

# Diphyllobothriasis in Saudi Arabia

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## ABSTRACT

We described a Saudi patient infected with *Diphyllobothrium latum* (*D. latum*). A 38-year-old male presented, complaining of passing worms. He had a history of recent travel to Europe and South East Asia. Stools examination revealed typical *D. latum* eggs. He was treated with praziquantel followed by saline purge, after which he discharged an intact tapeworm. Macroscopic and microscopic examinations of the worm confirmed the diagnosis of *D. latum*. This is the first case of diphyllobothriasis to be reported in Saudi Arabia. The epidemiology and methods of prevention of diphyllobothriasis are discussed.

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Diphyllobothriasis is caused by *Diphyllobothrium* spp. (fish tapeworm, broad tapeworm), which is an intestinal parasitic infection acquired by eating raw or partially cooked fish containing *Diphyllobothrium* spp. plerocercoids.<sup>1</sup> This infection is common in regions with cold water lakes such as, Europe,<sup>2</sup> Asia,<sup>3-6</sup> North America,<sup>7-8</sup> and South America.<sup>9</sup> In the present report, we are describing a case of Diphyllobothriasis in a Saudi patient. This is the first report of such infection in Saudi Arabia.

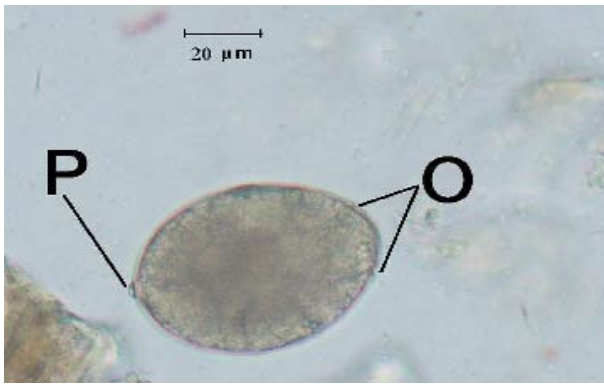
**Case Report.** A 38-year-old Saudi male government civil servant presented to the Primary Care Clinic, King Khalid University Hospital in 19 March 2005, complaining of passing "worms" in stools. He had been treated with mebendazole, but his condition persisted. He had no other complaints. The findings of physical examination were normal. He had previous tours in South East Asia in 2003, South Korea for 3 days, Singapore for 2 days, and Hong Kong for 12 days. He also traveled to Europe in 2004, visiting Austria for 4 days, Germany for 4 days, and Switzerland for 4 days. The patient had a history of

eating different fish during his trip. Blood picture was normal with hemoglobin 162 g/L, total white blood cell (WBC)  $10.9 \times 10^9/L$ , and differential WBC within normal limits. Liver function tests were normal except for a slightly elevated alkaline phosphatase of 143 U/L (normal range: 50-136 U/L), serum vitamin B12 was 225.4 pmol/L (normal range: 145-637 pmol/L), erythrocyte sedimentation rate was within normal range (0 mm/hour). Ultrasound of the upper abdomen showed normal kidney, spleen and gall bladder, and a liver of average size with mild fatty changes. Microscopic examination of stools demonstrated the characteristics of *Diphyllobothrium latum* (*D. latum*) eggs (**Figure 1**). The eggs were ovoid to elliptical in shape with terminal operculum, and distinct abopercular protuberance (bump). The eggs in stools measured 65-77  $\mu m$  in length by 45-52  $\mu m$  in width. He was treated with praziquantel 10 mg/Kg single dose followed by a saline purge, after which the complete strobila (all the worm) was discharged. The complete strobila measured 590 cm (**Figure 2**). Segments of the strobila and the anterior end of the worm (scolex, head or holdfast) were fixed in alcohol

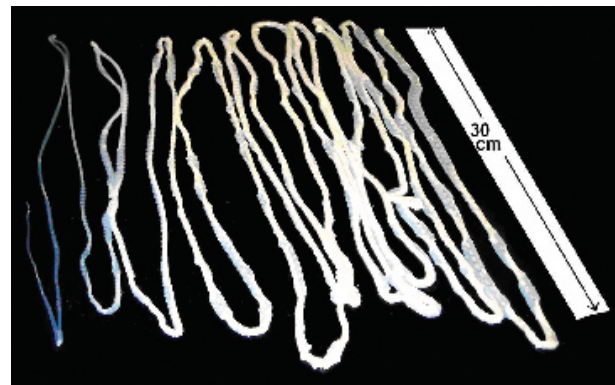
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**Figure 1** - Eggs in stools. Note the operculum (O) and the abopercular protuberance (P).



**Figure 2** - The complete strobila recovered from the patient.



**Figure 3** - *Diphyllobothrium latum*: Rosette shape uteri in the gravid proglottids (U), medial genital pore (p) stained with Aceto-carmine solution, X40.



**Figure 4** - Lateral view of the mounted scolex (holdfast). Note that it is club-shaped / spoon-shaped, with 2 deep dorsoventral suckorial grooves or bothria (B), which are typical structures of the pseudophyllidean tapeworm X40.

formalin and acetic acid fixative (AFA) and stained with Schneider's Aceto-Carmine. Whole mounts of the scolex and proglottids were examined under the microscope. The proglottids are wider and long. The proglottids are characteristic of pseudophyllidean tapeworms in that the uterus forms a rosette shape, and genital pores are medial rather than the lateral position as in *Taenia spp* (**Figure 3**). The scolex was spoon-shaped, approximately 1 mm in width and has a characteristic of pseudophyllidean grooves (bothria) rather than muscular suckers and hooks as in the scolex of *Taenia* (**Figure 4**).

**Discussion.** The cycle of this parasite is complex and it involves several hosts.<sup>1,2</sup> The fertilized eggs are released in stools. If they are released into water they mature within 8-12 days at a water temperature of 16-20°C, and yield coracidium larvae that are ingested by a copepod crustacean. Approximately 40 copepod species of the Eudiaptomus or Cyclops

genus is likely to be first intermediate hosts. The free-living stages emerge through the operculum and are ingested by crustaceans, where they lose their cilia and penetrate through the gut wall into the coelom. They take up nutrients and develop into the proceroid stage with a cercomer. They remain in the copepod until they are eaten by the second intermediate host, which is usually a pike or salmon. After being ingested by this secondary host, the parasite penetrates the gut, loses its cercomer, and makes its way to the muscle where it becomes a plerocercoid. If the second intermediate host is eaten by a larger predatory fish, then the plerocercoids migrate to the muscle of this fish. It migrates into the fish musculature or viscera where it can remain inactive for several years, but can re-encyst several times in other predatory fish. The plerocercoid can be up to a few centimeters in length, and is usually coiled within the muscle cell. When the plerocercoids are ingested by the definitive host, they pass through the stomach, and the scolex

becomes embedded in the mucosa of the small intestine and develops rapidly, producing eggs within 10-14 days. Humans and other fish-eating mammals such as dogs, foxes, cats, mink, bears, and seals become infected by ingesting this half-cooked fish. The plerocercoid larva develops into an adult that lives in the small intestine and yields its first eggs approximately one month after infestation. The adult tapeworm reach a length of 10 meters (>30 feet) and produces over a million of eggs a day. It is the longest human parasite known and can live for several years. Several species of *Diphyllobothrium* have been found to infected humans, but the main species is *D. latum*, *D. pacificum* and *D. nihonkaiense*.<sup>4</sup> The *D. latum* are known to be endemic in Europe, North America, and Asia. The *D. pacificum* is endemic in South America and *D. nihonkaiense* in Japan. The *D. latum* is the longest tapeworm that infects humans, measuring 4-15 m in length and, 10-20 mm in width. It consists of 3000-4000 proglottids. The scolex is shaped like a spoon and has a pair of grooves or bothria that serves as organs of attachment.

Morphological features of the present tapeworm are consistent with *D. latum*. Other *Diphyllobothrium* species are smaller, rarely more than one meter long. Moreover, microscopic findings in the present case excluded *D. pacificum*, since uteri from gravid proglottid of the worm formed a rosette, which was not observed in *D. pacificum*. Although, egg dimension cannot be used as a single criterion for species identification, the egg dimensions in the present case are suggestive of *D. latum* since the largest reported *D. pacificum* eggs (40  $\mu\text{m}$  wide and 60  $\mu\text{m}$  long) were smaller than the smallest eggs (45  $\mu\text{m}$  wide and 65  $\mu\text{m}$  long) in our case. Most infections are asymptomatic, however, diarrhea, abdominal pain, or discomfort occurs in <22% of infections.<sup>2</sup> Prolonged or heavy *D. latum* infection may cause megaloblastic anemia due to parasite-mediated dissociation of vitamin B12-intrinsic factor complex within the gut lumen, making B12 unavailable to the host.<sup>1</sup>

In 1999, the world prevalence of diphyllobothriasis was estimated at 9 million cases. A recent review of diphyllobothriasis in Europe indicated that several dozen cases had been reported each year in Finland and Sweden, with many cases in French or Italian speaking areas of subalpine lakes, and sporadic cases observed in Austria, Spain, Greece, Romania, Poland, and Norway.<sup>2</sup> Over 30 cases have been identified on the Swiss shores of Lake Maggiore since 1990, and 70 cases on the Swiss and French shores of Lake Lemman between 1993 and 2002. Eight to 12% of perch fillets from Lake Lemman and 7.8% of perch from Lake Maggiore were infested with larvae. The

sources of infection include marinated fish fillets in Northern Europe, "carpaccio di persico" in Northern Italy, and perch and charr consumed raw or half-cooked around Lake Lemman. In North America, a large outbreak of fish tapeworm occurred along the East Coast in 1980. The outbreak affected as many as 32 individuals and was thought to be, due to the consumption of salmon, brought fresh from Alaska.<sup>7</sup> However, there has been a decline in human cases reported from North America recently, while in South America an increase in reports incriminating salmonids suggests high levels of infections in these fish species.<sup>3</sup> In South America, cases have been reported from Brazil, Argentina, and Chile.<sup>9</sup> In Asia, diphyllobothriasis has been reported from Korea,<sup>4</sup> Malaysia,<sup>5</sup> and Japan.<sup>6</sup> Lee et al<sup>4</sup> reported that only 37 cases of *D. latum* were reported during the period of 1921-2001 in Korea, but they have alerted to a possible increase in cases of *D. latum* as a result of a recent increased of salmon production and consumption in that country.

Diphyllobothriasis has never been reported in Saudi Arabia. With the travel history given by the present case, probably he had acquired the infection during his travel abroad. However, some restaurants in Saudi Arabia serve imported fish, including salmon. The present case should alert the medical practitioner to the possibility of travelers acquiring the infection in areas where the disease is endemic. Moreover, due to the similarities in gross appearance, we would expect that *D. latum* could easily be mistaken for *Taenia saginata* unless the possibility of the former was taken into consideration. Public health measures for prevention of infection with *D. latum*, includes applying standard food safety measures to imported fish as well as safety measures applied to locally produced and consumed fish. These measures include prevention of factors allowing transmission of the parasite, which include the dumping of wastewater into lakes by humans and possible animal reservoirs.

The growing popularity of raw fish dishes such as, Japanese sushi and sashimi places humans at greater risk for this infection. Fish tapeworm infection is not acquired from properly canned fish. Infection from eating fresh fish can be prevented by cooking until all the parts of the fish reach a temperature of at least 56°C (133°F) for 10 minutes.<sup>8</sup> For those who prefer the pleasures of raw fish, adequate freezing is recommended. Freezing fish at -18°C (0°F) for 24 hours or to -10°C (14°F) for 72 hours is reported to prevent *D. latum* infection.<sup>8</sup> If fish is frozen at -20°C (-4°F), a temperature attainable in most domestic freezers, for at least 5 days this would prevent the survival of most helminth species.<sup>10</sup> Preparation by placing the fish in a brine solution may be effective if

appropriate salt concentration, fillet size, and contact time is observed. Commercially prepared lox (smoked salmon), is usually brined before smoking and should not constitute a source of infection.

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