

TRANSMISSION OF *Salmonella* Spp FROM WATER SOURCES TO FISH IN THE MUDDY SEASONAL WATER OF THE RIVER NILE STATE, SUDAN

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✉Supporting Information

ABSTRACT: This study was conducted in river Nile state, north Sudan aimed to give base line information on the potentialities of transmission of *Salmonella* spp from water source to fish in muddy season, in AL-fadlab and Al-akad stations. Twenty samples of water and *Schilbidae* spp fish were taken from the two stations and transferred to the laboratory for physiochemical and microbial analysis of water and studding fish species. Samples were performed using standard bacteriological procedures. Swaps from each fish gill were microbiologically analyzed for *Salmonella* spp and total plate count. Results indicated that studied fish infected by *Salmonella* spp in AL-fadlab station was 44.83 ± 8.6 while in Al-akad station was 9.33 ± 1.4 , *Salmonella* spp in water was 5.00 ± 1.0 in AL-fadlab station while it has no growth in Al-akad station. On the other hand, total plate count in fish gills was uncountable in AL-fadlab station and 30.40 ± 7.1 in Al-akad station. Total plate count in water, was 8.13 ± 1.87 for AL-fadlab station and 11.67 ± 2.04 for Al-akad station. Statistical analysis showed significant difference ($P < 0.05$) in all studied parameters except the total plate count in water. There was also no significant difference in weight and length of studied fish species and also in water turbidity and temperature from both stations, but water pH showed significant difference ($P < 0.05$, 7.62 ± 0.04 and 9.53 ± 0.08 for Al-fadlab and Al-akad, respectively). *Schilbidae* spp fish infected by *Salmonella* spp in studied stations is an indicator of the contamination by untreated municipal sewage, runoff, and storm-water. Therefore, *Schilbidae* spp fish from studied areas have to be carefully handling and heating before consumption to avoid the pathogenic bacteria risks.

Keywords: Chemical, Foods, Genetically, Health, Organisms, Risk

INTRODUCTION

Fishes are vertebrates, poikilotherms and live predominantly in water. Their body shapes may be elongate, dorsoventrally, laterally compressed or rounded in cross section but recognizable into head, trunk and post anal tail. They have been one of the main foods for humans anciently (Ibemenuga et al., 2014). Fish had long been regarded as a desirable and nutritional source of high quality protein and generous supply of minerals and vitamins constituting the major part of human diet (Hastein et al., 2006). Fresh water fish are subjected to the risk of contamination with various pathogens from different sources, primary during their presence in aquatic environment and secondary after being harvested through handling and marketing as well as storage. Such contamination may render these food articles unfit for human feed or even harmful to them (Elsherief et al., 2014). Fish and shellfish appear to be passive carriers of *Salmonella*, demonstrate no clinical disease and can excrete *Salmonella* spp. without apparent trouble. The contamination of this organism derives from terrestrial sources and fish may serve as a vector for *Salmonella* spp (Novotny et al., 2004). The presence of *Salmonella* as enter pathogens in farm fish may reflect the bad hygienic conditions during harvesting, transporting and marketing of the fish. The presence of considerable numbers of Salmonellosis indicates bad hygienic measures during catching and distribution of the fish (Valdivia et al., 1997).

It is clear that fish are continuously exposed to the microorganisms present in water and in sediment. These organisms will undoubtedly influence the microflora on external surfaces including the skin, gills of fish. And the digestive tract will receive water and food that is populated with microorganisms. On the other hand, colonization may well start at the egg and or larval stage, and continue with the fish live (Olafsen, 2001). If the fish are exposed to environmental stress, or injury, it causes sever outbreaks of disease and mortalities. Environmental stresses such as high temperature, poor water quality and high organic content primarily contribute to the onset and severity of Enterobacteriaceae infections in fish (Zheng, et al. 2004; Thillai Sekar et al., 2008). *Salmonella* spp have been found to survive and multiply in the gut,

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mucus and tissues of fish and that render fish acting as potential vector of human disease over long periods (David et al., 2009). The particular isolation of *Salmonella* spp, which when isolated from fish and fish products gives an indication about environmental fecal pollution of fish (Wogu and Maduakol, 2010).

This study aimed to isolate the total viable bacteria and *Salmonella* spp from the water and shilbidae spp fish in the belt of river Nile from two stations (AL- fadlab and AL- akad) and to determine water physiochemical characteristics in studied stations (pH, temperature and turbidity).

MATERIALS AND METHODS

Study area

Study was carried out in river Nile state north Sudan at (Al-fadlab) station in Atbara city and (Al-aked) station in Al-damar city during muddy season (2018), on the upstream of the River Nile.

Water and Fish Sample Collection

Twenty samples of water and fish shilbidae spp were collected from the studied stations using gills net between (6:00-8:00 am). Ten swabs samples were obtained by rubbing the sterilized cotton swab over the gills placed on ice in polythene bag and conveyed to the laboratory for microbiological examinations, water carried in test tube and transferred to Atbara water laboratory for the physiochemical and microbiological analysis turbidity was measure in the site.

Materials

Swab, test tube, picker, flask, sensitive balance, gloves, tips, micro pipette, loops, petri dish, autoclave, incubator, distil water, broth agar, nutrient agar, SSA agar, glass containers, cotton, pH meter, thermometer and alcohol.

Microbiological analyses

Five ml broth agar was added for each swab and inoculated for at 37 °C for 18 hour, after that the sample were serially diluted and 1ml of each diluted sample were plated for microbiological analysis.

Enumeration and Isolation of Bacterial

Preparation of the media and Isolation of the bacteria were done according to Cheesbrough (1984). Sterilization of the media was done by autoclaving at 121°C for 15 min. Pour plate method was employed for the determination of microbial load of samples. Tenfold serial dilution of the samples was made and 10 dilutions of the samples were plated out on: Nutrient agar medium for total viable count (TVC), *Salmonella*/Shigella agar (SSA) for *Salmonella* isolation. All samples were incubated at 37 °C for 24 - 48 h. After incubation the colonies were counted and isolated.

Statistical analysis

The obtained data were analyzed using independent samples T. test at 0.05 levels of significant, data were presented as mean ± standard error of mean. IBM SPSS statistics for Windows program, Version 20.0. Armonk, NY: IBM Corp was used in data analysis.

RESULTS AND DISCUSSION

Fish diseases due to bacterial infections are the major problems in the water sources as it found naturally in the fish environment and under certain stress condition causes severe economic losses to fish (Olsson et al., 1998). Fish and shellfish appear to be passive carriers of *Salmonella*, demonstrate no clinical disease and can excrete *Salmonella* spp. without apparent trouble. The contamination of this organism derives from terrestrial sources and fish may serve as a vector for *Salmonella* spp (Metz, 1980; Minette, 1986; Chattopadhyay, 2000).

From the results of the microbial and physiochemical analysis of water it reveals that *Salmonella* spp bacteria were obtained in water and studied fish spp, that may be due to the occurrence of some contaminant sources in surrounded area., and from folded water in rainy season. This implies that studied fish are passive carrier of *Salmonella* spp bacteria pathogens this finding agree with Salihu et al. (2012). Fish harvested from contaminated waters can carry *Salmonella* spp. (Pelczar et al., 1993) which is pathogenic to man and other animals. Total plate bacteria detected in both location fish was higher than reported by Mandal et al. (2009). Who found that total plate count in fish was (2.55±0.15). The study revealed that the bacterial load was high in muddy season in the studied locations, one of the reasons possibly being that the high ambient temperature in the water body was close to optimum for many Mesophilic bacteria in natural systems and the bacterial load in fish might be increased with the increase of water temperature (Fernandes et al., 1997; Hossain et al., 1999). Also these results agree with the finding of Rekhari et al. (2014) and Abd-Elall et al. (2014), they found that the bacterial load is higher in summer season in cultured fish. *Salmonella* spp was transmitted to the studied fish gills throw water reflect the risk of the contamination of water by pathogenic bacteria, the physiochemical characters of the water were in suitable numbers of water for aquaculture.

Table 1 - Salmonella spp, total plate count in fish Schilbidae spp gills and water from Al-fadlab and Al-akad stations

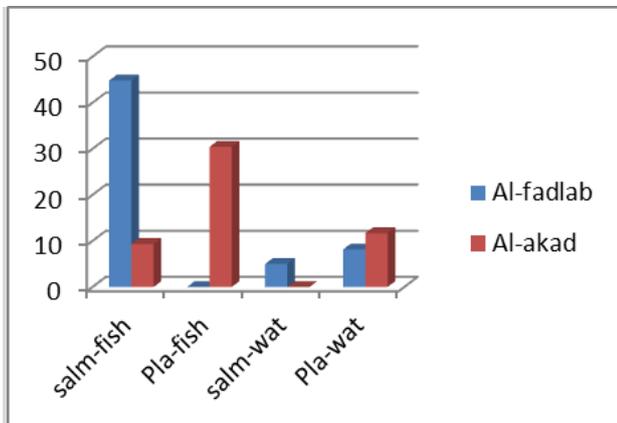
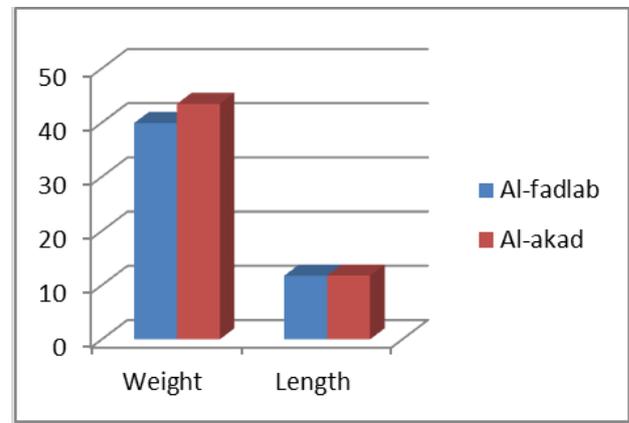
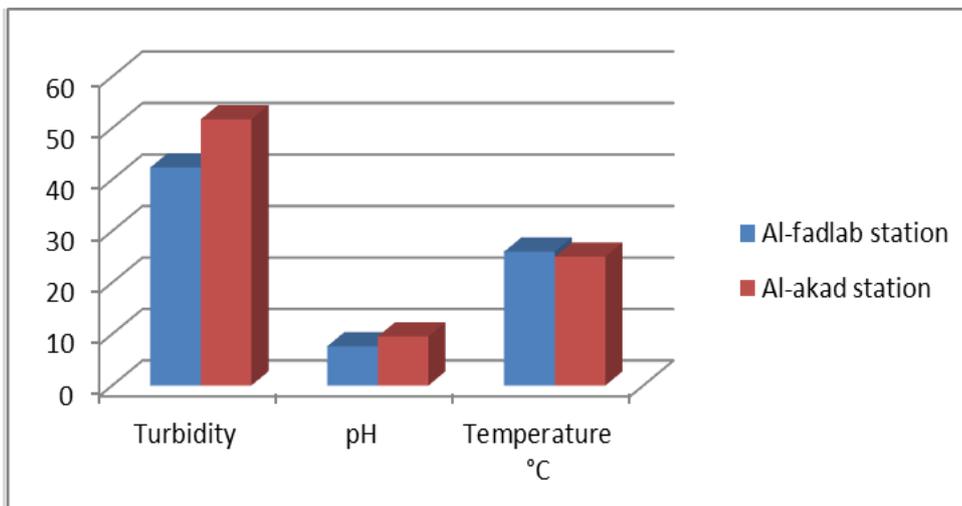
Parameters	Al-fadlab Station	Al-akad Station	Sig
Salmonella Spp (fish gills)	44.83±8.67	9.33±1.45	**
Plate count (fish gills)	Uncountable	30.40±7.18	**
Salmonella Spp (water)	5.00±1.00	No growth	**
Plate count (water)	8.13±1.87	11.67±2.04	NS

Table 2 - Weight and length of Schilbeidae spp fish from Al-fadlab and Al-akad stations

Parameters	Al-fadlab station	Al-akad station	Sig.
Weight (g)	39.92±2.48	43.47±6.97	NS
Length (cm)	11.75±0.51	11.78±0.61	NS

Table 3 - Water turbidity, pH and temperature °C in Al-fadlab and Al-akad stations.

Parameters	Al-fadlab station	Al-akad station	Sig.
Turbidity	42.32±6.85	51.68±12.72	NS
pH	7.62±0.04	9.53±0.08	**
Temperature °C	26.00±0.00	25.00±0.00	NS

**Figure 1 - Salmonella spp and total plate count in the studied station fish and water****Figure 2 - weight and length of Schilbeidae spp in studied stations****Figure 3 - Water parameters in studied stations**

CONCLUSION

Salmonella spp in fish was higher in Al-fadlab station than Al-akad station while the plate count was in the opposite situation. The *Salmonella* spp in water was high in Al-fadlab station compared with no growth in Al-akad station. There was no significant difference in weight and length of fish from the two locations. No significant difference in water temperature and turbidity from the two locations while there was significant difference in pH which is high in Al-akad location.

Recommendations

- *Shilbidae* spp fish from Al-akad Location and Al-fadlab Location areas have to carefully handling and heating before consumption to avoid the pathogenic bacteria.
- Continuous studies have to be conduct to assess the effect of contamination on these areas in fish health using different fish species and different season.
- Water quality has to be monitoring to evaluate any water risk that may affect the aquatic life.

DECLARATIONS

Authors' Contributions

All authors contributed equally to this work.

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Competing interests

The authors declare that they have no competing interests.

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