

# When worms come to attack from within while you are eating :An overview of *Diphyllobothrium* infections due ingestion of Seafood containing parasite eggs and infectious larvae of thegenus *Diphyllobothrium* unseen to naked eyes and the impact of Parasites present in raw, uncooked Seafood , Sushi , andaquacultures regions such as tapeworm of the *Diphyllobothriumlatum*species

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**ABSTRACT:** This paper outlines the harmful threats that Parasites represent to human health. Raw seafood and uncooked fish, has a high risk of containing eggs and larva unseen to naked eyes, parasites of *Diphyllobothriumlatum* species. They are ingested while consuming those Seafood, raw fish and Sushi. The patients get infected and contaminated. Parasites are also present in regions of aquacultures also. Tapeworm, or *Diphyllobothrium* spp, is acquired by eating raw or undercooked freshwater or anadromous fish (ie, sea fish that spawn in freshwater rivers, such as salmon). Marinated and smoked fish can also transmit the tapeworm<sup>1</sup>. *Diphyllobothrium* infections are often asymptomatic. When symptoms occur, they are often mild and vague, including fatigue, constipation, and poorly defined abdominal discomfort. Patients can inhibit diarrhea and vomiting, and was diagnosed with gastroenteritis. In case of suspicion of infection, the patient must go to the hospital. Fish tapeworm infections can be treated with a single dose of medication without any lasting problems. There are two main treatments for tapeworm infections: praziquantel (Biltricide) and niclosamide (Niclocide).

**KEYWORDS:** Tapeworm, *Diphyllobothriumlatum*, Seafood, Sushi

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Date of Submission: 04-11-2023

Date of Acceptance: 17-11-2023

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## I. INTRODUCTION

### What are Tapeworms ?

Tapeworms are parasitic flatworms (Platyhelminthes: Neodermata), which have no digestive tract (intestine). Its function is replaced by the tegument which contains unique, hair-like structures called microtriches on its outer surface<sup>2</sup>. In addition to their role in absorption of nutrients, microtriches may help in attachment to the host's gut. Body of tapeworms is usually elongate, dorsoventrally flattened, divided into the anterior part with attachment function known as scolex, proliferative region, that is neck, and long strobila. *Diphyllobothrium latum* and related species (the fish or broad tapeworm), the largest tapeworms that can infect people, can grow up to 30 feet long. While most infections are asymptomatic, complications include intestinal obstruction and gall bladder disease caused by migration of proglottids. Diagnosis is made by identification of eggs or segments of the tapeworm in a stool sample with a microscope. Safe and effective medications are available to treat *Diphyllobothrium*. Infections are acquired by eating raw or undercooked fish, usually from the Northern Hemisphere (Europe, newly independent states of the Former Soviet Union, North America, Asia), but cases have also been reported in Uganda and Chile. Fish infected with *Diphyllobothrium* larvae may be transported to and consumed in any area of the world. Adequately freezing or cooking fish will kill the parasite.

### Morphology of Tapeworms

The *Diphyllobothrium latum* adult worm is composed of three fairly distinct morphological segments: the scolex (head), the neck, and the lower body. Each side of the scolex has a slit-like groove, which is a bothrium for attachment to the intestine. The scolex attaches to the neck, or proliferative region. From the neck grow many proglottid segments which contain the reproductive organs of the worm. *D. latum* is the longest tapeworm in humans, averaging ten meters long. Unlike many other tapeworms, *Diphyllobothrium* eggs are typically unembryonated when passed in human feces<sup>3</sup>. In adults, proglottids are wider than they are long (hence the name broad tapeworm). As in all pseudophyllid cestodes, the genital pores open midventrally<sup>4</sup>.

### **Life cycle of *D. latum*, *Diphyllbothrium latum* – fertilized egg**

Adult tapeworms may infect humans, canids, felines, bears, pinnipeds, and mustelids, though the accuracy of the records for some of the nonhuman species is disputed. Immature eggs are passed in feces of the mammal host (the definitive host, where the worms reproduce). After ingestion by a suitable freshwater crustacean such as a copepod (the first intermediate host), the *coracidia* develop into proceroid larvae. Following ingestion of the *copepod* by a suitable second intermediate host, typically a minnow or other small freshwater fish, the proceroid larvae are released from the crustacean and migrate into the fish's flesh where they develop into a plerocercoid larvae (sparganum). The plerocercoid larvae are the infective stage for the definitive host (including humans)<sup>5</sup>. Because humans do not generally eat undercooked minnows and similar small freshwater fish, these do not represent an important source of infection. Nevertheless, these small second intermediate hosts can be eaten by larger predator species, for example trout, perch, walleye, and pike. In this case, the *sparganum* can migrate to the musculature of the larger predator fish and mammals can acquire the disease by eating these later intermediate infected host fish raw or undercooked. After ingestion of the infected fish, the plerocercoids develop into immature adults and then into mature adult tapeworms which will reside in the small intestine. The adults attach to the intestinal mucosa by means of the two bilateral grooves (bothria) of their scolices. The adults can reach more than 10 m (up to 30 ft) in length in some species such as *D. latum*, with more than 3,000 proglottids. One or several of the tape-like proglottid segments (hence the name tapeworm) regularly detach from the main body of the worm and release immature eggs in freshwater to start the cycle over again. Immature eggs are discharged from the proglottids (up to 1,000,000 eggs per day per worm) and are passed in the feces. The incubation period in humans, after which eggs begin to appear in the feces is typically 4–6 weeks, but can vary from as short as 2 weeks to as long as 2 years.

## **II. LITERATURE REVIEW**

Diphyllobothriasis is considered a parasitic, zoonotic infection. *D. latum* causes a wide spectrum of disease and severity. The tapeworm induces changes in the concentration of several immunomodulators in the host. It can also cause structural changes in the GI tract as it modulates neuroendocrine responses and enhances secretion and gut motility. Damage may also come from the body's immune response against the worm and its millions of eggs (around 1 million/day) mediated by mast cells, eosinophilic cell degranulations resulting to inflammatory cytokines.<sup>6</sup> Diphyllobothriosis is considered as the most important fish-borne zoonosis with up to 20 million individuals infected.<sup>1</sup> *D. latum* causes B12 deficiency in humans<sup>7</sup> leading to megaloblastic or pernicious anemia.<sup>8 9</sup> The worm absorbs around 80% of dietary B12 and prolonged infection can also cause abdominal pain, mechanical obstruction, and symptoms of iron deficiency anemia.<sup>10</sup> Patients with prolonged infection of *D. latum* must also undergo B12 supplementations along with anti-parasitics such as niclosamide or praziquantel.<sup>11</sup> Diagnosis of the fish tapeworm requires a thorough history with particular attention to the patient's occupation, hobbies, eating habits, and travel history. Diphyllobothriasis is known to occur in both endemic and non-endemic areas as a result of globalization. As mentioned previously, it is associated with the consumption of raw or poorly cooked fish. Additionally, due to its extremely high fecundity, it is easily spread in regions with poor hygiene and sanitary practices. Human infection with *D. latum* can range from an asymptomatic state to mild gastrointestinal symptoms to severe cases of anemia as well as luminal obstruction. Studies have shown that in patients infected with *D. latum*, twenty-five percent will manifest symptoms of abdominal pain, diarrhea, fatigue, headaches, or pernicious anemia.<sup>12</sup> A Korean study looking at *D. latum* infections identified a total of 49 cases between 1971 and 2012. When looking at the composite data in these cases, the patients were most commonly men between the ages of 30 and 49<sup>13</sup>. The significant signs and symptoms encountered were abdominal pain, vomiting, diarrhea, in addition to dizziness, myalgia, anemia, fatigue, and dyspepsia<sup>12</sup>. In another Korean study looking at *D. latum* infections, all identified patients were males between the ages of 17 and 35 with primarily abdominal pain and distension as presenting complaints<sup>14</sup>. A case series in 2012 looked at 20 cases of confirmed diphyllobothriasis and found that the most frequently reported symptoms were fatigue and mild abdominal discomfort, identified in 66.6% of patients<sup>15</sup>. A larger Japanese study from 2012 to 2015 with 139 patients with confirmed *D. latum* infection revealed mild diarrhea as the most common symptom following by abdominal pain<sup>16</sup>.

Diphyllobothriasis can affect different organ systems with varied manifestations and are listed below based on published case reports and series:

- Central nervous system manifestations include paresthesia, demyelinating symptoms secondary to prolonged anemia and vitamin B12 deficiency, headaches, and encephalopathy.<sup>1</sup>
- Ocular manifestations include optic neuritis secondary to long-standing vitamin B12 deficiency.<sup>1 17</sup>
- Gastrointestinal manifestations include acute abdominal pain, diarrhea, constipation, intestinal obstruction, subacute appendicitis, cholecystitis, as well as cholangitis.<sup>1 12</sup>
- Hematological manifestations include megaloblastic anemia, vitamin B12 deficiency, pancytopenia, eosinophilia, and pernicious anemia.<sup>1 15</sup>

- Respiratory manifestations include dyspnea in the setting of severe vitamin B12 deficiency.<sup>1</sup>
- Dermatological manifestations include glossitis and allergic symptoms, as well as pallor.<sup>1</sup>

### III. DISCUSSION

The diagram below shows the different stages by which the Tapeworm enter the Fish and then the human body after ingestion.<sup>18</sup>

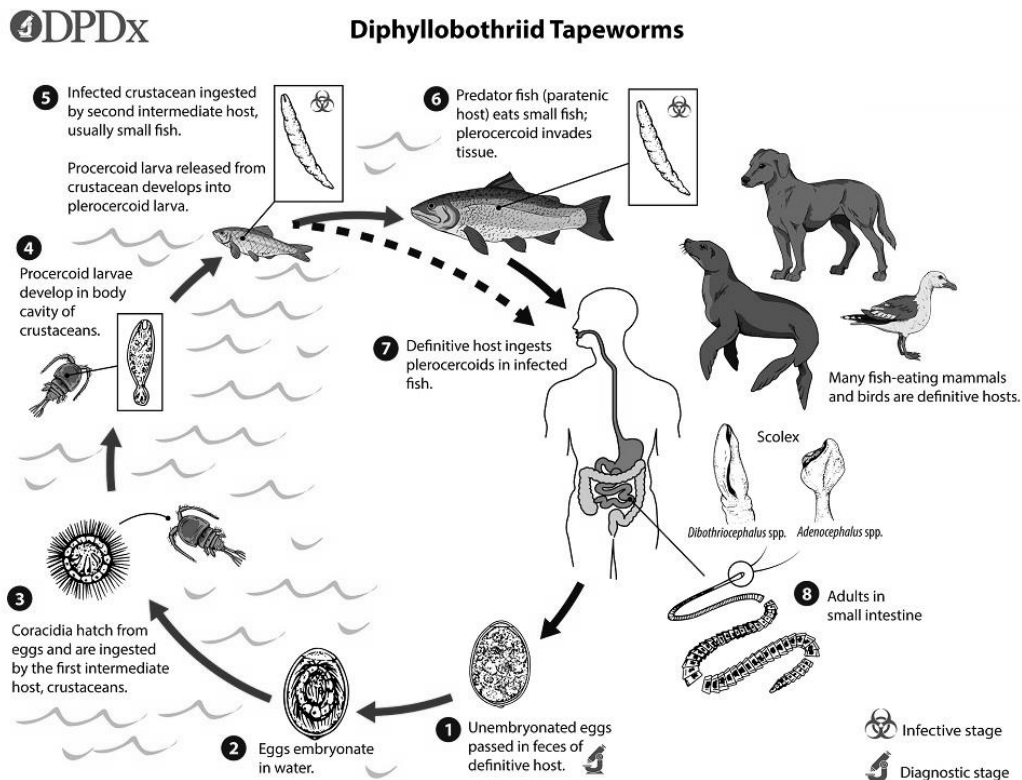


Diagram describing stages by which the human host gets infected<sup>18</sup>

1. Eggs are passed unembryonated in feces<sup>18</sup>.
2. Under appropriate conditions, the eggs mature (approximately 18 to 20 days) and yield oncospheres which develop into a coracidia.
3. After ingestion by a suitable crustacean (first intermediate host) the coracidia develop into proceroid larvae.
4. Proceroid larvae are released from the crustacean upon predation by the second intermediate host (usually a small fish) and migrate into the deeper tissues where they develop into a plerocercoid larvae (spargana), which is the infective stage for the definitive host.
5. Because humans do not generally eat these small fish species raw, the second intermediate host probably does not represent an important source of human infection. However, these small second intermediate hosts can be eaten by larger predator species that then serve as paratenic hosts.
6. In this case, the plerocercoid migrates to the musculature of the larger predator fish; humans (and other definitive host species) acquire the parasite via consumption of undercooked paratenic host fish.
7. In the definitive host, the plerocercoid develops into adult tapeworms in the small intestine. Adult diphyllbothriids attach to the intestinal mucosa by means of two bilateral grooves (bothria) of their scolex.
8. The adults can reach more than 10 m in length, with more than 3,000 proglottids. Immature eggs are discharged from the proglottids (up to 1,000,000 eggs per day per worm) and are passed in the feces. Eggs appear in the feces 5 to 6 weeks after infection.

### IV. CONCLUSION

Prevention is better than cure. To avoid getting contaminated by Tapeworms, raw fish, uncooked fish should be as far as possible avoided. Nonhygienic conditions of restaurants and sushi are high risks on contamination and infections. In case of suspicion of infection, the patient must go to the hospital. Fish tapeworm infections can be treated with a single dose of medication without any lasting problems. There are

two main treatments for tapeworm infections: praziquantel (Biltricide) and niclosamide (Niclocide). Praziquantel is used to treat different kinds of worm infections. It causes severe spasms in the worm's muscles so the worm can be passed through the stool and Niclosamide is prescribed specifically for tapeworm infections and kills the worm on contact. The dead worm is later passed through the stool.

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