



Fish Parasites: A Review

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ABSTRACT

Just like humans and other animals, fish serve as host to a wide variety of parasites that can be pathogenic under some circumstances. The degree of pathogenicity depends on the number of parasites in each fish, their stage of development, location, age and size of the fish, since young fish are more likely to be damaged by parasites. These parasites are passed directly between ultimate hosts, others need to navigate through a series of intermediate hosts before reaching a host in (or on) which they can attain sexual maturity. Parasitic infections have been demonstrated to have consequences for almost every aspect of fish behaviour. The damage caused by parasites may be mechanical, causing the blockage of ducts and the deformation of organs. The activities of the parasites are to secrete enzymes that destroy tissues, others secrete irritating substances and blood-feeding parasites may secrete anticoagulants. This review is aimed at enlightening on the potential risk of diseases, parasites and associated pathological effects with fish culture in order to avoid economic loss. It also encourages consumers to handle fish with care and endeavor to cook their fish food very well so as to destroy the disease carriers that might be harbored in the fish.

INTRODUCTION

Fishes have played an important part in human society since time immemorial and fishing is an important social economic activity in many societies all over the world (Marshall, 2011). Culturally, fish can symbolize good luck, prosperity and long life. Fish was once termed the poor man's protein because it was cheaper than beef, chicken and pork. It is three times cheaper to produce a kg of protein (fish) than that of beef. On the other hand many fish sea food and aquatic products are expensive, luxury items and becoming more so thus taking them out of the reach of the poor. Fish is an essential food for people in developing countries. Asia with special references to India is by far the most important region for the direct human consumption of fishes, owing to a mixture of large population and relatively high per capita consumption levels of about 59.3% of the world population lives in Asia (Pandey, 2011). According to Gaonkar, (2008), fish has been the most important and sustaining factor for the people around the world. It is particularly true in case of the Coastal communities, as fish constitutes the most important part of their diet and also the main source of their livelihood. It is a major industry for the Coastal people. It is also main raw material for man industries, in the manufacture of fish meal for the poultry and the production of oils of various kinds.

Parasites are organisms that live on a host and get its food from or at the expense of the host. There are organisms that derive nourishment and protection from other living organisms known as hosts. Many of these organisms can be transmitted from reservoirs of invasion by water, soil or fish to fish contact. Some of the organisms are symbiotic while others are parasitic and derive nourishment and protection from other living organisms and hosts. Parasites range in size from tiny single-celled organisms to worms visible to the naked eye. In United States, the most common food borne parasites are protozoa, round worms and tapeworms.

Parasites can either be external or internal. The external or ecto parasites are those parasites, which are found on the body surface and are known to affect the skins and fins of the host fish. They include; *Epiosoma*, *Chilodonella*, *Ambiphrya*, *Ichthyophthirius* and *Tetrahymena* species etc. (Roberts, 2001). The internal parasites or endo parasites are those parasites that are found within the host organism and are known to affect the internal organs or the visceral organs. They include, *Cryptobia iubilans*, *Hexamita*, *Trypanosoma*, *Coccidia* and *Myxosoridians* (Poulin, 1992).

Like all wild animals, fishes could be infested by a wide variety of parasites that can be pathogenic under some circumstances. The degree of pathogenicity will depend on the number of parasites in each fish, their stage of development, location, age and size of the fish, since young fish are more likely to be damaged by parasites, the damage caused by parasites may be mechanical, causing the blockage of ducts and the compression or deformation of organs. The activities of the parasites secrete enzymes that destroy tissues, others secrete irritating substances and blood-feeding parasites may secrete anticoagulants (Marshall, 2011).

Zoonotic parasites are those parasites which are transmissible from fish to man or from man to fish leading to parasitic zoonosis(es) (Bhatia

et al., 2010). Zoonoses are communicable diseases common to man and fish and have been recognized from many countries, over 200 have been described (WHO, 2013). According to Carnes, (2012), almost any cooked fish is safe to consume as long as it has been properly handled and prepared. Also, parasitic infestations cause parasitic zoonoses when fish and shell fish are consumed in the raw state. Consumers should take common precautions including obtaining sea food from reputable sources especially if the sea food is to be consumed uncooked. Adequate cooking is the safest way to preventing related infections to human (Butt, et al., 2004). Many fish ailments can spread at an alarming rate if left untreated. So, forewarned is definitely fore-armed (Elieson, 2002).

Parasitic Infestation

Contributing Factors to Parasitic Infection

A parasite is defined as an animal/organism or a plant which lives in or upon other animal/organism/organisms (technically called the host) and draws its nutrients directly from it (Bhatia et al., 2010). There are organisms that derive nourishment and protection from other living organisms known as hosts (food safety, 2010). Parasites suck up fluid from the fish and cause some stress which leads to disease if not arrested (Ovie, 2010). Many of these organisms can be transmitted by water, soil or fish to fish contact (food safety, 2012). According to Bhatia, et al., (2010), those organisms, whether they are metazoans (helminthis, arthropods) or protozoa (unicellular organisms) classified under sub-kingdom protozoa or viruses, bacteria, fungi or rickettsia, can be called as parasites. There are two typical crustacean parasites known to infest, the anchor worm which is a copepod and the fish lice/Argulus (Ovie, 2010). Flukes are small worm-like parasites up to 2mm in length. They are monogenean trematodes which describe their biological classification and in fact they only need on host to complete their life cycle (monogenean) whereas many parasitic trematodes need two or more hosts and are thus digeneans (Johnson, 2009). According to Bhatia et al., (2010), parasites can either be ecto or endo parasites. Endoparasite (internal) is one which lives inside the organ/tissues/body cavity or body fluids of the host. They are heminthis and protozoan parasites of mammals and birds and larvae (bots) of some insects. While Ectoparasite is one which lives on the surface (on or in) of the skin of its host. Example, most insects and archinds. Parasitic worms can either be internal or external in their infestation (Johnson, 2009).

Just like humans and other animals fish suffer from their shape of health problems and there are few things more alarming than noticing that some of your prized pond life is looking ill or worse still, dying (Elieson, 2002). According to Marshall, (2010), like all wild animals, fishes are infested by a wide variety of parasites than can be pathogenic under some circumstances. He further stressed that, the degree of pathogenicity will depend on the number of parasites in each fish, their stage of development, location, age and size of the fish, since young fish are more likely to be damaged by parasites. A range of organisms are commonly found in ponds, but fortunately many of them don't cause much trouble for fish that are

There are some serious threats, making any delay in diagnosis potentially disastrous. Clearly then it pays to have a good working knowledge of the diseases and ailments likely to affect your fish and to keep them well fed and in good condition (Elieson, 2002).

The living and non-living things that can cause problems for fish can be classified into infectious/transmissible or non-infectious. Infectious organisms include; viral, bacterial, protozoans, fungi. Non-infectious are caused by nutritional or genetic conditions (Olaosebikan et al., 2011). The damage caused by parasites according to Marshall (2011), may be mechanical, causing the blockage of ducts and the compression or deformation of organs. The activities of the parasites as he further stressed is to secrete enzymes that destroy tissues, others secrete irritating substances and blood-feeding parasites may secrete anticoagulants.

The prevalence of zoonotic parasites and related health problems are constantly changing because of alteration in ecological pattern, socio-economic condition, environmental variations, a large scale exchange and increase in populations and other factors like lack of sanitation, mass travelling, changes in food style and habits etc. Food-borne parasitic zoonoses form the most important and a wide component of parasitic zoonoses (Bhatia et al, 2010). Protozoa are one-celled organisms that can cause diseases ranging in severity from mild to deadly. They are microscopic in nature and are mild to infest the skin, gills of cultured fish (Zaykoski, 2011). Ichthyophthirius multifiliis are ciliated protozoan parasites that are known to be major problem to aquaculturists and commercial fish producers world-wide (Reed and Floyd, 2012). Another protozoan parasite, known as Ichthyobodo necatrix, Chilodonella, Trichodina, are flagellates that are found in young fish just as they start feeding externally in cold waters. And it causes frequently fatal fish disease (Ovie, 2012).

Similarly, Quarles (2012), reported that, myxosom acerevralis attacks mostly young fish within the first year of its life as the fish gets older the chance of developing the disease (whirling disease) is greatly reduced. He also said once the fish become stressed, other diseases find easy pathways to cause weakened conditions within the individual until death results. Stress may be due to nutritional disorders caused by an inability of the body to absorb and use nutrients or by over consumption of certain foods. Nutritional disorders can be particularly serious in young fishes, since they interfere with growth and development and may predispose to many health problems such as infection and chronic disease (WHO, 2013). Branchiomyces sanguine infestation according to Reclus (2007), the fish shows rapid movements, swollen gills and discoloured gill filaments with excess mucus. Fish do not eat, lie motionless in the tank or gasp at water surface.

Aeromonas spp are very common and are some of the most difficult health problems to deal with in the pond (Olaosebikan et al., 2011). According to Malawi (2008), Aeromonas punctata, are characterized by swelling of the body and especially abdomen, which causes the scales to stand out with a pine cone appearance. Aeromonas salmonicida which is present in water all the time usually when fish get sick with an infection, something has happen to make them susceptible to bacterial invasion (Francis, 2007). Furunculosis usually occurs in fish from marine and estuarine environments and has been reported throughout the world. It is reported in fresh water fish. Common names for furunculosis of fish include "red pest" of eels "vibro-infection" "red boil" and "pike pest" (Reed and Floyd 2012).

Parasitic Effects on Human

Indeed, many parasites complete their life cycle in the predators usually birds and other fishes but also otter, cats, dogs, snakes and crocodiles. Some parasites can infect humans, the trematod Clonorchis sinensis occurs quite regularly in societies where uncooked fish is widely eaten (Carnes, 2012). According to Butt et al., (2004), parasites are responsible for a substantial number of seafood associated diseases. He further said, the factor most commonly associated with infection is consumption of raw or uncooked seafood, and people with underlying disorders, particularly liver disease are more susceptible to infection. Zoonotic parasites are those which are transmissible from animals to man or from man to animals. Of these, some zoonotic parasites require both animal and man essentials to complete their life cycles, some other parasites are common to animals and man, while a few others are exclusively of animals but their invasive stages enter man accidentally. The disease(s) caused by such parasites are called "parasitic zoonosis(es)" (Bhatia et al., 2010).

According to WHO (2013), zoonoses have been recognized for many centuries and over 200 have been described. They are caused by all types of pathogenic agents including bacteria, parasites, fungi and viruses. The prevalence of zoonotic parasites and related health problems are constantly changing because of alteration of ecological pattern, social economic conditions, environmental variations and increase in populations (Bhatia et al., 2010).

There are over 50 helminthic infections from fish/shell fish (i.e. parasites that parasitizes human gut) that can infect humans. Most parasitic infestations from ocean fish are rare. Pelagic fishes such as tuna probably have the least amount of parasitic load. This is mainly due to their wide roaming migrations. They are near the top of the food chain, and may consume prey that have parasites but are not in an area long enough to ingest many prey that have a high parasitic load. There are however, cases reported of humans becoming infected with round worms after infesting raw

yellow fin tuna (Carnes, 2012).

According to Bhatia et al., (2010), all parasites have different types of effects on their hosts. Some are innocuous, some are mildly pathogenic, and others are moderately harmful while a few others are highly pathogenic and fatal. Variability in the degree of harmful effects amongst various parasites is related to their number, invasive power, virulence, reproductive potentiality, propensity of release of toxic products and their localization in the body of their hosts, besides many other intrinsic and extrinsic factors in their surrounding within and outside of their hosts like, general health condition, age, breed, sex, nutritional level, concurrent infections, state of hygienic condition, inclement weather etc.

Some tape worm and nematodes parasites of fishes are also known to infest humans and can cause a variety of unpleasant conditions (gastro-intestinal problems) such as bloating, cramping, diarrhea or unusual bowel movements. Also many people may "write" off the symptoms simply as a case of the "stomach flu" or other short-lived stomach problem. Besides parasites, there are a couple of other illnesses that should be considered when consuming raw fish/shell fish are hepatitis A, amoebic (Carnes, 2012).

Digenean metacercariae from fish which commonly infest man are members of the families' opisthorcidae and heterophidae. According to Meyer (1970), these parasites are wide spread throughout Asia and eggs are passed out of the mammalian host in the faeces and must be eaten by suitable gastropod mollusk cercariae released from the mollusk can infest fresh water fish, second intermediate host and encyst under the skin.

According to Chai et al., (2005), fish borne parasitic zoonoses have been limited for the most part of populations living in low and middle-income countries, but the geographical limits and populations at risk are expanding because of growing international markets, improved transportation system, and demographic changes such as population movements. Food borne zoonoses cause death and serious diseases in human and animals world-wide, and are both public health significant and socio-economic importance (Peng et al., 2008).

Prevention And Control Of Parasitic Infestation Strategies for prevention and control

There are some essential prerequisites on which principles of prevention and control of a parasitic infestation can be formulated (Bhatia et al., 2010). According to this author, nature of infestation(s) (whether it is ubiquitous, endemic or sporadic), type of life cycle of disease causing parasite(s) in the area of operation and involvement in any intermediate host/vector(s) (if any and their places). History of the infestation in the area, geo and agro-climatic data and rainfall in the area, nutritional level of fish and the source of their feed and portable water, are information needed to be gathered before developing strategy for prevention and control of parasitic diseases. According to Ovie, (2010), to prevent fish diseases and parasites in cultured system, the fish should be supplied with abundant and good quality water (with the supply of good quality water, lack of oxygen and pollution will be ruled out in the system). The problem of high turbidity as a result of silting and aquatic plants must be controlled. During harvesting, the bottom of the pond must be totally emptied so that no pools of water will remain for disease agents and parasites to thrive. When stocking ponds, overstocking should be avoided. The history of fingerlings (larvae) obtained must be known to be from a reputable source so as to avoid transferring infested fish into the farm.

The term prevention of a disease is used when efforts are made to prevent healthy animals from infection (Bhatia et al., 2010). According to this author, the parasitic immunity is the resistance offered by the host (fish) in different ways towards the injury or damage caused by a large variety of parasites and their products. The immune response to parasites is an important phenomenon in the pathology of infection/infestation and in the control of parasite populations.

Control of digenea parasites can be difficult especially in areas where raw fish is widely consumed. Public health education is required to persuade people not to eat raw fish as a way of reducing the level of infestation in man. Proper cooking or deep freezing kills the metacercariae (Meyer, 1970). Butt et al., (2004) advised consumers to take common precautions including obtaining seafood from reputable sources especially if the seafood is to be consumed uncooked. Adequate cooking of seafood is the safest way to preventing related infections. Similarly, Carnes, (2012) handled with care (correctly). If possible freeze the raw fish to decrease the likelihood of ingesting viable parasites. Don't experiment with consuming new types of raw fish especially fresh water fish, you may regret it later. Also consuming fast growing fish species or smaller individuals might be safer.

Control of the metacercariae parasites may be facilitated by the proper disposal of human faecal material and the use of molluscicides. The broad fish tapeworm of man, pseudophyllidean diphyllobothrium latum, has been recorded from many parts of the world, especially the Baltic regions and great lake areas of North America (Meyer, 1970).

Control of a parasitic disease means to minimize the intensity and prevent further spread of an existing infestation in fish by adopting the followings; segregation of clinical cases and their proper treatment (chemotherapy). All apparently healthy fish should be given preventive medication (chemoprophylaxis). Immunoprophylaxis (vaccination) may be done as stated under prevention and all other methods of prevention may

be adopted (Bhatia et al., 2007). According to Kolndadach et al., (2007), the combat of fish parasites and diseases requires a multidisciplinary approach. These includes; chemotherapy, immunization, and quarantine, environmental, nutritional and genetic manipulations. However, the most important and effective strategy is prevention.

There has been few concerted research investigations, concerned solely with establishing definitive criteria (toxicity and efficacy) for treatment compounds, far less methods for the application of such chemicals and drugs have been established (Roberts, 2001). Current trends in intensive farming lay emphasis on the prevention rather than the treatment of fish disease but the majority of outbreaks of disease in cultured fish could usually be attained to inadequate management. The health of fish should be checked if the evidence of parasitism, treatment should be avoided during flooding (Woo, 1987). Formalin which is a highly toxic compound has long been a traditional treatment of fish ecto parasites. It is extremely effective against most protozoans as well as some monogenetic trematodes through bath, flush or flowing treatment methods, when applied at concentrations of 167 – 250 mg/l for 1 hour (Roberts, 1978). According to this author, formalin is a reducing agent and causes additional reduction of oxygen level in the water. Therefore oxygen level should be closely monitored during the treatment.

Parasitic Diseases and Therapy

A disease is an abnormal condition that affects the body of an organism. Diseases caused by parasites can be grouped together to their aetiology (Ayyappan et al., 2006).

Protozoan Diseases

Various protozoan parasites are found on the body of the fishes. They may live externally on the body surface or internally in the visceral organs (Pandey and Shukla, 2010).

Ichthyophthiriasis: It is also called "ich disease". It is the worst protozoan disease caused by ciliated protozoan parasite, *Ichthyophthirius multifiliis*, which shows white spots or pimples on the skin and fins. The gills may also be attacked (Pandey and Shukla, 2010).

Control of this infection is concentrated on a life stages outside derma tissues of the host (Ayyappan et al., 2006). Hence the parasite cannot live outside the host; the infected fish should be placed in several storage tanks so as to eliminate it (Reed and Francis, 2012). He further explained that water temperature has a tremendous influence on how fast the life cycle for "ich" is completed. At warm temperatures, life cycle is complete in about 48 hours which means that, a chemical treatment should be applied every other day at cooler temperatures the life cycle is prolonged and treatments should be spaced 4 or 5 days apart. In warm water, a minimum of three treatments applied 2 to 3 days apart is required in cooler water; a minimum of five treatments should never be discontinued until all mortality has stopped. According to Ayyappan et al. (2006), this parasite can be controlled by hourly treatment for seven days in 2% - 5% NaCl solution, pond treatment advocated is application of 15 – 25 mg/L formalin. A repeated formalin bath using 200-250ppm daily can also be used as well as common salt applied at 30g/liter of water has been found to yield good results when used repeatedly for several days (Ovie, 2010). Visible lice (*Argulus*) should first be killed by dabbing them with potassium permanganate or an anti-parasitic medication. Then they should be carefully removed from the fish using tweezers. This is done so as to reduce stress on the fish (Elieson, 2002).

Trichodiniasis: This disease is caused by a group of paritrical ciliated protozoans. The organisms are saucer shaped, 50 microns diameter, with rows of cilia at both ends and a macro and micro nucleus (Moeller, 2013). It mainly attacks on the skin of Tilapia and Salmonids fishes and cause lesions (Pandey and Shukla, 2010).

Treatment method adopted according to Ayyappan et al., (2006) are water quality management, diminishing stocking density of fish, bad treatment of fishes with two to three percent Sodium Chloride or 50 mg/L KMnO₄, and pond treatment with 5 mg/L KMnO₄ or 25 mg/L formalin.

Costiasis: This disease is caused by *Ichthyobodo* or *Costia necatrix*. It is a piriform shaped protozoa 6-12 microns long with two short and two long flagella. These attach to the skin or gills of fishes (Moeller, 2013).

Treatment: Diseased fishes are treated by keeping them for 10 to 15 minutes in either 3-5% NaCl or in 1-1250PPM formalin solution. Addition of KMnO₄ is also useful. Overcrowding should be avoided and pH of water should be checked regularly (Pandey and Shukla, 2010).

Milk fish disease: This disease is caused by genus *Henneguya*. It is characterized by tadpole-shaped cysts, with two eye spots or polar capsules. Symptoms involve whitening of skin. This parasite responds well to the treatment suggested for *Ichthyophthirius* (Pandey and Shukla, 2010).

Helminthes

Dactylogyrosis and gyrodactylosis: These are flukes that affect fry, fingerlings and adult fishes. In dactylogyrosis, the colour of the fishes fades and there is excessive mucus secretion. In gyrodactylosis there is a fading of the normal body colour, dropping of scales and excessive mucus secretion.

In general there is growth reduction and morbidity in affected fishes for both diseases. The parasites can be controlled by therapeutics, vice, bath treatment with 1-5% NaCl for 10 to 15 minutes or 100 mg/L formalin with aeration, pond treatment with 25 mg/L formalin or 5 mg/L KMnO₄ (Ayyappan et al., 2010).

Bath treatment should be used for control of skin flukes. To maintain the health balance and to minimize the chance of outbreaks, health management procedures must be practiced. Health monitoring and early diagnosis is a key for control of parasitic diseases. When unusual symptoms are first observed in a particular fish, actions must be taken to quickly reduce, if not eliminate, the number of parasites on fish and in the aquatic ecosystem. In general, hydrogen peroxide and formalin are commonly used as bath treatments against protozoa and capsalid monogeneans.

Black spot disease: It is a very common disease of marine fishes caused by *Cryptocotyle lingua*. Metacercariae are formed in the skin and the host fish lays down a readily visible black capsule around them. Prevention from this disease may be achieved by destroying secondary host (Pandey and Shukla, 2010).

Ligulosis: Caused by *Ligula intestinalis*. It is a tapeworm that infects a number of fishes, specially the Cyprinids. It is marked by swollen intestine which is often choked by cystodes cysts or the worms. Bath treatment with KMnO₄ (4ppm), NaCl solution (3-5%), Copper Sulphate (500ppm for 1 to 2 minutes), formalin (250ppm for 1 hour), Malachite green (65-70ppm for 10 to 30 seconds), Picric acid (3-100,000 parts) (Pandey and Shukla, 2010).

Crustaceans

Argulosis: Caused by *Argulus*. *Argulus* is a fish louse. It is a common copepod crustacean parasite attacking the tropical fresh water fishes. It attaches itself below the eyes of the fishes by its hooks and two suckers. It sucks the blood with the help of its piercing organs.

Treatment: The pond should be drained and limed before stocking. Keep the infected fishes in 3-5% of NaCl bath or in 250ppm of formalin solution for an hour. Solution of KMnO₄ (0.2-0.3g/gallon of water) may be added to eradicate parasites from the large fish ponds. Too strong solution of KMnO₄ may prove fatal to fishes (Pandey and Shukla, 2010).

Ergasilosis: infestation occurs in gills, buccal cavity, operculum and gills. The causative agent is the species of genus *Ergasilus*. Infection increases with size of the fish causing damage of the gill tissue and retardation in growth.

The parasites are controlled by pond treatment with KMnO₄ at mg/L or bath treatment of affected fish with 2-3% NaCl (Ayyappan et al., 2006).

Lernaeosis: This disease is prevalent in Indian major Carps. Heavily infected fishes become moribund with erratic movement and emaciation. Attachment areas on host exists sloughing off and ulceration. The causative agents are *Lernae achackoensis*, *L. bengalensis* and other species of *Lernaea*. The parasites are controlled by the same treatment as for *Ergasilus* sp (Ayyappan et al., 2006).

CONCLUSION

All fish are potential hosts to different species of parasites that cause disease leading to significant mortality among earthen and concrete ponds (cultured) as well as in the wild. Parasites have been found to cause serious losses in fish ponds in Nigeria and their lesions render the fish unmarketable. Man can also be infected at the cause of consumption of diseased or infected fish. Therefore, fish farmers are encouraged to apply the appropriate prophylactic measures so as to prevent and control the outbreak of disease which may lead to losses. Moreso, adequate cooking of seafood is suggested way to preventing related infections.

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