

## REVIEW ARTICLE

# Effect of *Anisakis* spp. Parasite on Human Digestion System

Osa Endiputra<sup>1\*</sup>, Astika Synthia Devi<sup>1</sup>, Vivin Farchia Ningsih<sup>1</sup>

<sup>1</sup>Departement of Parasitology, Medical Faculty, Universitas Islam Sultan Agung, Semarang, Indonesia

\*corresponding author email: [drosaendi@gmail.com](mailto:drosaendi@gmail.com)

### ABSTRACT

*Anisakis* spp. is a genus of parasitic nematode which can be transmitted to human through seafood like fish and marine mammals. *Anisakis* may cause health problems in digestive system and allergic reactions when a raw or undercooked fish containing *Anisakis* larvae in third stage of life is consumed. Three species have evidently caused diseases for human: *Anisakis simplex sensu stricto*, *Anisakis simplex C* and *Anisakis pegreffii*. The main symptoms are abdominal pain, nausea, vomiting and urticaria. Some larvae are resistant to heat and digestive enzymes, thus, incidents of this worm induced disease still occur.

**Keywords:** *Anisakiasis*, Sea Mammal, Invasive, IgE

### ABSTRAK

*Anisakis* spp. merupakan salah satu jenis parasit nematoda yang dapat menular kepada manusia melalui perantara hewan laut seperti ikan dan hewan mamalia laut. *Anisakis* dapat menyebabkan masalah kesehatan dalam sistem pencernaan dan dapat menimbulkan reaksi alergi bagi orang yang sering makan daging hewan laut setengah matang atau mentah yang mengandung larva stadium III. Terdapat tiga spesies yang telah terbukti dapat menimbulkan penyakit pada manusia, yaitu *Anisakis simplex sensu stricto*, *Anisakis simplex C* dan *Anisakis pegreffii*. Keluhan utama yang sering dirasakan adalah nyeri abdomen, mual, muntah dan urtikaria. Terdapat larva yang resisten terhadap panas dan enzim pencernaan, oleh karena itu penyakit akibat cacing ini masih tetap terjadi.

**Kata Kunci:** *Anisakiasis*, Mamalia laut, Invasif, IgE

### INTRODUCTION

*Anisakis* spp. is a parasitic nematode distributed throughout the world. *Anisakis* which infects human causes *Anisakiasis*, a disease transmitted through fish and other sea animals containing these larvae in third stage of life. These larvae may enter human body through raw fish they consume. Some fishes studied containing these larvae include sardines, hake, anchovy, mullet, salmon, tuna and some seashells. Special reports of *Anisakiasis* increase in Spain, Italia and Japan, that their citizens are used to consuming raw fish. On the contrary, report of *Anisakiasis* case is almost none in regions with low habit of raw fish consumption. Another reason that there is no *Anisakiasis* case may be misdiagnosis, even if it is quite low. The reason of this is clinical manifestation of *Anisakiasis* signs and symptoms which are similar to those of appendicitis, gastric ulcer and allergic reaction (Perez et al, 2015 & Mahillo et al., 2010).

The clinical manifestations frequently arising from this parasite are from gastrointestinal complaints to allergic reactions. It is reported in the United States,

Europe and Japan that there are more than 50 and even up to 2000 cases of *Anisakiasis* found annually. Debates on the emerging clinical manifestations still occur until recently since according to research, larvae will die for exposure to heat or cooking and in case they enter human body, they will be crushed by enzymes in stomach, particularly pepsin. However, the increasing number of cases in some regions proves that these larvae may cause health problems if left untreated (Mahillo et al., 2010). Some preventive actions to detect the existence of larvae have been conducted, like inspection of fish flesh with assistance of ultraviolet ray, but this is perceived ineffective since it cannot observe larvae inside the flesh and takes too much time to check. Another method is using enzyme, but this will damage the quality of fish flesh, making it unfit for consumption (Mahillo et al., 2010).

Some worms are found inside canned fish in Indonesia recently. Besides, the increasing trend of raw fish consumption like sushi and sashimi in Indonesia may also become an important factor. There will be problems if explanation of this disease is still

Copyright © 2019 Authors. This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License (<http://creativecommons.org/licenses/by-nc-sa/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are properly cited.

Endiputra, et al.

minimal. The number of incidents and deaths is almost unreported in Indonesia, but it does not mean that the society, particularly medic, does not need to get clearly informed of problems which will arise from parasitic *Anisakis* spp. An understanding of *anisakis* and *anisakiasis* will not be complete if people do not know how this *anisakis* spp. lives its life cycle.

### *Anisakis* spp. Life Cycle

*Anisakis* spp. is of Anisakidae family and Ascarida order. Phylogenetic research proves that *Anisakis* is a closer relative of *Ascaris* long known by the society. *Anisakis* distribution may be found throughout the world with fish, shrimp and other sea animals as its host. There are three *Anisakis* species which may cause health problems to human: *Anisakis*

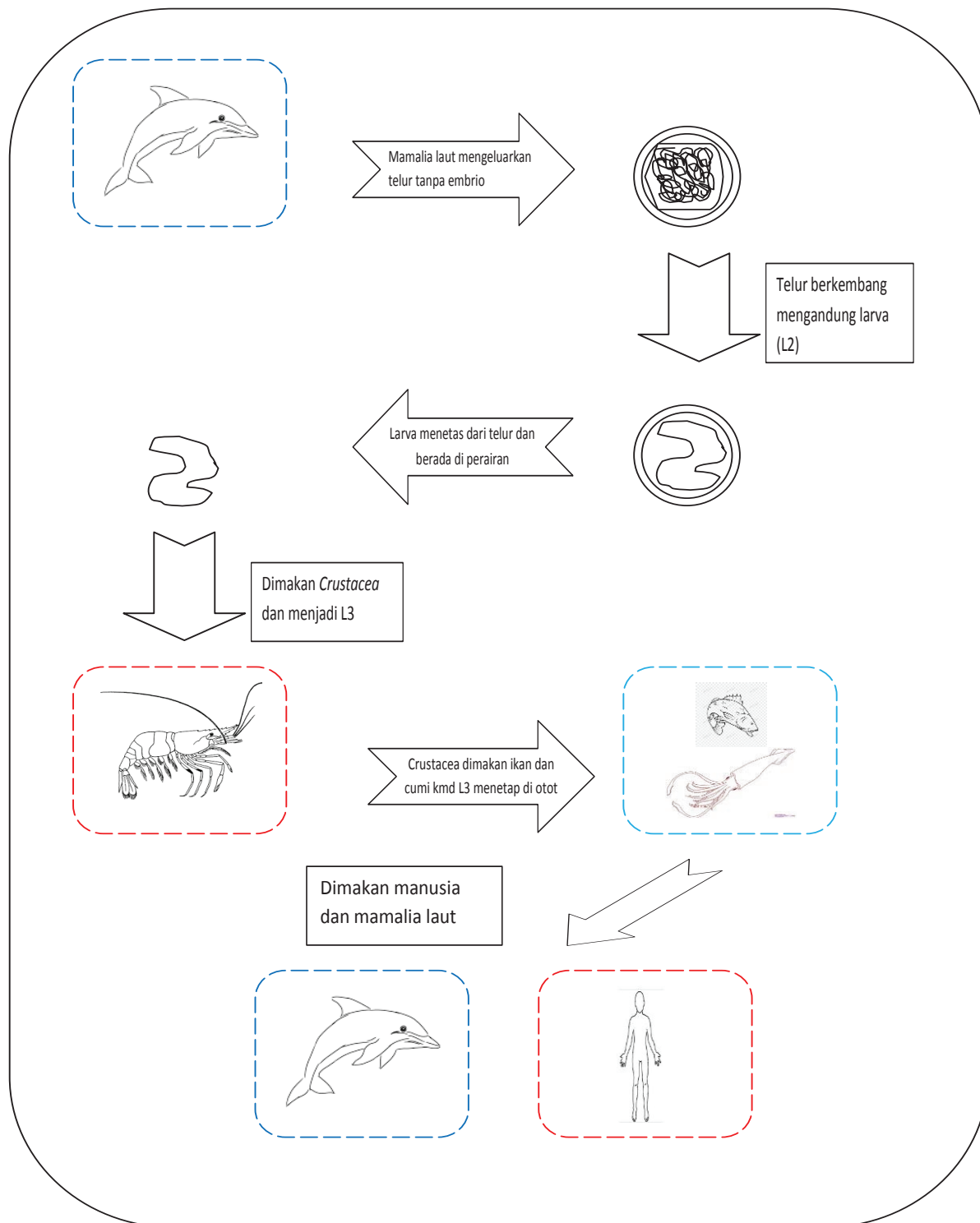


Figure 1. *Anisakis* spp. life cycle Quoted from: [www.cdc.gov/parasites/anisakiasis/biology.html](http://www.cdc.gov/parasites/anisakiasis/biology.html)

simplex sensu stricto, *Anisakis simplex* C and *Anisakis pegreffii* (Nieuwenhuizen et al., 2014). The definitive host of this parasite is water mammals like dolphins, whales and seals as well as turtles. *Anisakis* take dolphins and whales as its host to live and reproduce. Both mammals's feces contain eggs which may turn to larvae at sea, which are then eaten by shrimps, shells and sea animals, and eventually eaten by human (figure 1). Human who eats shrimps, shells and sea animals will accidentally swallow these larvae. If their immune system is good enough, the parasite will be crushed within 3 weeks or quickly taken out through vomiting or diarrhea (Nieuwenhuizen et al., 2014). However, in case of inappropriate immune system, *anisakis* larvae will develop and cause *anisakiasis*.

To prevent larvae from developing to *anisakiasis*, fish or sea animals which will be consumed need to be cooked or heated above 60°C for 1 minute or stored below -20°C for about 60 hours. However, even after various procedures which have met the standards above, there are still reports of *anisakiasis* incidents with the main complaint of urticaria (Nieuwenhuizen et al., 2014).

### **Gastrointestinal Complaints**

Infiltration of third stadium larvae because of consuming raw or undercooked fish may cause acute gastric infection. Larvae will stick to stomach mucosa wall and issue proteolytic enzyme to penetrate into mucosa and cause local inflammation in the form of erosion at the place of penetration (Perez et al., 2015). Complaints may arise in the form of light to severe abdominal pain, nausea, vomiting and diarrhea. Diarrhea is expected to be body's way to immediately dispose of parasite entering human body, thus anti-diarrhea drug is infrequently given. In case this disease develops to chronic stadium, it may cause abscess or eosinophilic granuloma. This may cause symptoms like appendicitis, gastric ulcer, duodenal ulcer, inflammatory bowel disease and even intestinal obstruction (Nieuwenhuizen et al., 2014).

Furthermore, *anisakis* accidentally swallowed will stick to and damage gastric wall and intestine. This intestinal wall damage may develop to granuloma and even perforation. The location of these worm manifestations are only centralized in stomach and intestine, in which occurrences in stomach are reported more than in intestine. Supporting examination which may be conducted is endoscopy and Computed-Tomography (CT). Endoscopy is conducted to find larvae in stomach, while CT is conducted to relieve any

### ***Effect of Anisakis spp. Parasite on Human Digestion System...***

possibility of serious abdominal disease. Outcome of CT on gastric and intestinal *Anisakiasis* shows swelling on stomach wall, duodenum dilation and even ascites (Shibata et al., 2014).

### **Allergic Reactions**

Besides the above mentioned gastrointestinal complaints, swallowed third stadium *anisakis* larvae may also cause symptoms related to allergy like urticaria, nausea, vomiting, dyspnea and even anaphylactic reaction. The arising symptoms with regard to the release of inflammation mediator by mast cells and basophils include histamine and cytokine (Nieuwenhuizen et al., 2014 & Perez et al., 2015). Besides larvae, *anisakis* worm with habitat in gastrointestinal tract may also cause allergy with some manifestations like urticaria, rhinitis, bronchoconstriction and cough. Nevertheless, allergy arising is unnecessarily preceded or accompanied with indigestion (Baird et al., 2014).

The arising allergy is mediated by Th-2 cells, which play an important role to repel any penetrating parasites. Th-2 cells activation also produces antibody IgE, recruits eosinophils, mast cells and basophils and thus causes goblet cells hyperplasia, non-striated muscle contraction in digestion and an increase in vascular permeability, which are processes to dispose of any penetrating parasites. Furthermore, antibody IgE will be bound to many cells like mast cells in digestive system and skin as well as basophil in blood vessel. After contact between IgE and penetrating allergen, IgE will produce various inflammation mediators which causes clinical signs like mucus secretion, accumulation of eosinophil and release of cytokine and histamine. Human have contact with allergen, which is larva, either alive or dead, from various fish products or seafood since some *anisakis* larva are evidently resistant to heat and digestive enzyme like pepsin (Baird et al., 2014).

### **PREVENTION**

*Anisakiasis* is caused by larvae penetrating into gastrointestinal tract. This occurs since human consume raw and undercooked food. Although *anisakis* infection incident is commonly unpredictable and occurs quickly, but preventive measures may be taken (Moliner et al, 2018). It may be prevented by not consuming raw and undercooked food, particularly seafood, like sushi and sashimi or by cooking fish products or seafood appropriately, at 60°C for 1 minute, or by freezing them before cooking at minimum -20°C for about 60 hours. The methods above may evidently crush any larvae in seafood (Moliner et al, 2018).

*Endiputra, et al.*

## CONCLUSION

*Anisakis* spp. is one parasitic nematode which may infect human. Like parasites in general, this worm's life cycle requires some stages and transformations in host's body. Most infections are caused by accidentally swallowing its host like fishes, shrimps and seashells containing (infective) third stadium larvae. The correct preventive measures are to cook and store sea fishes or sea animals correctly in order to mitigate the risk of anisakis infection, since undercooked or raw food is the main risk factor of this disease.

## CONFLICT OF INTEREST

There is no conflict of interest within the manuscript.

## REFERENCES

- Baird, F.J., Gasser, R.B., Jabbar, A., Lopata, A.I. 2014. Molecular dan Cellular Probes. *Mol Cell Probes* 28(4):167-174
- Mahillo, A.I.R., Munoz, M.G., Heras, C., Tejada, M., Moneo, I. 2010. Quantification of *Anisakis simplex* Allergens in Fresh, Long-Term Frozen, and Cooked Fish Muscle. *Foodborne, Pathogens and Disease* 7(8):967-973
- Moliner, M.S., Morales, V.M., Valero, M.A. 2018. Epidemiology and Management of Foodborne Nematodiasis in the European Union, Systematic Review 2000-2016. *Pathogens and Global Health*. doi:10.1080/20477724.2018.1487663.
- Nieuwenhuizen, N.E. and Lopata, A.L. 2014. Allergic Reactions to *Anisakis* Found in Fish. *Curr Allergy Asthma Rep* 14(455):1-6
- Perez, J.C.G., Perez, R.R., Ballester, A., Zuloaga, J., Puntero, B.F., Diaz, J.A., Caballero, M.L. 2015. Previous Exposure to the Fish Parasite *Anisakis* as a Potential Risk Factor for Gastric or Colon Adenocarcinoma. *Medicine* 94 (40):1-7
- Shibata, E., Ueda, T., Akaike, G., Saida, Y. 2014. CT findings of gastric and intestinal anisakiasis. *Abdom Imaging* 39:257-261