J. Fd Hyg. Safety 17(4), 206–209 (2001)

Infection of Parasitic *Anisakis* Type Larvae (Nematoda) from Some Rockfishes, *Sebastes* spp.

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볼락류 *Sebastes* spp.에 있어서 선충류 아니사키스 유충의 감염

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ABSTRACT – From February through March 2002, sixteen rockfishes representing three species were collected from Oregon Coast Aquarium and Newport fish market and examined for nematodes. During this study, a total of 157 *Anisakis* type larvae were recovered from *Sebastes* spp. and parasitized for an average infection prevalence of 50.0%. The yellowtail rockfish, *S. flavidus,* darkblotched rockfish, *S. crameri,* and canary rockfish, *S. pinniger* examined were infected with 110 *Anisakis simplex* larva, 30 *Contracaecum* spp. larva and 17 *Pseudoterranova decipiens* larva. Of the rockfishes examined, 75.0% carried *Sebastes crameri,* and 12.5% *S. flavidus* and *S. crameri,* respectively. The sites of infection for *Anisakis* type larvae were the intestine, omentum, and stomach walls. *A. simplex* larvae infected 60.0% on *S. crameri* and 33.3% on *S. flavidus* and *S. pinniger,* respectively. The prevalence of *Contracaecum* sp. larvae and *Pseudoterranova decipiens* larvae on *S. pinniger* was 33.3%. The intensities of *A. simplex* larvae ranged from 1 to 87 in *S. flavidus, S. crameri,* and *S. pinniger.* The intensity of *Contracaecum* spp. larvae and *P. decipiens* larvae ranged from 0 to 30 in *S. pinniger.*

Key words: *Anisakis* type larva, *Sebastes* spp., prevalence. intensity

Anisakis larvae were first recognized as potential human pathogens in Holland in 1955 by Van Thiel *et al.* (1960). Larval *Anisakis* type in marine mammals, fish, and invertebrates have been associated with inflammatory lesions in the gastrointestinal tract of humans as well as mammals (Margolis 1977). If infected fish are eaten by man in an uncooked state, the larvae can survive and may migrate from the intestine to the body cavity and cause eosinophilic phlegmon or abdominal pain. The consumption of raw or uncooked fish is a widespread custom in many parts of the world. Parasitic *Anisakis* type larvae are of potential public health importance since they can infect man and cause an eosinophilic phlegmon or abscess in the stomach or intestine in most cases (Asami *et al.* 1965; Van Thiel *et al.* 1960). Many authors have reported *Anisakis* type larvae associated with gastric and intestinal eosinophilic granuloma of the alimentary tract in man (Yokogawa and Yoshimura 1965; Thiel 1966; Kikuchi *et al.* 1972).

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The present study indicates that of the three species of parasitic nematodes found to parasitize rockfishes, *Anisakis simplex* larvae, *Contracaecum* spp. larvae and *Pseudoterranova decipiens* larvae are more prevalent. This study reports on the prevalence and intensity of infection of parasitic *Anisakis* type larvae that are of potential public health importance.

Materials and Methods

Sixteen rockfishes were brought to the laboratory alive and examined within 24 hr of collection. The length of hosts was measured. The internal organs of rockfishes collected were examined for nematodes. The viscera of the host are removed, the organs opened, and placed in individual jars containing enough solution to cover the materials. Internal organs were preserved in acetic acid-formalin-alcohol (AFA) as described in Appy (1981). Macroscopically visible gastrointestinal parasites were enumerated upon dissection.

Infective *Anisakis* type larvae were dissected carefully

out of the intestine, omentum, and stomach wall with care being taken not to break the worms. Visable larvae were rinsed thoroughly in 0.85% saline. The nematodes were both fixed and preserved in 70% ethanol. Nematodes were cleared in a 1 : 9 solution of glycerin and 70% ethanol or 85% lactic acid. Parasites were examined under a streomicroscope at magnifications of 50x. All parasites were identified and a note made of the numbers found in the gastrointestinal tract respectively. Nomenclature of the rockfishes follows that of Kramer and O'Connell (1995). Parasites species were based on Hoffman (1967) and Margolis and Arthur (1979). Prevalence and intensity of infection are used as described by Margolis *et al*. (1982). Prevalence is the percentage of fish infected and intensity is the number of parasites per infected fish.

Results

Sixteen specimens of rockfishes belonging to three species have been examined. One hundred-fifty seven *Anisakis* type larvae were collected during this study. The average length of *S. flavidus, S. crameri,* and *S. pinniger* was 44.5, 33.7, and 58.0cm respectively. Infection of *S. flavidus* and *S. pinniger* was 12.5% respectively on aquarium and 75.0% on fish market (Table 1).

Of the three species of parasites occurring in the rockfishes, *A. simplex* larvae infected *S. flavidus, S. crameri* and *S. pinniger* while *Contracaecum* spp. larvae and *P. decipiens* larvae infected only *S. pinniger*. Prevalence of *A. simplex* larvae was 33.3% on *S. flavidus* and *S. pinniger* and 60.0% on *S. crameri.* Prevalence of *Contracaecum* sp. and *Pseudoterranova decipiens* larvae was 33.3% respectively on *S. pinniger. A. simplex* of *S. crameri* appeared to be the dominant species, accounting for 60.0%, while the remaining species of rockfishes reached 33.3% of the parasite loads.

Mean intensities of infection for *A. simplex* larvae were recorded as 5.3, 1.1 and 29.0, respectively on *S. flavidus, S. crameri,* and *S. pinniger.* Mean number of parasites per fish for *Contracaecum* sp. larvae and *Pseudoterranova decipiens* larvae were 10.0 and 5.7, respectively. The highest figure was 87 for *A. simplex* larvae on *S. pinniger,* while canary rockfish was found with the maximum number in this study (Table 2). In infection sites of *Anisakis* type larvae, intestine accounted for 77.1%, omentum for 17.2%, and stomach wall of 5.7% of the parasitic load (Table 4).

Discussion

From all sixteen species of rockfishes, one hundred-fifty seven *Anisakis* type larvae representing three species were collected during this study. Three species, *Anisakis simplex* Rudolphi 1809, *Contracaecum* sp. Clemens 1921 and *Pseudoterranova decipiens* Krabbe 1878, have been found on rockfishes. These larvae belonging to the genus *Anisakis* have an almost cosmopolitan distribution. *A. simplex* larvae were one of the most common parasitic nematodes found on rockfishes, followed in decreasing proportions by *Contracaecum* spp. larvae and *P. decipiens* larvae.

Table 1. A summary of nematodes of the rockfishes, *sebastes* spp. collected from aquarium and fish market.

Host	Average length (cm)	No. examined	No. infected (%)	Commends
Sebastes *flavidus,* Ayres	44.5	3	1(12.5)	aquarium
S. crameri, Jordan	33.7	10	6(75.0)	
S. pinniger, Gill	58.0	3	1(12.5)	fish market
Total		16	8(50.0)	aquarium

Table 2. Percentage prevalence (PP) and Intensity of infestation (IN) of nematodes in rockfishes

Parasites	*S. flavidus*		*S. crameri*		*S. pinniger*	
	PP	IN	PP	IN	PP	IN
Anisakis simplex, larvae	33.3	1-16(5.3)	60.0	1-2(1.1)	33.3	1-87(29.0)
Contracaecum spp. larvae					33.3	0-30(10.0)
Pseudoterranova *decipiens*, larvae					33.3	0-17(15.7)

Anisakis type larvae have been observed in the intestine, omentum, and stomach wall of rockfishes. The larvae of *Anisakis simplex* were obtained from gastrointestinal tract of *S. flavidus, S. crameri* and *S. pinniger*. The larvae of *Contracaecum* spp. and *P. decipiens* were collected from intestine of *S. pinniger*. The heaviest concentration of *Anisakis* type larvae occurs in the mesenteries in the vicinity of the posterior region of the intestine. Its distribution on the gastrointestinal tracts suggested *Anisakis* type nematodes favour the submucosa of intestine, decreasing in abundance on omentum and stomach wall.

Fifty percents of rockfishes were infected with one or more species of parasites. The prevalence of *S. crameri* was the highest of the host specimens encountered. *A. simplex* larvae were the most prevalent rockfishes species of all nematodes found. *Contracaecum* spp. and *P. decipiens* larvae were not found on *S. flavidus* and *S. crameri*. Intensity of infection was higher on *S. pinniger* than on *S. flavidus* and *S. crameri*.

Anisakis type larvae may be transmitted to man through eating infected marine fish either raw or uncooked. These nematode larvae may result in granulomatous, abscess-like reactions characterized by eosinophilia, fever, vomit, and abdominal pain, frequently appendicitis and intestinal obstructions (Jules *et al.*, 1975). Chitwood (1970) reported species of *A. simplex, Contracaecum* spp. and *P. decipiens* larvae could all cause “a dangerous parasitic syndrome in man”. Immature forms of nematodes, such as *Anisakis* Type larvae proliferate in some rockfishes, and thus, anisakiasis may be concern because of custom of eating inadequately cooked rockfishes in America.

Table 3. Occurrence of nematodes collected from rockfishes, *sebastes* spp.

Parasite	Hosts		
	S. flavidus	*S. crameri*	*S. pinniger*
Anisakis simplex, larva	++	+	+++
Contracecum sp., larva	–	–	++
Pseudoterranova *decipiens*, larva	–	–	++

– negative, + mild, ++ moderate, +++ heavy infection

Table 4. Infection sites of sixteen 3rd stage larvae of *Anisakis* in the rockfishes, *sebastes* spp.

Location	No. of fish infected	Percentage	No. of larvae found	percentage
Intestine	8	50.0	121	77.1
Omentum	1	6.3	27	17.2
Stomach wall	1	6.3	9	5.7
Total	16		157	

국문요약

2002년 2월부터 3월까지 오레건 주에 위치한 오레건 해안 수조와 뉴포트 어시장으로부터 16마리의 볼락류 *Sebastes* spp.를 채집하여 검사한 결과, 3종의 볼락류로부터 총 157개체의 아니사키스 유충이 검출되었으며 50.0%의 감염률을 나타내었다. 3종의 볼락류인 *Sebastes flavidus*, *S. crameri*, *S. pinniger*로부터 *Anisakis simplex* 유충 110개체, *Contracaecum* spp. 유충 30개체 그리고 *Pseudoterranova decipiens* 유충 17개체가 각각 검출되었다. 아니사키스 유충의 감염부위는 장관, 장간막과 위벽이었다. *A. simplex* 유충은 *S. crameri*에서 60%, *S. flavidus*와 *S. pinniger*에서 각각 33.3%의 감염률을 나타내었다. *Contracaecum* spp. 유충과 *P. decipiens* 유충은 *S. pinniger*에서 33.3%의 감염률을 나타내었다. *A. simplex* 유충의 감염강도는 *S. flavidus*, *S. crameri* 그리고 *S. pinniger*에서 1에서 87이었고 *Contracaecum* spp. 유충과 *P. decipiens* 유충은 *S. pinniger*에서 0에서 30까지 나타내었다.

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