Gazi University Journal of Science
GU J Sci
23(3):255-260 (2010)

GUJS
www.gujs.org

Fish-borne Parasitic Zoonoses in Turkish Waters

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Received: 05.03.2009 Revised: 23.12.2009 Accepted: 04.02.2010

ABSTRACT

The purpose of this study, to give information about zoonosis in freshwater and marine fishes. Three digeneans (*Heterophyes heterophyes, Opisthorchis felinus*, *Centrocestus formosanus*), one nematod (*Anisakis simplex*) and one cestod species (*Diphyllobothrium* sp.) which have zoonosis character were recorded from 15 host fishes. Anisakis was reported from marine fishes which is heavily consumed by people. Limited number of parasite having zoonosis character have been determined in marine and fresh water fishes in Turkey since 1931. For this reason, advanced studies are necessary about this subject.

Key Words: *Turkey, zoonosis, fish, Heterophyes, Anisakis, Opisthorchis, Diphyllobothrium.*

1. INTRODUCTION

From 1931 to 2010, several articles, doctorate and master's theses and reports have been published mentioning parasites of freshwater and marine fish by Turkish researchers. Twenty nine protozoon parasite species, 12 Myxozoa, 283 helminths (87 species of Monogenea; 84 species of Digenea; 47 species of Cestoda; 37 species of Nematoda; 16 species of Acanthocephala; 12 species of Annelida); 2 species of Mollusca and 61 parasitic Arthropods (1 species of Branciuran; 39 species of parasitic Copepod; 17 species of parasitic isopods; 3 species of Arachnida; 1 species of Diptera) have previously been reported parasitising marine and freshwater fishes in wild habitats. Regarding farmed fish, *Cyprinus carpio* was the most parasitized fish species with 33 parasite species. Protozoan parasites have been reported extensively according to locality and host diversity from imported and internally produced aquarium fish [1-5].

The epidemiology of some of fish zoonoses may be influenced by a non-optimal treatment of fish products during hunting and frozen storage, as well as by traditional food habits, like consuming raw, improperly smoked, salted or cooked fish [Latin American ceviche, Japanese sushi and sashimi, Dutch maatjesharing (herring), Norwegian gravlax (salmon), Hawaiian lomi-lomi (raw salmon), Spanish boquerones (anchovies in vinegar) may lead to infection. People handling and consuming meat from fishes, such as fishermen and sellers, or people who come into contact with fish for research or during daily and monthly care of aquarium and cage fishes are also at risk of contracting these zoonotic diseases. Some zoonotic infectious agents have been transmitted to humans from stranded animals [6]. In Turkey, there is traditional fish eating habits like salt bonito (lakerda in Turkish), salted and dried atlantic

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mackerel (çiroz in Turkish) and caviar. It is possible that parasites may be found in these sea products.

Well-known zoonotic infectious agents transmitted to humans from captive fishes are protozoon such as *Cryptosporidium* and *Giardia*; Nematodes such as *Capillaria philippinensis*, *Dioctophymiasis renalae, Eustrongyloides*, *Gnathostoma hispidum, G. spinigerum, G. doloresi* and *G. nipponicum*, *Anisakis simplex, A. typical, A. physeteris, Pseudoterranova decipiens* and *Contracaecum osculatum;* Cestodes such as *Diphyllobothrium latum, D. cordatum, D. pacifica, D. dendriticum, D. alascense, D. lanceolatum, D. ursi, D. dalliae, D. nihonkaiense, D. hians, D. cameroni, D. yonagoense, D. scoticum*; Trematodes such as *Clonorchis sinensis, Opisthorchis viverrini, O. felineus, Heterophyes nocens*, *H. continua*, *H. heterophyes*, *H. dispar*, *Heterophyopis continua*, *Haplorchis taichui*, *H. pumilo*, *Metagonimus yokogawai*, *M. takashii*, *Pyidiopsis summa*, *Diorchitrema falcatus*, *Stictodora fascatum*, *Centrocestus armatus*, *Echinostoma hortense*, *E. cinetorchis*, *Echinochasmus japonicus*, *Paragonimus westermani, Nanophyetus salmincola* [6-8, 22].

These parasites have been known to cause some diseases like gastritis, ulcer, cancer or appendictis in human being [9, 10].

On the other hand, some of these parasite larvae can penetrate into the muscle of human. For example anisakiasis infection has been most frequently reported in Italy, Japan, United States, Scandinavian Countries, The Netherlands and, more recently, Spain [9, 10]. In our country, no cases of this disease have been reported yet. For these reasons, fish-borne parasitic zoonoses in Turkish waters were checked in this paper.

3. RESULTS AND DISCUSSION

Although three sides of Turkey are surrended by seas, consumption of aquatic products per person is 7.229 kg. When this value is compared with other countries, it is a fairly little quantity. In Turkey, aquatic products are consumed as fresh (75%), frozen or processed products [11]. Because of sushi and raw fish eathing habits, there have been zoonosis risk in Turkey in recent years. Which institution controls these risk groups is not known.

Some parasites causing zoonoses are found in some fishes. These parasite species are *Opisthorchis felinus, Heterophyes heterophyes, Centrocestus formosanus* (Digenea), *Diphyllobothrium* sp. (Cestoda), *Anisakis simplex* (Nematoda) [12-21]. These parasite species and their hosts are given in Table 1.

Table 1. Fish parasites causing zoonoses in Turkey.

Parasite species causing zoonoses	**Host Fish-Intermediate host fish**	**Locality**	**References**
Heterophyes heterophyes (V. Siebold, 1852)	*Mugil cephalus* (Flathead mullet)	Aegean Sea	Tareen (1981)
Opisthorchis felinus (Rivolta,1884)	*Rutilus rutilus* (Roach)	Uluabat, Manyas Lakes	Geldiay & Balık (1974)
Centrocestus formosanus (Nishigori, 1924)	*Xiphophorus maculatus*	Imported	Yıldız (2005)
	C*arassius auratus*	Imported	Yıldız (2005)
	Pterophyllum scalare	Imported	Yıldız (2005)
	Poecilia reticulata	Imported	Yıldız (2005)
Diphyllobothrium sp.	*Scophthalmus rhombus* (Brill)	Black Sea	Merdivenci (1983)
Anisakis simplex (Rudolphi, 1809)	*Scomber japonicus* (Chub mackerel)	Aegean Sea	Akmirza (1997)
	Trachurus mediterraneus (Mediterranean horse mackerel)	Aegean Sea	Akmirza (1998a)
	Mullus surmuletus (Striped red mullet)	Aegean Sea	Akmirza (2000a)
	Diplodus annularis (Annular seabream)	Aegean Sea	Akmirza (2000b)
	Pagellus erythrinus (Common pandora)	Aegean Sea	Akmirza (2000b)
	Oblada melanura (Saddled seabream)	Aegean Sea	Akmirza (2000b)
	Boops boops (Bogue)	Aegean Sea	Akmirza (2000b)
	Sardina pilchardus (European pilchard)	Sea of Marmara	Oğuz et al (2000)
	Merlangius merlangus (Whiting)	Sea of Marmara	Oğuz et al (2000)
	Trachurus trachurus (Atlantic horse mackerel)	Sea of Marmara	Oğuz et al (2000)
	Engraulis encrasicholus (European anchovy)	Sea of Marmara	Tuncel (2003)
	Scomber scombrus (Atlantic mackerel)	Sea of Marmara	Keser et al (2007)

There are no records fish based zoonoses in hospitals or other healty institutions in our country. If we check fresh water and marine fish parasite fauna, we can notice that some fish carry parasites that cause zoonoses. These may cause some infections in men. There is insuffitient investigation about this subject in Turkey.

3.1. *Heterophyes Heterophyes*

This fluke lives in the small intestine and caecum of fish-eating mammals including man. It uses snails (e.g. *Pirenella conica*) as first and various brackish species or freshwater fish (e.g. *Oreochromis* spp., *Tilapia* spp., *Mugil* spp.) as second intermediate hosts. Humans become infected by eating raw, pickled or insufficiently cooked contaminated fish. Small intestinal fluke, which is uncommon but widely distributed (Middle East, Turkey, eastern and southeastern Asia) is seen in dog, cat, fox and man; many species of fish (brackish or freshwater fish) act as second intermediate host and only heavily infected individuals may show nonspecific diarrhea, abdominal pain, and eosinophilia [22].

Heterophyes heterophyes was determined in the muscle of *Mugil cephalus* caught from Aegean Sea [12]. As known, mullet feed on sewerage rich in detritus. For this reason, mullet is an intermediate host for cercaria of digenean. In spite of the medical risks, it is consumed by unconscious public. There is no proper records and extensive scientific research about this subject in the hospitals. In addition, there is zoonosis caused by fishes in Turkey. Moreover, this parasite is found in dogs as definitive host [23-25].

3.2. *Opisthorchis Felinus*

Opisthorchis spp. causes bile duct infections after Opisthorchiasis, ingestion of undercooked fish or crustaceans containing the metacercariae. Luminal infections of the bile duct with a small parasite burden may be asymptomatic. The worms are attached to the wall of the bile ducts with their 2 suckers giving rise to local inflammation. Large numbers of parasites may introduce heavy biliary obstruction, with resultant jaundice and secondary infection leading to cholangiohepatitis, liver abscesses, cholecystitis, and pancreatitis. In the pancreatic ducts both squamous metaplasia and adenomatous hyperplasia may occur. Eggs pass out of the bile duct and are found in the stools [22].

According to fish parasite studies in Turkey, *Rutilus rutilus* is intermediate host for *Opisthorchis felinus* [13, 26, 27]. It was reported as definitive host in bile duct of Van cat and wild cat, respectively.

3.3. *Centrocestus formosanus* (Nishigori, 1924)

Centrocestus formosanus is a minute trematode species inhabiting the intestine of birds and mammals, including chickens, ducklings, mice, rats, rabbits, dogs, cats, and foxes. The second intermediate hosts include various species of freshwater fishes, frogs, and toads. However, natural human infections with this fluke have never been documented. *Centrocestus formosanus* is so far known to be distributed in Taiwan, China, Japan, the Philippines, Thailand, India, Hawaii, Vietnam, Croatia, USA, Mexico, Colombia and Turkey. Among the *Centrocestus* species, those reported from human infections in experimental and natural studies are *C. armatus*, *C. kurokawai, C. cuspidatus, C. caninus, C. formosanus* [28].

Centrocestus formosanus has been reported in ornamental fish *(Xiphophorus maculatus,* C*arassius auratus, Pterophyllum scalare* and *Poecilia reticulata)* imported into Turkey from Singapore [29]. It has a significant importance for zoonoses but the risks associated with this parasite in wild fish of Turkey are unknown.

3.4. *Anisakis Simplex*

Anisakiasis refers to infection by larval ascaridoid nematodes whose normal definitive hosts are marine mammals. The genus involved are *Anisakis*, *Pseudoterranova* and *Contracaecum*. Larvae from squids and marine fish can invade the gastrointestinal tract of humans, causing an eosinophilic granuloma syndrome. It is frequently reported in areas of the world where fish is consumed raw, lightly pickled or salted. The areas of highest prevalence are Scandinavia (from cod livers), Japan (after eating sushi and sashimi), The Netherlands (by eating infected fermented herrings (Maatjes), and along the Pacific coast of South America (from eating ceviche). Acute gastric infections are manifested by gastric pain, nausea and vomiting 4–6 h after ingesting raw infected seafood. During the chronic phase, vague epigastric pain, nausea and vomiting may last from several weeks to 2 years [8]. *Anisakis* sp. is reported from 10 marine fishes in Turkey [15-21].

3.5. *Diphyllobothrium sp.*

The adult *Diphyllobothrium latum* may reach up to 12 meters, increasing throughout its life. The plerocercoid may pass through other paratenic hosts until consumed finally by a mammalian definitive host [28]. Mammals such as bears, dogs, and humans eat those fish and aquire the worms, which grow and reproduce in the host's intestines [30, 31].

Diphyllobothrium latum can be very harmful on human. Infection (diphyllobothriasis) in humans can lead to anemia, due to depletion of vitamin B-12 [32]. A severe broad tapeworm infection in humans is known to cause anemia due to the lack of vitamin B-12, which the tapeworm absorbs through the lining of the gut. The parasite can be avoided by thoroughly cooking fish and taking care when working with fish flesh [30, 33].

In our country, genus *Diphyllobothrium* was determined from brill, *Scophthalmus rhombus.* But, it was determined as only genus [14]. There is limited studies in connection with parasites causing diseases in fresh water, marine and culture fishes in Turkey. To fight in parasites causing diseases which threat fisheries, parasitic diseases agents must be well-defined. That is to say, more studies must be carried out on fish parasites to confirm the existing species. To reduce the risks for fish consumers, advanced studies about parasite-host realtionships are necessary in Turkey.

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