Mercury Content in Several Species of Marine Fish

by F. CUGURRA and G. MAURA
University Institute of Pharmacology
Faculty of Pharmacy
Via Capo S. Chiara 5, Genova, Italy

Some researches have proved that fish, shellfish as well as seals can be contaminated by mercury (RIVERS, et al. 1972; FREEMAN, et al. 1973.

It has been demonstrated that where mercury compounds are concerned, some microorganisms produce a biological methylation (JENSEN and JARNOLOV 1969): as a result organic mercury enters the food chain. This explains why similary to seals mercury is found, almost entierely, as methyl mercury in fish and shell fish (WESTOO 1966a, 1967b; BACHE, et al. 1971; KAMP, et al. 1972).

Moreover as fish concentrate heavy metals, including mercury, they oppose greater resistence to such metals.

As to other species, the mercury contamination problem should not be undervalued: for instance the great mortality of birds in Sweden, following ingestion of mercury-containing pesticides (BORG, et al. 1966).

The danger for human health, due to fish consumption, has been very well documented. It will be remembered the Minamata and Niigata poisoning (KURLAND, et al. 1960; BERGLUND, et al. 1971).

Acùte and chronical exposure to organomercury compounds (methyl mercury) can cause irreversible damages to the central nervous system (SWENSSON 1952; KURLAND, et al. 1960; CURLEY, et al. 1971) as it is the most vulnerable organ to this kind of poisoning. It is known that the biological half-life of methyl mercury in human beings is of about 70 days (ABERG, et al. 1969).

In view of the fact that our knowledge to this date, on fish contamination by mercury has to be continuously kept up to date, we thought it should prove useful to conduct a survey for determining the total mercury content in fish available on the market or fished in the port of Genoa (Italy).

Bulletin of Environmental Contamination & Toxicology,
Vol. 15, No. 5 © 1976 by Springer-Verlag New York Inc.

MATERIAL and METHODS

Tinned tuna, anchovies, sardines and mackerel as well as frozen umbrina and dried cod fish, have been bought on the market. Fresh fish, sardines and oculata have been fished in the port of Genoa.

The total mercury contents has been determined with a variation of flameless Atomic Absorption method (HATCH and OTT 1968; LINDSTED 1970).

In short 3 gr. of tissue has been digested by heating it with a sulphocromic mixture. This way mercury has been reduced to metallic state by stannous chloride and then extracted by running steam.

An Atomic Absorption Spectrophotometer Model 240 EEL (Evans Electroselenium Limited, England) equipped with an EEL compressor and a RE 511 Goerz recorder has been used.

RESULTS and DISCUSSION

Table 1 shows the total mercury contents in tinned tuna. Analysis have been carried out on different species and different brands existing on the market. High levels of mercury are found in Parathunnus obesus (0,649 ppm) and much higher levels in Tunnus thynnus fished in the Mediterranean (1,326-1,003 ppm). The mercury contents found in Neothunnus macropterus (0,278 ppm) and Katsuwonus pelamis (0,274 ppm) is lower than that in the same species of fresh fish (RIVERS, et al. 1972) respectively 0,54 and 0,38 ppm.

As investigation carried out in Great Britain revealed a mercury contents of 0,1-0,8 ppm in tinned tuna (MIN. AG. FISH FOOD 1970).

Mercury is found also in tuna fish mainly in the methyl mercury form (JOHANNSON, et al. 1970).

Table 2 lists mercury contents in other types of tinned fish. Different brands of tinned anchovies, sardines and mackerel have been taken on the local market. The highest levels have been found in the Engraulis encrasicholus (0,416 ppm) fished in the Adriatic sea and the lowest in the Clupea sardina (0,194 ppm) compared to an average contents in Scomber scomber (0,257 ppm).

Table 3 shows that the total mercury contents in fresh fish reaches higher peaks, Oblata melamura

TABLE 1

Total mercury in tinned tuna

Scientific name	ppm*	average ppm §
Parathunnus obesus	0,649±0,100(5)**	
Neothunnus macropterus	0,281±0,000(5)	
Neothunnus macropterus	0,276±0,000(5)	0,278±0,000(2)
Katsuwonus pelamis	0,283±0,000(5)	
Katsuwonus pelamis	0,266±0,000(5)	0,274±0,000(2)
Tunnus thynnus	0,932±0,134(5)	
Tunnus thynnus	0,989±0,083(5)	
Tunnus thynnus	1,641±0,126(5)	
Tunnus thynnus	1,744±0,161(5)	1,326±0,212(4)
Tunnus thynnus(undercut)	1,174±0,286(5)	
Tunnus thynnus(undercut)	0,832±0,173(5)	1,003±0,170(2)

* ppm ± S.E.M.
** No. of determination
§ Average of some stocks

(2,593 ppm) Clupea sardina (0,484 ppm) both fished at the docks of Genoa; the latter is about four times higher than in tinned sardines.

High values are also found in friger Umbrina cirrhosa (0,707 ppm), lower values in Gadus morrhua dried fish (0,326 ppm).

Very high values have been found in dolphin (Delphinus delphis) tissue, both fresh and dried (musciame), respectively 27,52±1,08 - 17,52±0,45 ppm. (Cugurra and Maura in press).

Since mercury has been discovered in fish (Johnels, et al. 1967) this problem has become more important.

It is known that fish taken out from polluted waters is the main source of mercury poisoning for man.

Researches made up to now have reveled dangerous mercury concentration in particular areas subject to industrial pollution as Minamata, Niigata, the Swedish lakes and in North America.

TABLE 2

Total mercury in other species of tinned fish

Common and Scientific name	ppm*	average ppm §
Anchovy		
Engraulis encrasicholus[a]	0,464±0,044(6)**	
Engraulis encrasicholus[b]	0,369±0,037(5)	0,416±0,044(2)
Anchovy with caper[b]		
Engraulis encrasicholus	0,288±0,046(5)	
Anchovy with piquant sauce[b]		
Engraulis encrasicholus	0,338±0,046(5)	
Sardines		
Clupea sardina[b]	0,219±0,000(5)	
Clupea sardina[c]	0,169±0,000(6)	0,194±0,000(2)
Mackerel		
Scomber scomber[d]	0,264±0,000(8)	
Scomber scomber[e]	0,250±0,000(6)	0,257±0,000(2)

* ppm ± S.E.M.
** No. of determination
§ Average of some stocks
a) Fished in the Adriatic sea
b) Bought on the market
c) Fished and packed in Spain
d) Fished and packed in Portugal
e) Fished and packed in Japan

In non-polluted areas fish have a mercury contents of 0,01-0,1 mg/kg wet weight (LOFROTH 1970) and the highest concentration legally admitted for human health is of 1,0 ppm in Sweden, 0,5 ppm in the United States and 0,7 ppm in Italy.

As a result, the continous ingestion of fish having mercury contents above 1-2 ppm, is therefore potentially dangerous. Obviously this varies depending on the type of food consumed by a given population.

In the Mediterranean, pollution-and not only from mercury-seems to reach alarming levels according to various report established by FAO. Some areas have already been declared as being most dangerous; in Italy

TABLE 3

Total mercury in non-tinned fish

Scientific name	ppm*
Clupea sardina[a]	0,484±0,031(6)**
Oblata melamura[a]	2,593±0,296(6)
Umbrina cirrhosa[b]	0,707±0,000(4)
Gadus morrhua[c]	0,326±0,000(4)

* ppm ± S.E.M.
** No. of determination
a) Fished in the docks of Genoa
b) Deep-freeze slice bought in Genoa
c) Material dried and bought in Genoa

the lagoon close to Ravenna (Jun Ul 1971).

It is of interest to gather pertinent element in the various areas likely to being affected by such pollution.

ACKNOWLEDGMENT

We should like to thank the Health and Hygiene Department, Social Security of the Ligurian Region, for their 1974 contribution. We also thank Mr. Paolo Paudice, Mr. Luciano Maiolo and Miss. Annamaria Caviglia for their skilled technical assistence.

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