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Potential parasitic hazards for humans in fish meat

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Abstract

The image of fish as a healthy food is the main reason for increasing demand for fish meat but there are serious safety concerns related to the presence of parasitic hazards in fish meat. The main goals of this paper are to describe the most important parasitic hazards in fish meat, to indicate the need for adequate preparation of fish meat and to increase public awareness of the risks associated with consumption of fish containing viable infectious parasitic hazards. Avoiding consumption of raw or poorly cooked fish is the best preventive measure to avoid infection by fishborne parasites.

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Keywords: fish meat; nematodes; cestodes; trematodes; management of parasitic hazards

1. Introduction

Aquaculture is one of the fastest expanding sectors of the economy in the area of food production and demand for fish meat is continuously increasing. Fish meat is a valuable source of all nutrients[1] and especially essential fatty acids which are present in optimum quantities for human needs[2,3,4]; this is the main reason for increasing demand for

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fish meat. On the other hand, there are serious safety concerns related to the consumption of raw fish meat due to the presence of parasitic hazards. Because of all the mentioned facts, good knowledge and management of parasitic hazards associated with the consumption of fish meat is of major health and economic significance. The main goals of this paper were to describe the most important parasitic hazards present in fish meat, to indicate the need for adequate preparation of fish meat to reduce the risk of human fishborne disease, and to increase public awareness concerning the risks of consuming fish meat containing infectious parasitic hazards.

2. Parasites

Parasitic infections can affect a large number of fish species, especially in countries where untreated human and animal waste is used as fish feed in fish production. There are a moderate number of these parasites which have been reported in humans, but only a few cause serious diseases. Nematodes and trematodes are the most important while cestodes and acanthocephalans have been reported from humans on rare occasions[5].

2.1. Nematodes

Some nematodes are zoonotic. Among these parasites, *Anisakis* spp. has the highest medical importance because of the severe allergic reactions and gastrointestinal symptoms it causes in humans after eating or handling infected fish or crustaceans[6]. These symptoms are especially prevalent in countries where it is common to eat raw or undercooked fish and anisakiasis is a serious zoonotic disease with a dramatic increase in prevalence throughout the world in the last two decades. The highest prevalence of anisakiasis is found in north Asia and western Europe (The Netherlands, Germany, France and Spain)[7]. In Serbia, *Anisakis* can be present in imported marine fish. Ćirković et al.[8] inspected 2414 samples of imported marine fish in the period 2000-2013. *Anisakis* spp was identified in 25 (1.29%) samples of herrings (*Clupea harengus*) and mackerel (*Scomber scombrus*). *Pseudoterranova decipiens* is also frequently associated with human disease[9]. Humans are infected with larval *A. simplex* by eating raw, inadequately cooked, poorly salted or smoked salmon, herring, cod or mackerel, while *P. decipiens* is commonly present in cod, halibut or flatfish[5]. *A. simplex* larvae enter the gastric or intestinal mucosa in humans and can cause an abscess or eosinophilic granuloma[10]. Also, these parasites can enter the peritoneal cavity and also enter other organs, while some of the nematodes may not invade tissue but instead can pass out with faeces, vomit or pass up the oesophagus [10]. *P. decipiens* larvae can cause 'tickling throat syndrome' in which a tickling sensation occurs and the patient may cough up the larvae [11]. Besides that, *Contracaecum osculatum* has been reported to cause disease in humans, but infection with larvae of *Contracaecum osculatum* is less common[12].

The most significant freshwater fish zoonotic nematodes which occur in Serbia are *Eustrongylides* spp.[13], of which the most important species is *Eustrongylides excisus*[14]. In humans who have consumed raw or undercooked fish, *Eustrongylides* spp. have produced gastritis and intestinal perforation[15]. Human infections with *Eustrongylides* spp. occur after ingestion of raw or poorly cooked fish meat, since fishes act as intermediate and paratenic hosts in the development of their lifecycles. The pathogenicity to humans can be different to and, most times, more conspicuous than that observed in birds, the natural definitive hosts for this species[16]. *Eustrongylides* spp. have been reported in various freshwater fish in Japan, Iran, Papua New Guinea, Canada, Bangladesh etc[5].

2.2. Trematodes

It has been estimated that the number of people infected with fish-borne trematodes exceeds 18 million worldwide. Moreover, the number of people at risk, including those in developed countries, is more than half a billion[7]. Notwithstanding 33 species of digenetic trematodes having been registered as transmissible to human through the consumption of fish, crustacea or molluscs, only a few represent zoonotic threats[17]. *Chlonorchis sinensis*, *Opisthorchis* spp., *Heterophyes* spp., *Metagonimus* spp., *Nanophyetes salminicola* and *Paragonimus* spp. are the most important among trematodes from the public health point of view[5]. The members of the *Heterophyidae* family are among the most significant and the most important are *Heterophyes heterophyes* and *Metagonimus yokogawai*[17]. People become infected by eating raw, marinated or improperly cooked fish. Human infections are frequently reported in the Middle East and Asia, especially the Philippines, Indonesia, Thailand, China, Japan and

the Republic of Korea[7]. The accumulation of large numbers of these digenetic trematodes in the small intestine may cause inflammation, ulceration and necrosis[18].

Liver fluke infection caused by *O. viverrini*, *O. felineus*, and *C. sinensis* is a major public health problem in East Asia and Eastern Europe, while *O. viverrini* is endemic in Southeast Asian countries, and *C. sinensis* infection is common in rural areas of Korea and China[19]. Cyprinidae fish species are the major intermediate hosts of parasites *C. sinensis* and *Opisthorchis* spp., and more than 100 species of freshwater fish have been shown to be naturally infected with *C. sinensis* and more than 35 with *Opisthorchis* spp.[6]. Most people with opisthorchiasis or clonorchiasis have no symptoms, while non-specific symptoms such as abdominal pain, flatulence, and fatigue occurs in 5-10% of people[18]. Further, enlargement of the gall bladder can be detected as well as heavy, long-standing infection including cholangitis, hepatomegaly, fibrosis of the periportal system, obstructive jaundice, cholecystitis, and cholelithiasis[19]. Moreover, the pathology caused by all species is similar and the risk of cholangiocarcinoma may be high in chronic cases[19].

3. Strategies for reducing the parasitic hazards in fish meat

The most important risk factor for all fishborne parasitic zoonoses is the consumption of raw or undercooked fish. It is noteworthy that the numbers of cases in outbreaks of food-borne diseases caused by consumption of fish are generally small when compared to those caused by poultry, dairy and meat products[20].

Visual inspection and removing visible parasites are suggested to prevent this hazard[21]. According to the EU[22], fish food producers must ensure that fishery products have been subjected to a visual examination for the purpose of detecting visible parasites before being placed on the market. Murrell[23] also suggested several control measures for preventing parasite infection originating from freshwater, such as environmental control of surface water where fish are caught, hygienic aquaculture, and the control or elimination of the first intermediate hosts (snails). FDA[21] indicated that the effective methods to kill parasites are freezing, heating, and adequate combination of salt content and storage time or hot smoking. On the other hand, brining and cold smoking may reduce the parasite hazard in fish, but they do not eliminate it or minimize it to an acceptable level[23]. The recommendation to avoid consumption of raw or poorly cooked fish is still the best preventive procedure. Although *Eustrongylides* spp. and *Anisakis* spp. have not been confirmed as causes of disease in humans in the Republic of Serbia, further parasitic surveys in the intermediate (oligochaetes, fish), paratenic (amphibian, reptile), and final (birds) hosts are necessary, as well as continuous monitoring of imported marine fish species. The consumption forms and the preparation of fish food should be modified in such a way that hazards to human health due to these zoonotic parasites and other pathogens would be avoided. Health education is a key factor in combating fishborne zoonotic infections.

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