

**Chemical Quality of Herring Fish (*Clupea Harengus*) Infested With
Anisakid Nematodes**

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ABSTRACT

Larvae of the *Anisakis simplex*, are commonly found in the herring fish. Although most of the *Anisakis* larvae were found in the abdominal cavity, the small proportion lodged in the flesh was sufficient to affect fish quality and safety. This study was planned to declare the effect of infestation with *Anisakis simplex* parasite on the chemical composition as well as the chemical deteriorative criteria of the herring fish (*Clupea harengus*). Results indicated that there were significant differences ($P < 0.05$) between infested and non-infested fish in the following parameters: the mean percentages of total protein, crude fat and moisture contents and the mean pH; total volatile bases-nitrogen and thiobarbituric acid number. Also, the obtained results cleared that the parasitic infestation of herring fish (*Clupea harengus*) with larvae of *Anisakis simplex* has adverse effect on fish nutritive value and their chemical deteriorative criteria.

Key words: herring fish (*Clupea harengus*); *Anisakis simplex*; nutritive value; chemical composition; pH; total volatile bases-nitrogen and thiobarbituric acid.

INTRODUCTION

Fish are susceptible to infestation by a number of parasites including protozoa, trematodes, nematodes, and cestodes. Parasite infestation renders fish unmarketable for reasons of human health and aesthetics. Anisakid nematode parasites are adult worms that feed in the gastric tract of amphibians, reptiles, birds and mammals (whales and dolphins). Larvae of two species of the nematode family Anisakidae, the "seal or cod worm" (*Phocanema decipiens*) and the "herring worm" (*Anisakis simplex*), are commonly found in the flesh of cod, haddock, fluke, Pacific salmon, herring, flounder, and monkfish. Infestation in humans can be extremely pathogenic if ingested in raw, undercooked, insufficiently frozen or marinated form and its symptoms, which occurred within 12 h of eating the seafood meal - epigastric pain, occlusion, diffuse abdominal pain, and appendicitis. incidence and its incedance is expected to increase with the increase in

the number of sushi and sashimi bars Choudhury and Bublitz (1997), Moneo *et al.* (2000), Pereira *et al.* (2000) and Schuster *et al.* (2003). Although most of the *Anisakis* larvae are found in the abdominal cavity, the small proportion lodged in the flesh is sufficient to affect food quality and safety. However, the prevalence of *Anisakis* larvae in fish fillets varied considerably among the size groups of each species: 15 to 60% in herring (*Clupea harengus*), 32 to 77% in mackerel (*Scomber scombrus*), and 89 to 100% in blue whiting (*Micromesistius poutassou*) Levsen *et al.* (2005). Infestation rate is high in fishes: cod (88%), rock fish (86%), herring (88%), salmon, mackerel. Public health education should discourage the eating of raw fish. Thorough cooking to 70 °C or adequate freezing to -20 °C for 72 h are the best preventive measures. The larvae fixed in the muscles were observed in 12% of the infested fish examined and could be the main source of infestation in man Myjak *et al.* (1995 and 1997). Sealworms are most abundant in the flaps and fillets of the fish. Whaleworms are occurring most frequently in and on organs in the body cavity, but also in the flaps of the fish Hauksson (1992). Immediately gutting on board cannot eliminate or even reduce the risk from eating raw or inadequately processed herring. Roepstorff *et al.* (1993). *Anisakis* nematode are relevant to the fishing industry either because they are macroscopically visible or because they are pathogenic to humans if swallowed alive Lick (1991). This study aimed to investigate the effect of *Anisakis* nematode parasite on the chemical composition as well as the chemical deteriorative criteria of the herring fish (*Clupea harengus*).

MATERIALS AND METHODS

A total number of 20 frozen herring (*Clupea harengus*) fish of about 350–400g {ten fishes were infested with larvae of *Anisakis* nematode parasites "herring worm" (*Anisakis simplex*) and ten fishes were free from any parasitic infestation} were subjected to laboratory examinations.

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The samples were taken from whole fish muscles (Dorsal; Ventral and Caudal muscles) and the following tests were performed:

1. Determination of crude fat content (Soxhlet extraction); (AOAC, 1990)
2. Determination of total protein content (AOAC, 1990)
3. Determination of moisture content (AOAC, 1990)
4. Measurement of pH (AOAC, 1990)
5. Determination of total volatile bases nitrogen (FAO, 1980)
6. Determination of thiobarbituric acid number (TBA); (Tarladgis *et al.*, 1960 with modification of Pikul *et al.*, 1983)
7. Statistical analysis: data were analyzed using T-test according to Petrie and Watson (1999).

RESULTS AND DISCUSSION

In regard to the main chemical composition, the

results in table (1) revealed that the mean percentage of protein; fat and moisture contents of the whole muscles of infested frozen herring (*Clupea harengus*) fish with larvae of Anisakid nematode parasites "herring worm" (*Anisakis simplex*) were 19.01 ± 0.53 , 11.58 ± 0.74 and 65.77 ± 1.51 and for herring fishes free from any parasitic infestation were 20.38 ± 0.74 , 12.52 ± 0.74 and 63.05 ± 1.51 respectively. It is obvious from these results that the mean percentage of protein and fat contents of the whole muscles of infested fishes were (about 7%) lower than that of non-infested fishes. On contrary, the moisture content of the whole muscles of positively invested fishes was (about 4%) higher than that of negatively invested fishes. Also, results illustrated that the mean percentages of total protein and crude fat contents of non-infested samples were significantly higher ($P < 0.05$) than that of infested samples and the mean percentage of moisture content of non-infested samples was significantly lower ($P < 0.05$) than that of infested samples.

Table 1. Percentage of total protein; crude fat and moisture contents of whole muscles of both infested and non-infested frozen herring fish (*Clupea harengus*)

	Protein%		Fat%		Moisture%	
	infested	non-infested	infested	non-infested	infested	non-infested
1	18.92	20.13	11.77	12.41	65.43	63.54
2	18.23	21.31	11.48	12.85	66.62	62.52
3	18.91	19.56	10.89	12.37	67.45	63.71
4	19.74	19.65	12.06	13.68	64.27	60.44
5	18.87	20.94	11.58	11.89	65.28	64.36
6	19.62	20.73	10.63	11.52	66.47	64.75
7	19.27	21.58	12.27	12.31	63.92	63.53
8	18.14	20.42	11.45	11.60	64.84	64.66
9	19.06	19.93	12.03	13.38	66.36	61.13
10	19.38	19.57	11.64	13.15	65.25	61.82
Minimum	18.14	19.56	10.63	11.52	64.27	60.44
Maximum	19.74	21.58	12.27	13.68	67.45	64.75
Mean	19.01*	20.38	11.58*	12.52	65.77*	63.05
SD	0.53	0.74	0.51	0.74	1.01	1.51

* There are significant difference ($P < 0.05$) between the means.

Table 2. pH; Total Volatile Bases - Nitrogen [(TVB-N) (mg/100g)] and Thiobarbituric acid number [(TBA) (mg MD/ Kg)] of both infested and non-infested frozen herring fish (*Clupea harengus*).

	pH		TVB-N		TBA	
	infested	non-infested	infested	non-infested	infested	non-infested
1	5.81	5.68	16.55	15.18	0.15	0.15
2	5.86	5.62	16.68	14.22	0.16	0.14
3	5.83	5.65	16.57	14.48	0.17	0.13
4	5.82	5.66	16.42	14.74	0.18	0.15
5	5.89	5.79	16.70	16.63	0.20	0.18
6	5.90	5.70	17.30	16.11	0.21	0.16
7	5.87	5.69	17.23	15.42	0.19	0.15
8	5.89	5.77	17.45	15.97	0.20	0.16
9	5.85	5.75	16.66	15.80	0.18	0.17
10	5.93	5.80	17.92	16.30	0.22	0.19
Minimum	5.81	5.62	16.42	14.22	0.15	0.13
Maximum	5.93	5.8	17.92	16.63	0.22	0.19
Mean	5.86*	5.71	16.95*	15.48	0.19*	0.16
SD	0.038	0.063	0.494	0.814	0.022	0.018

* There are significant difference ($P < 0.05$) between the means.

Concerning the chemical deteriorative criteria, the presented data in table (2) showed that the mean pH; Total Volatile Bases-Nitrogen [(TVB-N) (mg/100g)] and Thiobarbituric acid number [(TBA) (mg MD/Kg)] of the whole muscles of infested frozen fish were 5.86 ± 0.038 ; 16.95 ± 0.494 and 0.19 ± 0.022 and 5.71 ± 0.063 ; 15.48 ± 0.814 and 0.16 ± 0.018 respectively for herring fishes free from any parasitic infestation. It is cleared from these data that the mean values of pH; TVB-N and TBA of the whole muscles of infested fishes were higher than that of non-infested fishes. These results pointed out that the mean percentages of pH; TVB-N and TBA of infested samples were significantly higher ($P < 0.05$) than that of non-infested samples.

Finally the obtained results cleared that the parasitic infestation of herring (*Clupea harengus*) fish with larvae of Anisakid nematode parasites "herring worm" (*Anisakis simplex*) has adverse effect on fish nutritive value and their chemical deteriorative criteria.

Several authors reported that the parasitic infestation are one of the most important limiting factors of fish productivity which lead to economic losses Snieszko and Axelrod (1980); Gonzalez (1988); Lick (1991) and Karl and Muenkner (2002).

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الملخص العربي

تأثير الإصابة بيرقات ديدان الأناساكيذ على الجودة الكيميائية لأسماك الهيرنج

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المصابة و الأسماك السليمة في كلا من (نسب البروتين و الدهون و الرطوبة و تركيز الأس الهيدروجيني و نسبة النيتروجين الكلبي المتطاير ورقم حمض الثيوباربيتورك) و أن إصابة الأسماك بهذه الديدان كان له تأثير عكسي على جودتها و قيمتها الغذائية.

توجد يرقات ديدان الأناساكيذ داخل التحريف البطني و أحيانا داخل عضلات أسماك الهيرنج المصابة مما يؤثر على جودة و سلامة هذه الأسماك. تم القيام بهذا البحث لمعرفة تأثير الإصابة بهذه الديدان على التركيب الكيميائي و دلالات الجودة الكيميائية في أسماك الهيرنج. أظهرت النتائج أن هناك فرق معنوي بين الأسماك