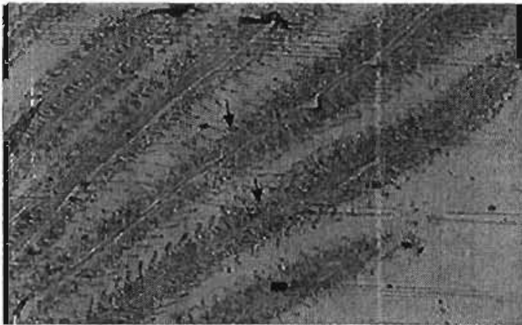

**Figure 1:** Section of gills of O.niloticus exposed to 1.0 mg/L UIA showing moderate to severe proliferation of secondary lamellae (arrow) and congestion of branchial branches (arrow head).

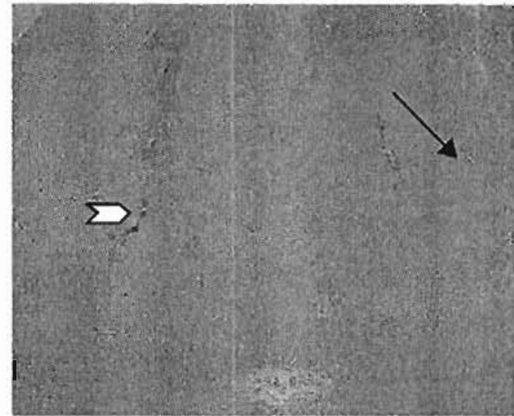

**Figure 3:** Section of liver of O.niloticus exposed to 0.5 mg/L UIA showing slight or minimal hemosiderosis (arrow).and nearly normal Hepatic architecture with slight congestion of blood vessels (arrow head).

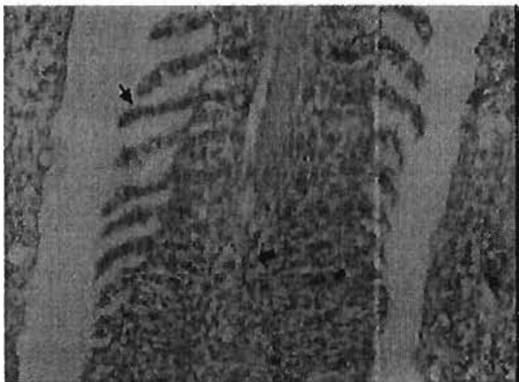

**Figure 2:** Section of gills of O.niloticus exposed to 2.0 mg/L UIA showing sever congestion of secondary lamellae (arrow) with Round cell infiltrating their stroma (thick arrow).

**Figure 4:** Section of liver of O.niloticus exposed to 1.0 mg/L UIA showing hemorrhage necrotic hepatocyted (lytic necrosis).

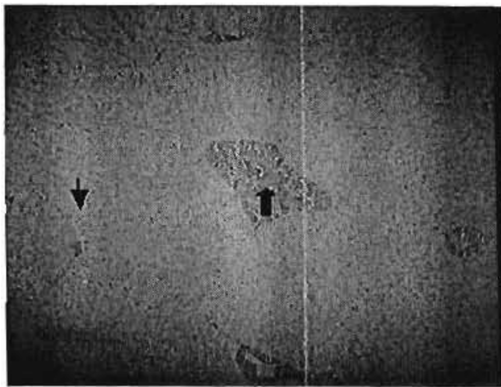

**Figure 5:** Section of liver of O.niloticus exposed to 2.0 mg/L UIA showing replacing narrowing of hepatic cords (thin arrow) and sever congestion of blood vessels (thick arrow).

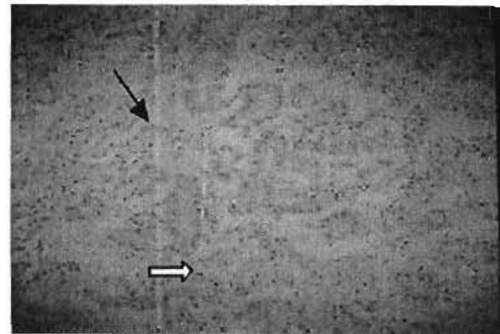

**Figure 7:** Section of kidney of O niloticus exposed to 1.0 mg/L UIA showing necrotic renal tubular epithelium (thin arrow) and vaculation of renal tubular epithelium (thick arrow).

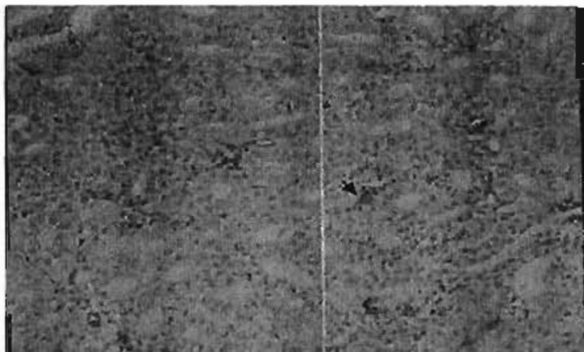

**Figure 6:** Section of kidney of O.niloticus exposed to 0 5 mg/L UIA showing slight or minimal congestion and nearly normal architecture (arrow).

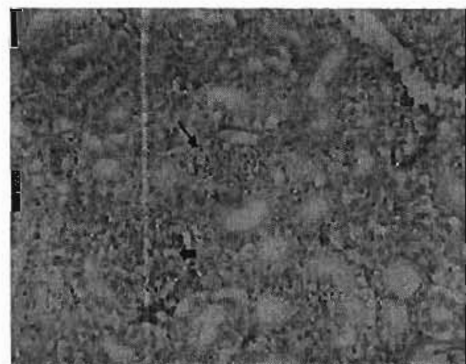

**Figure 8:** Section of kidney of O.niloticus exposed to 1.0 mg/L UIA showing chronic inflammatory cells in interstitial tissue (thin arrow) with Hypercellularity in mesangial cells (thick arrow).

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# الملخص العربى

## دور الأسـماك المسوقـة فى محافظـة الدقهلية فى نقـل ميكروبـات الزوائف الهوائية (الايرومونس) للإنسان

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أجريت هذه الدراسة لتوضيح دور الأسماك فى نقل بعض ميكروبات الزوائف الهوائية (.Aeromonas spp) إلى الإنسان، تم تجميع ١٨٧ عينة والتى اشتملت على ١٠٢ عينة من الأسماك (٣٦ عينة من أسماك المياه العذبة والتى اشتملت على ١٨ عينة من كلاً من البلطى النيلى وسمك البورى، و٣٦ عينة من الأسماك البحرية والتى اشتملت على ١٨ عينة من كلاً من الماكريل والسردين، ١٥ عينة من السردين المملح و ١٥ عينة من الرنجة المدخنة) و٨٥ عينة من الإنسان (٣٠ عينة من مسحات الأيدى و ٢٠ عينة براز من بائعى الأسماك علاوة على ذلك ٣٥ عينة براز جمعت من ٢٠ من البالغين و ١٥ من الأطفال الذين يعانون من الإسهال). عينات الأسماك تم الحصول عليها من أسواق الأسماك بمحافظة الدقهلية، فى حين كانت عينات البراز كانت من مرضى مستشفيات جامعة المنصورة، وقد أظهرت النتائج أن النسبة المئوية لميكروبات الزوائف الهوائية (.Aeromonas spp) عموماً المعزولة من المسحات السطحية للأسماك ومن مخلوط متجانس الأسماك كانت ١٧,٦٥٪ و ١٦,٦٦٪ على التوالى، وكان معدل التوزيع للميكروب فى كلاً من المسحات السطحية والمخلوط المتجانس بين الأنواع المختلفة للأسماك هو ١٦,٦٦٪ و ٢٧,٢٧٪ للبلطى النيلى، ٢٧,٢٧٪ و ١٦,١٦٪ للبورى ١٦,٦٦٪ و ١١,١١٪ للماكريل ١٣,٣٣٪ و ٢٢,٢٢٪ للسردين صفر ٪ و ١٦,٦٧٪ للسردين المملح و ٦,٦٦٪ و ١٣,٣٣٪ للرنجة المدخنة على التوالى، وبتصنيف عدد ٣٥ عترة من ميكروب الزوائف الهوائية المعزولة من كلاً من المسحات السطحية والمخلوط المتجانس للأسماك وجد أنها كانت تتبع أنواع الزوائف الهوائية نوع ايرومونس هيدروفيلا (A.hydrophila) (٤٤,٤٤٪ و ٥٨,٨٢٪)، الزوائف الهوائية القبيعية (A. hydrophila) (٤٤,٤٤٪ و ٤١,١٧٪) والزوائف الهوائية نوع سوبريا (A.sobria) (١١,١١٪ و صفر ٪)، بالنسبة لعينات الإنسان، قد تم عزل ميكروب الزوائف الهوائية (.Aeromonas spp) من ١٦,٦٦٪ من مسحات الأيدى لبائعى الأسماك وقد تم تصنيفها إلى الزوائف الهوائية نوع هيدروفيلا (٦٠٪) والزوائف الهوائية القبيعية (٤٠٪)، ومن ناحية أخرى لم يتم عزل الزوائف الهوائية من عينات براز بائعى

الأسماك، فى حين أن الزوائف الهوائية القبيعية عزلت فقط من ٦٦.٦٪ من عينات براز الأطفال، وعلاوة على ذلك الزوائف الهوائية نوع هيدروفيلا تم عزلها فقط من ١٥٪ من عينات براز البالغين (١٥٪) أثبتت النتائج أن عترات الزوائف الهوائية نوع هيدروفيلا المعزولة من ٥٤.١٧٪ من الأسماك و ١٠٠٪ من عينات الإنسان كانت عترات غير منتحرة (non-suicidal). الضراوة والقدرة المراضية لبعض عترات الزوائف الهوائية نوع هيدروفيلا الغير منتحرة تم تقيمها عن طريق الحقن البروتينى للفئران البيضاء السويسرية، وقد تم مناقشة أهمية ميكروب الزوائف الهوائية من الناحية المشتركة وكذلك الأمان الصحى والاجراءات الوقائية لتجنب عدوى الإنسان بالزوائف الهوائية (نوع الأيرومونس).