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ASSESSING THE INTER-RELATIONS BETWEEN FISH HEALTH AND STOCK STATUS ON HUMAN HEALTH AND CONSUMER PERCEPTION

Aurelia TOTOIU[1], Magda-Ioana NENCIU[1], Carmen Georgeta NICOLAE[2]

[1]National Institute for Marine Research and Development "Grigore Antipa" Constanta,
300 Mamaia Blvd, 900581, Constanta, Romania
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Marasti Blvd., District 1, 011464, Bucharest, Romania

Corresponding author e-mail: atotoiu@alpha.rmri.ro, atotoiu@yahoo.com

Abstract

This paper aims to discuss the influence of infectious-contagious and parasitic diseases that can be transmitted to humans and their impact on human health. Many fish bacteria can infect humans, mostly part of the genera Vibrio and Aeromonas. Another bacterium that has a very high resistance and can be transmitted is Mycobacterium marinum. Parasitic diseases, as well as infectious diseases can be transmitted to humans, in some cases the accidental host that interrupts the life cycle of the parasite. These can be transmitted by eating infected fish that are consumed in raw state, not cooked enough, or subjected to treatments that do not guarantee the destruction of larvae (marinated, vinegar, salted, cold-smoked, dry). These illnesses may occur to fishermen, people who manipulate fish, but also to consumers. Consumers expect safe and healthy fish and fishery products, which is why parasite infestation may also have economic repercussions by decreasing the commercial values.

Key words*: fish, human health, parasitic diseases.*

INTRODUCTION

Fish is a healthy food for humans. Fish is one of the most beneficial protein sources for human diet. Fish and seafood, in general, are filled with essential nutrients, like Omega-3 fatty acids, and are an excellent source of protein to keep the body lean and muscles strong. Fish has also impacts on other functions of the body, including liver, brain and heart (Ene et al., 2016).

However, research has shown over the years that fish, besides its food qualities, can cause serious illnesses to human communities.

Under certain conditions, there is a risk of human illness through fishing, handling, inappropriate storage and fish consumption. These risks are closely related to the way fish is cooked, the degree of industrialization, and the traditional habits of each geographical area (Durborow, 1999).

There are some fish diseases and infections that can be transmitted from fish, and the water in which they are cultured, to humans. Although the infection of humans with fish pathogens is a relatively unusual event, it is a health risk that needs to be recognised by fish farmers and other people who handle and/or consume farmed seafood (Lehane and Rawlin, 2000).

The incidence of transmission of diseases from fish to humans is dependent upon several factors including the type of organism (viral, parasitic or bacterial), the susceptibility of the host (immuno-compromised individuals, presence of open wounds) and environmental factors (quality of the water, depth of penetration of fish spines) (Durborow, 1999).

Optimum farm design, appropriate husbandry and handling, water quality management and regular fish health monitoring will reduce the risk of disease transfer from fish and their environs to workers in the aquaculture industry (Haenan et al., 2013).

The biological information about fish growth indicates the general well-being and characteristics of the specific environment (Stavrescu-Bedivan, 2016).

In the case of fishery and animals harvested from the natural environment affected by pathogens, only appropriate cooking and severe sanitary-veterinary regulations can prevent the spreading of illnesses to humans.

Moreover, the presence of visible parasites, for instance, in the flesh of marine fish has long

been known and is perceived to be both an aesthetic and human health problem.
A recent study (Bao et al., 2017) revealed that people tend to avoid eating parasitized fish, and are willing to pay above market price to avoid adverse effects on health and food quality. Overall, the results suggest that the presence of parasites in fish is an important health and aesthetic issue for consumers, and this is relevant for the fishing and food industries as well as for food safety authorities.

MATERIALS AND METHODS

The present study is a review of the most significant and potentially dangerous illnesses caused by either bacteria or parasites affecting fish.
The methodology for the diagnosis of ichthyozoonoses is made by performing sets of analyzes in specialized laboratories at persons suspected of these diseases that have come into contact or have consumed fish or fish products suspected of being infected with these pathogens or showing the symptoms of these bacterial or parasitic diseases.

RESULTS AND DISCUSSIONS

Diseases transmitted to humans through fish and other fishery products are called ichthyozoonoses.
These diseases cause problems for both fishery producers, by having their products rejected from the market, and consumers, by affecting their health.
By eating fish and fishery products, humans can be infected with or become hosts of pathogenic bacteria and parasites, biotoxins and chemicals.
The most common and known ichthyozoonoses are those caused by bacteria and parasites.

Bacterial ichthyozoonoses

The most common ichthyozoonoses are those produced by the bacteria: *Vibrio parahaemolyticus* and *Clostridium botulinum*.
Infection with *Vibrio parahaemolyticus* is specific to human communities (Figure 1).
V. parahaemolyticus is a marine bacterium that multiplies in fish and fish products at temperatures above 8^{o}C.

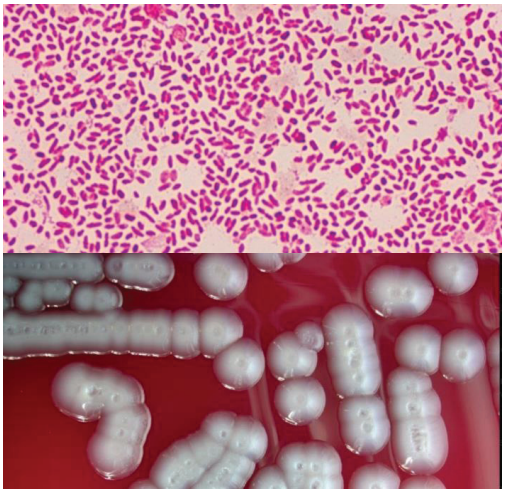

Figure 1. *Vibrio parahaemolyticus*
(Source: http://microbe-canvas.com)

This bacterium is able to cause food intoxication within hours of contamination. Symptoms of contamination can occur after 4 - 48 hours after the fish has been consumed in a raw or insufficiently fried, boiled state.
Its survival in various marine fishery products varies depending on temperature and shelf life.
The way to prevent this disease is to educate human communities on the risk of contamination with this bacterium if the fish have not been sufficiently heat-treated, but also to be aware of the importance of cooking hygiene (Huss, 1988).
There are other bacteria of the genus *Vibrio* that can be transmitted to humans and can cause major illnesses such as cholera, which in many countries is transmitted to humans by consuming marine fishery products. The population should be constantly informed of the risk of this disease and how it can be prevented.

Botulism is a food poisoning caused by botulinic bacillus toxin - *Clostridium botulinum*, as a result of human consumption of semi-conservers of fish. Research has shown that semi-conserved fish (salted, marinated, fermented and smoked) can become dangerous for humans if they contain pre-formed toxins in the raw product.
Clostridium botulinum is an anaerobic, spore-forming and spore-producing bacterium (Figure 2). Fresh fish is a potent botulinum toxin

producer. It is widely consumed without causing incidents, because, if it is cooked at 60-80 ^{o}C it is destroyed in 5 minutes.

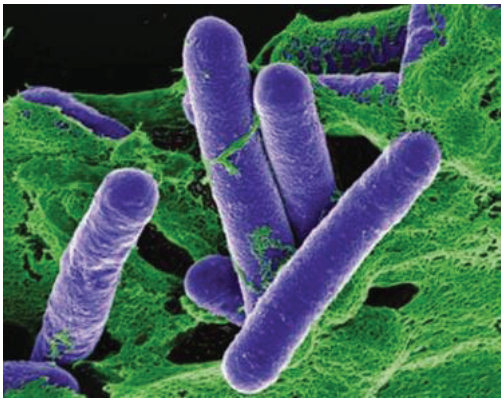

Figure 2. *Clostridium botulinum*
(Source: www.medical-actu.com)

In the event of contamination with this botulinic toxin and the occurrence of food poisoning, death may occur. Preventing this type of intoxication requires strict control of the raw fish before processing (Huss, 1988).

Mycobacteriosis or "fish tuberculosis" caused by *Mycobacterium marinum* is an infectious disease reported in many fish species.
Mycobacteria are potentially infectious in humans, they penetrate the surface of the skin due to the existence of cuts or injuries at its level, causing serious granulomas infectious (Figure 3).
This bacterium can be transmitted to fishermen, personnel handling fish and fishermen, consumers.

Salmonellosis can be caused by all *Salmonella* serotypes. The source of human infection can be fish in the waters contaminated with wastewater.

Erysipelosis is an infectious-contagious disease of the skin and subcutaneous tissue caused by the bacterial *Erysipelothrix insidiosa*, following contact with infected fish and fishery products. It is a professional disease that is recorded in fish farming workers, sports fishermen, workers in fish processing plants.

Other pathogenic bacteria present in fish that can cause infections in humans are: *Aeromonas hydrophila* and *Edwardsiella tarda*. These can cause skin lesions and gastroenteritis (Munteanu and Bogatu, 2003).

Fish-handler's disease is a nonspecific term that is in the medical and lay literature that describes a disease or syndrome of humans that may occur after handling fish or, in some instances, other aquatic organisms. It has been associated with occupations (fishermen or lobstermen), hobbies (tropical fish tanks, pet shop workers), or water sports (boating, swimming pool use). Researchers also discovered that at least two different genera of bacteria (*Mycobacterium* and *Erysipelothrix*) were the main causative infective agents of the disease (Durborow, 1999).

Figure 3. Skin lesion caused by *Mycobacterium marinum*
(Source: NYC Dept. of Health and Mental Hygiene, www. nymag.com)

Fish-handler's disease occurs when cuts or scrapes in the skin become infected with the bacteria *Erysipelothrix* sp. and/or *Mycobacterium* sp. (Figure 3). Handling and preparing fish and shellfish and many other similar activities can create small cuts and scrapes in the skin, where bacteria may enter. Developing fish-handler's disease requires deliberate contact with fish. Fish-handler's disease occurs worldwide wherever fish and shellfish are handled (Lehane and Rawlin, 2000).

Parasitic ichthyozoonoses
Parasites are a common presence in fish. Most are not transmissible to humans, but raise questions about fish quality. However, there are

species of parasites with zoonotic features that infest some species of fish in the larvae stage, which can be transmitted to humans by eating raw fish or insufficiently heat treated.

The most frequent parasites of the fish belong to the groups: protozoa, worms and crustaceans.

Parasitic protozoa do not pose a danger to the health of the consumer, but there are several species that cause the degradation of fish meat and reduce its food value.

The most destructive mixosporidia belong to the genus *Kudoa*, which are capable of intense proteolytic activity even in frozen fish, producing the softening and gelling of their meat.

Infested fish with mixosporids and microsporids have a much diminished food value and a repellent aspect, which is why they cannot be marketed. Infested fish is only used for the preparation of fish flour and fish oil (Sindermann, 1970).

The parasitic worms transmissible through fish to humans belong to the groups: Trematoda, Cestoda, Nematoda and Acanthocephala.

Researchers have shown that there are a fairly large number of worms that can spread from fish, where larvae are found, to humans.

In the human body, through fish digestion, the larvae develop by transforming themselves into adult worms, which, through their coalescing, toxic, inoculating action, cause the hosts serious illnesses.

Some species of trematod worms can cause inflammation and degeneration of the gallbladder and liver, asthma, headaches. These worms are resistant to salting and freezing and, in order to prevent human infestation, it is advisable to treat the fish well before consumption. Severe infestations can lead to death (Bauer, 1987).

Anisakidosis is one of the most important nematodoses of humans transmitted by fish consumption. It is caused by infection with larval stages of fish nematodes of the genera *Anisakis, Contracaecum* etc. Anisakidosis is a serious zoonotic disease caused by the consumption of raw or undercooked fish dishes containing the larvae of parasite with clinical entity of acute or chronic infection.

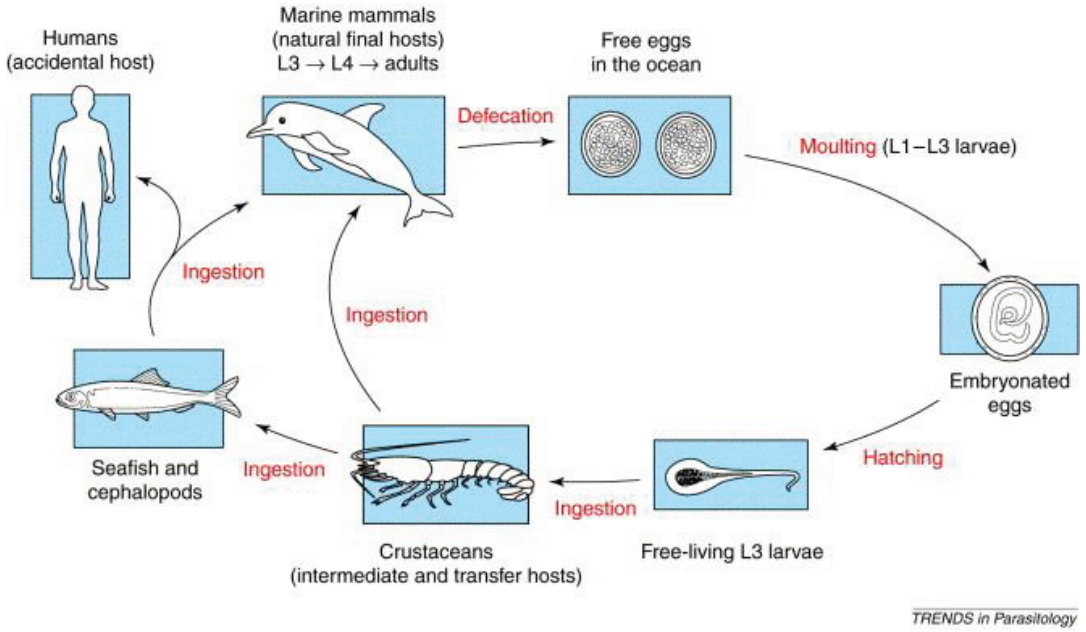

Figure 4. Life cycle of anasakids (after Audicana et al., 2002)

Anisakids are parasites widely distributed in marine mammals, particularly in colder temperate and polar waters. This parasite causes eosinophilic granuloma in the alimentary tract of man when raw or inadequately cooked fish with live larvae are ingested (Oshima, 1972).

Anisakis species have complex lifecycles which pass through a number of hosts through the course of their lives. Eggs hatch in seawater, and larvae are eaten by crustaceans. The infected crustaceans are subsequently eaten by fish or squid, and the nematodes burrow into the wall of the gut and encysted in a protective coat, usually on the outside of the visceral organs, but occasionally in the muscle or beneath the skin. The lifecycle is completed when an infected fish is eaten by a marine mammal, such as a whale, seal, sea lion, dolphin and other animals like seabirds and sharks. The nematode encysted in the intestine, feeds, grows, mates, and releases eggs into the seawater in the host's feces. As the gut of a marine mammal is functionally very similar to that of a human, Anisakis species are able to infect humans who eat raw or undercooked fish (Figure 4).

Anisakids pose a risk to human health through intestinal infection with worms from the eating of under processed fish, and through allergic reactions to chemicals left by the worms in fish flesh (Amato et al., 2007).

The application of HACCP (Hazard Analysis and Critical Control Points) principles and traceability in the production system, where each stage is evaluated for the existence of hazards and risks for public health, is a tool that has the potential to assume safety of cultivated and/or caught fish at risk of infection with zoonotic fish borne pathogens (Nicolae et al., 2015).

CONCLUSIONS

Ichthyozoonoses can be very dangerous for human communities, causing serious illness, sometimes even death. In some cases, their transmission can be done very easily, just by simply touching the fish and the presence of a hand injury can be the gateway of contamination. Their treatment can only be done by accurately diagnosing them and then treating them with the appropriate medication.

Fish borne pathogens are derived from the consumption of raw fish, or fish dishes or products that have not been cooked or have not been processed sufficiently to kill the parasites in farm. Apparently, the control is easy with consumer education campaigns, mass education, besides the consumption of well cooked/processed fish products.

Ichthyozoonoses can affect human communities along the Romanian Black Sea coast, as many of the bacteria and parasites that cause them have been identified in fish caught locally.

ACKNOWLEDGEMENTS

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