

## MANGANESE CONTENT IN THE MUSCLE TISSUE OF THE TROUT (*SALMO TRUTTA*) IN SOME RIVERS OF ALBANIA

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### Abstract:

Bioaccumulation and magnification is capable of leading to toxic level of these metals in fish even when exposure is low. The presence of metal pollutant in fresh water is known to disturb the delicate balance of the aquatic systems. Fishes are notorious for their ability to concentrate heavy metals in their muscles and since they play an important role in human nutrition, they need to be carefully screened to ensure that unnecessary high levels of some toxic trace metals are not being transferred to man through fish consumption. This study evaluates the content of the manganese element (Mn) in the muscle tissue of the trout (*Rainbow trout*), caught upstream and downstream in some rivers of Albania, such as: Vjosa, Buna, Drini. A total of 60 *Salmo trutta* samples were analyzed in the Laboratory of Toxicology, Department of Food Safety at the Institute of Food and Veterinary Safety in Tirana. The average value of manganese concentration in the trout's muscle tissue caught in the Vjosa river was 0.45 mg/kg of the upstream samples and 0.90 mg/kg of the downstream samples. In the muscle tissue of the trout caught in the Buna river, the average value of manganese concentration was 1.65 mg/kg in the upstream samples and 0.75 mg/kg in the downstream samples. In the muscle tissue of the trout caught in the Drini river the average value of manganese concentration was 0.55 mg/kg in the upstream samples and 0.80 mg/kg in the downstream samples.

**Key words:** manganese, muscle tissue, trout, river.

### Introduction

There are many sources of heavy metals in the environment, both natural and anthropogenic. Natural sources include geological heavy metals deposits, forest fires and other wood burning activities volcanoes, and volatilization from the oceans. Humans may accelerate the natural weathering process of heavy metals such as manganese by removing it from the areas of geological deposit and introducing or re-introducing it to the heavy metals cycle. Examples include consumer and industrial products, coal and other fossil fuel combustion, chlor-alkali processing, heavy metals waste in landfills or storage etc.

One of the ecological problems of the present modern society is contamination of the environment with harmful chemical substances. As a result, there are normative parameters published that allow such small substances in the biosphere, mainly on some foodstuffs at tolerable rates, which may be absorbed within the organism of humans or animals, [4].

Thus the value of fish is based on its condition for consumption. Such availability is directly depended on the quality of water where fish live. Different from other organisms, fish take a considerable quantity of substances from the water and food found in it.

Albania is rich of in watery resources, natural or artificial, with fishing capacity for man's food. Considering the importance of fish in the nutritious diet of man, we studied the content of manganese (Mn) in the trout's muscle tissue. The study that we undertook is the first of its kind in our country. It tries to give a precise presentation on the level of Mn waste in the fish of rivers, especially in the species of the Trout. Considering the fact that this study is the first of its kind, we think that it will simultaneously serve as an index for the future for the evaluation and monitoring of other metals that pose a threat for the consumers' health. From the consulted literature of the neighbour countries and beyond we found no results of similar studies. Based on the great importance that Mn has in the group of metal wastes, in the ichthyc products as well as those of animal

origins, we emphasise that the maximal allowed limit of waste is 30 mg/kg referring to FAO [6] and WHO [11].

### Material and methods

In this study we used 60 samples of the Rainbow trout. Each sample consisted of muscle tissues of 5 different individuals. 24 samples were taken from the Vjosa river (5 in the upstream and 19 in the downstream). 16 samples were taken from the Buna river (8 in the upstream and 8 in the downstream). 20 samples were taken from the Drini river (7 in the upstream and 13 in the downstream). All the fish, in total 300, was caught from June to September 2009 and the samples were analyzed in the Laboratory of Toxicology, Department of Food Safety, at the Institute of Food and Veterinary Safety in Tirana, Albania.

Fish samples were identified and then transported by means of a moveable fridge. The samples were prepared by means of a scalpel. For analytic

procedures we took 3g for each sample. The manganese content was defined through the spectrophotometric absorbent (AAS), based on the method of the standard supplement, [2]. Calibration curve for manganese was evaluated through the instrumental state and dilution 1000 ppm of the original standard dip produced by “Merk” company, [7, 8].

### Results and discussions

Results of the research for manganese content in the muscle tissue of the trout (*Rainbow trout*), caught upstream and downstream urban localities from the rivers of Vjosa, Buna and Drini are shown in the following tables. The highest average value of manganese content resulted in the muscle tissue of the fish caught in Drin (1.83 mg/kg), while the lowest in the muscle tissue of the fish caught in Vjosa (0.44 mg/kg).

**Table 1:** Mn content values of the muscle tissue of the trout in upstream and downstream, according to months in some rivers of Albania.

Rivers	Months			
	June	July	September	
<b>Vjosa</b>	Upstr.	0.46 mg/kg	0.46 mg/kg	0.44 mg/kg
	Downst.	0.87 mg/kg	0.89 mg/kg	0.94 mg/kg
<b>Buna</b>	Upstr.	1.67 mg/kg	1.65 mg/kg	1.65 mg/kg
	Downst.	0.75 mg/kg	0.76 mg/kg	0.74 mg/kg
<b>Drini</b>	Upstr.	0.55 mg/kg	0.56 mg/kg	0.54 mg/kg
	Downst.	1.77 mg/kg	1.8 mg/kg	1.83 mg/kg

The average value of the Mn content in the muscle tissue of the trout caught upstream the river of Vjosa was 0.453 mg/kg, towards 0.90 mg/kg downstream. In the muscle tissue of the trout caught upstream Buna it was 1.656 mg/kg, while downstream 0.750 mg/kg. In the muscle tissue of the trout caught in Drin, the average of the concentration value of

manganese was 0.553 mg/kg at the upstream samples and 1.80 mg/kg at the downstream samples.

Our results of the average value of manganese content in the muscle tissue of the trout caught upstream and downstream the rivers of Vjosa and Buna do not deviate from the significant data of the literature [3].

The average permitted value of the manganese content in the muscle tissue of the trout is 25 - 30 mg/kg. [7, 11].

But the average values of the manganese content of the trout caught in Drin were higher as a result of the industrial effluent flowing out directly to the river's flow, by causing pollution levels in water and in the fish grown in it, [5].

Results display (table 1) that the embouchures of the rivers Vjosa and Drini, in September present a slight increase of the Mn concentration in the musculature of the analysed fish samples. We suggest that this is the result of the increased production of the mineral industries which contaminate the waters of these rivers.

Rivers like those that flow in the northern and southern part of Albania, contain high levels of Mn, as a result of the mineral content in the geological areas that lay around them, thus making a risk from the residues for the fish growing in these rivers.

Amongst the most important industrial effluents there are: coal mines for Vjosa, copper mines, chrome and iron for Drini and Buna. The highest Mn levels mainly come from the mining industry of copper and chrome, in proportion with that of coal, [3].

The main role of manganese in the metabolic processes is the activation of enzymes with a wide spectre such as: carboxylase, argyrosis, phosphatase, [9]. Manganese lack is extremely dangerous, because it causes anomalies in the formation and growth of the skeleton, and nervous disorders in small children, [1].

## Conclusions

The results of the analyses carried out in the prepared samples with muscle tissue from the Rainbow trout fish, showed that they contained Mn, as a result of the mineral industry which has begun its reactivation after having been given with concession.

Industrialization and urbanization are the causes of the increase of manganese content in the muscle tissue of the examined trout, and as a result they make up a mineral batch for the consumer, where the increase of the Mn concentration simultaneously

increases the risk for different pathologies such as abnormalities in skeletal development or nervous disorders. Avoiding maximally and as soon as possible the time of Mn concentration from the products that we consume would reduce the above mentioned risk by thus reducing personal and societal costs.

From the study that we carried out based on the Analytical International Standards, the muscle tissue of the trout caught in the rivers of Albania has different concentrations of the essential element manganese (Mn), where the average value fluctuates from 0.44 mg/kg in the Vjosa river to 1.83 in the Drini river.

Referring to the maximal limits for Mn concentration in food products estimated by FAO and WHO, two of the most important world organizations, we come to the conclusion that the values derived from this study are lower than the maximal allowed limit. This conclusion shows that the consumers who eat Rainbow trout and other small fish from the rivers Vjosa, Buna and Drin are not threatened.

However the development of the mineral industry over the recent years has increased the necessity to monitor it continuously, in order to keep under control Mn and a lot of other elements which are products of the mineral industry and pose a threat for the consumers health as well as for the ecosystem. If they were filtered before being discharged in rivers they would be harmless.

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