December 2010

Center for environmental research and information “Eko-svest”

[MERCURY STATUS REPORT IN MACEDONIA]

Results from testing of hair samples for mercury presence

Introduction

The Center for research and information environment "Eco-sense" in 2010 implemented project to raise public awareness of toxic metal mercury. The project is funded through the ISIP program implemented by the Czech organization ARNIKA. In period of four months, "Eco-sense" organized testing of hair samples for presence of the toxic metal mercury.

Testing was performed by the Institute of Chemistry, Natural Sciences Faculty, using atomic absorption spectroscopy, a technique used for determination of the concentration of a chemical element in a sample obtained for analyzing. The testing included 50 samples of hair, obtained from persons who voluntarily agreed to this kind of testing. Prerequisites for testing were persons to have over 18 years, and to provide sufficient amount of hair (1 gram) and fill in a form consenting to testing for presence of mercury in their hair sample. The form contained questions about respondents who are related to: age, sex, place of birth, eating fish, use of hair color, consuming cigarettes foreknowledge of the effects of mercury and awareness about sources of mercury.

The obtained samples of hair were placed in separate plastic containers, each labeled with appropriate code and number, known only to the tested person. This ensures protection of personal data and information.

In Macedonia, only the Institute of Chemistry deals with testing of heavy metals, including mercury, into soil and air and other media.

The aim of all the testing and research is to show whether and how much mercury is present in our organism and environment. Human body does not need mercury at all and therefore there is no safe level of mercury in the body. Even an atom of this metal will cause any damage to the body.

High amounts of mercury can be fatal to humans, but even relatively small amounts of components containing mercury can have harmful effects on the development of brain, and also have possible harmful effects on the cardiovascular, immune and reproductive system. Especially harmful long-term exposure to low concentrations of this heavy metal.

Mercury and its compounds affect the nervous system, kidneys and liver and can adversely affect the immune processes, cause tremors, reduced vision and hearing, paralysis, insomnia and emotional instability. Components of mercury can pass through placenta and can cause brain damage during fetal development.

Test results

According to the Institute of Chemistry, the reference values for the presence of mercury in hair are considered values of 0, 2-2 mg / kg.
For reference values according to the United States are considered values to 1mg/kg (1000 micro grams). These are the values at which there are no visible adverse effects on human health, but it is considered that no amount of mercury in hair is normal and safe for the body, so it is safest not to be present at all.
In all 50 participants was found mercury.
In all 50 participants mercury values were within the limits of reference values given from the Institute of Chemistry, and only one sample was found higher than reference values according to United States (1, 61 mg / kg).
Here are graphic and tabular displays of concentrations of mercury found in hair samples of the 50 participants, grouped according to different features.

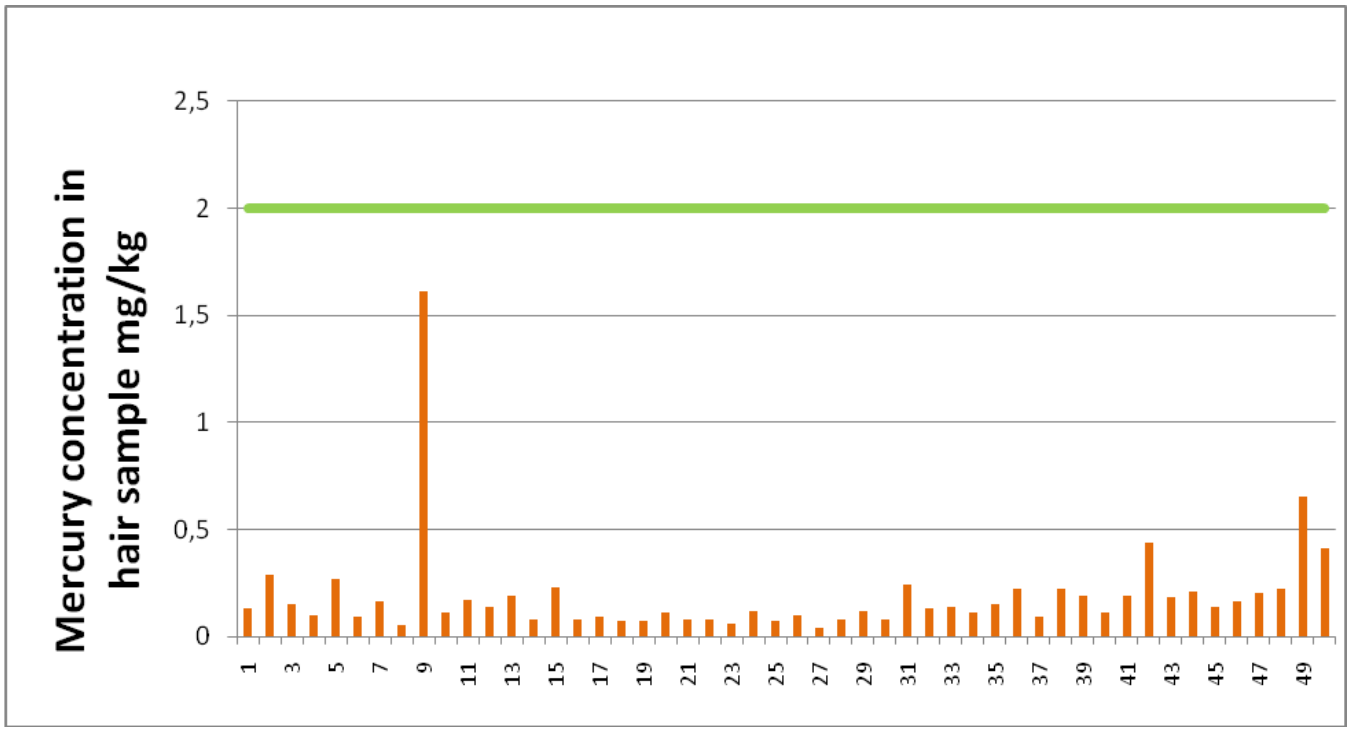

Chart 1. Graphic display of concentrations of mercury in hair in participants under reference values obtained from the Institute of Chemistry

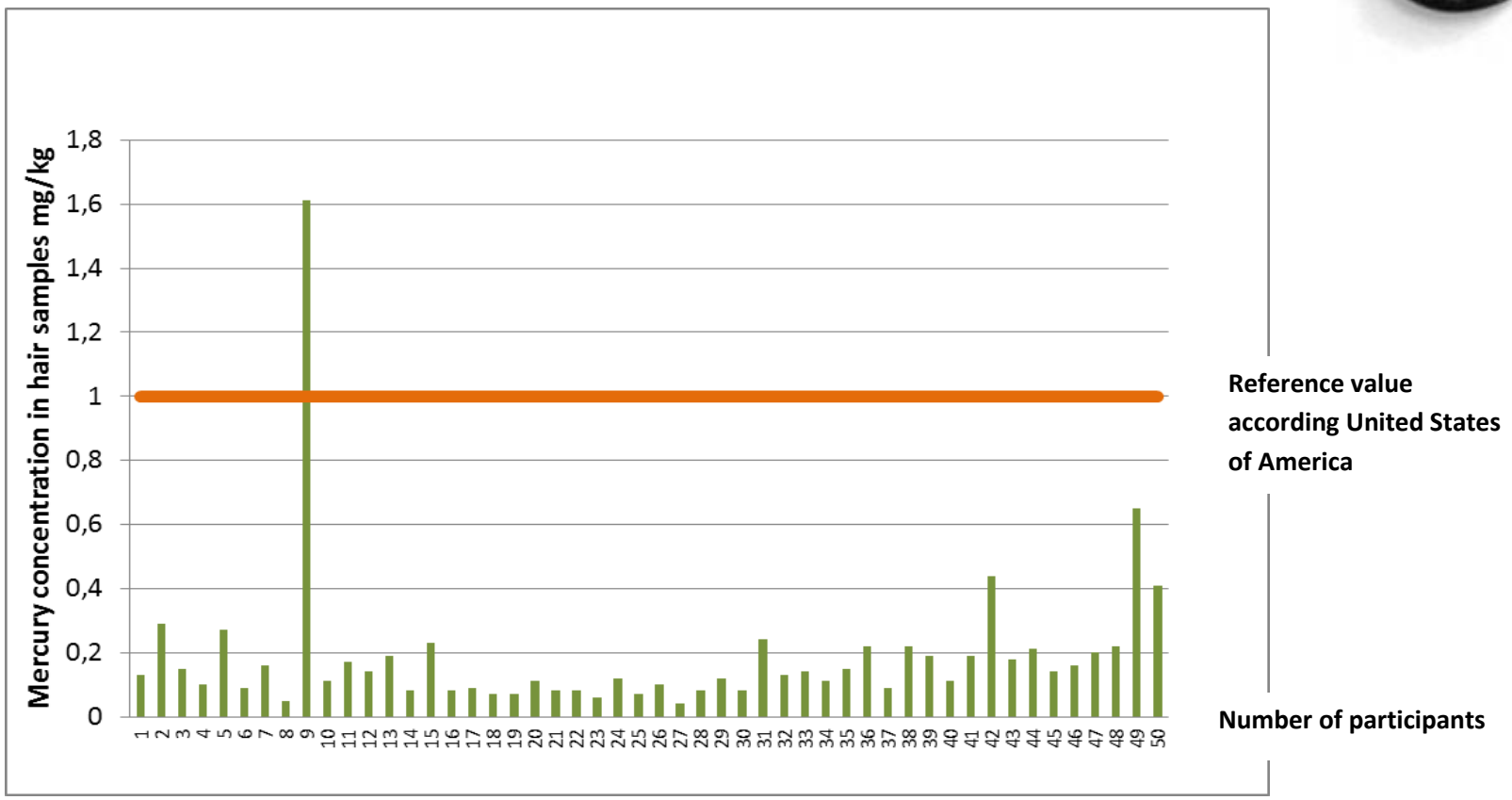

Chart 2. Graphic display of concentrations of mercury in hair in subjects under reference values of the United States

Of all respondents, 73% were female and 27% male. Below follows a graphic display percentage by sex. Generally, interest in testing was stronger among the female.

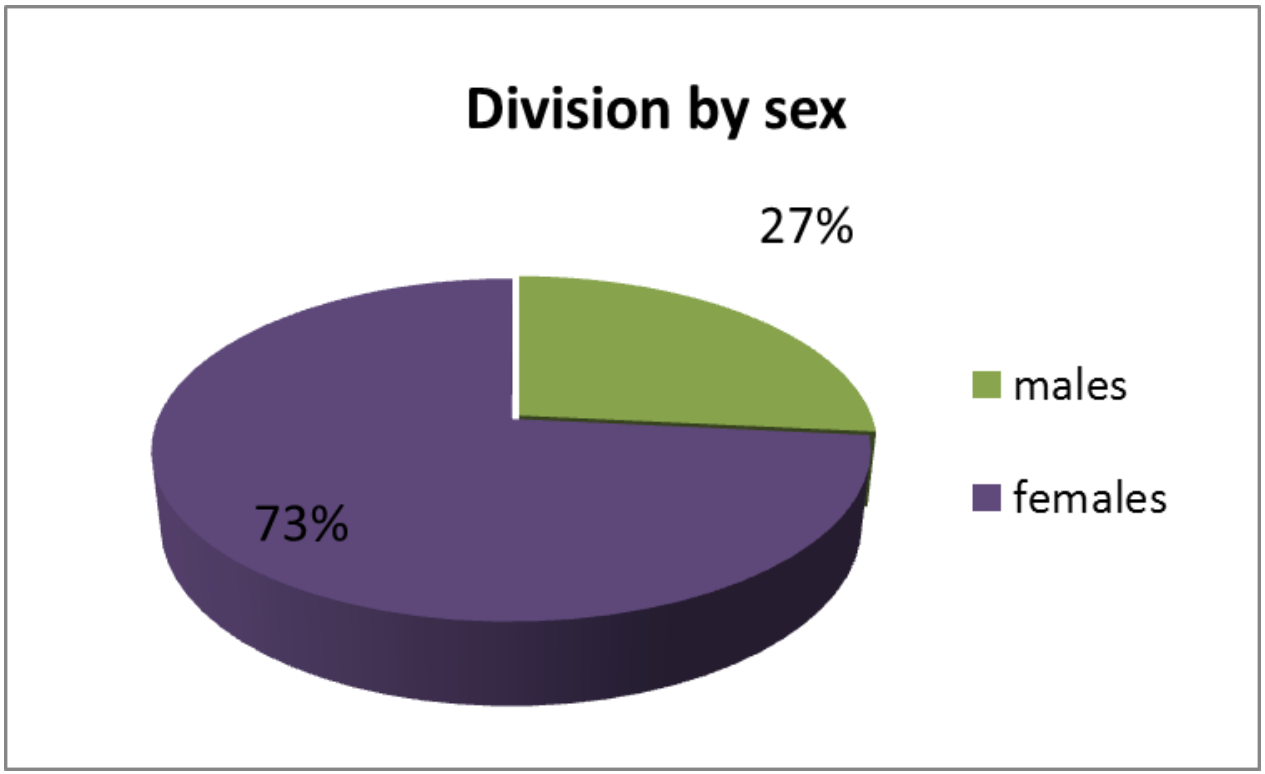

Chart 3 Division of participants by sex

Of the 50 participants, only 6% did not consume fish, while the remaining 94% consumed fish usually once a week.

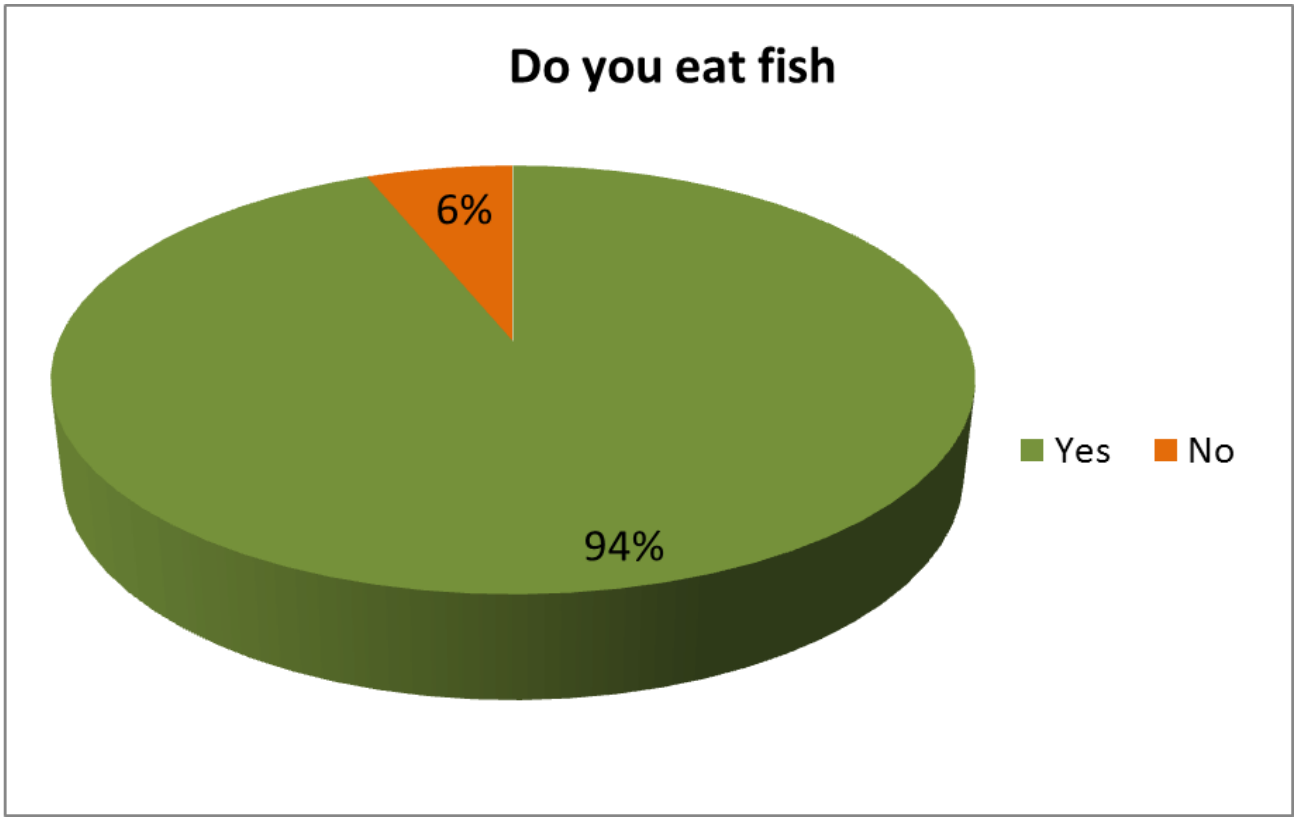

Chart 4. Division of participants according consuming fish.

In some studies indicated that smokers have elevated levels of mercury in the body and therefore the questionnaire included this question. Of 50 people interviewed, 27% were smokers, and other 73% were nonsmokers.

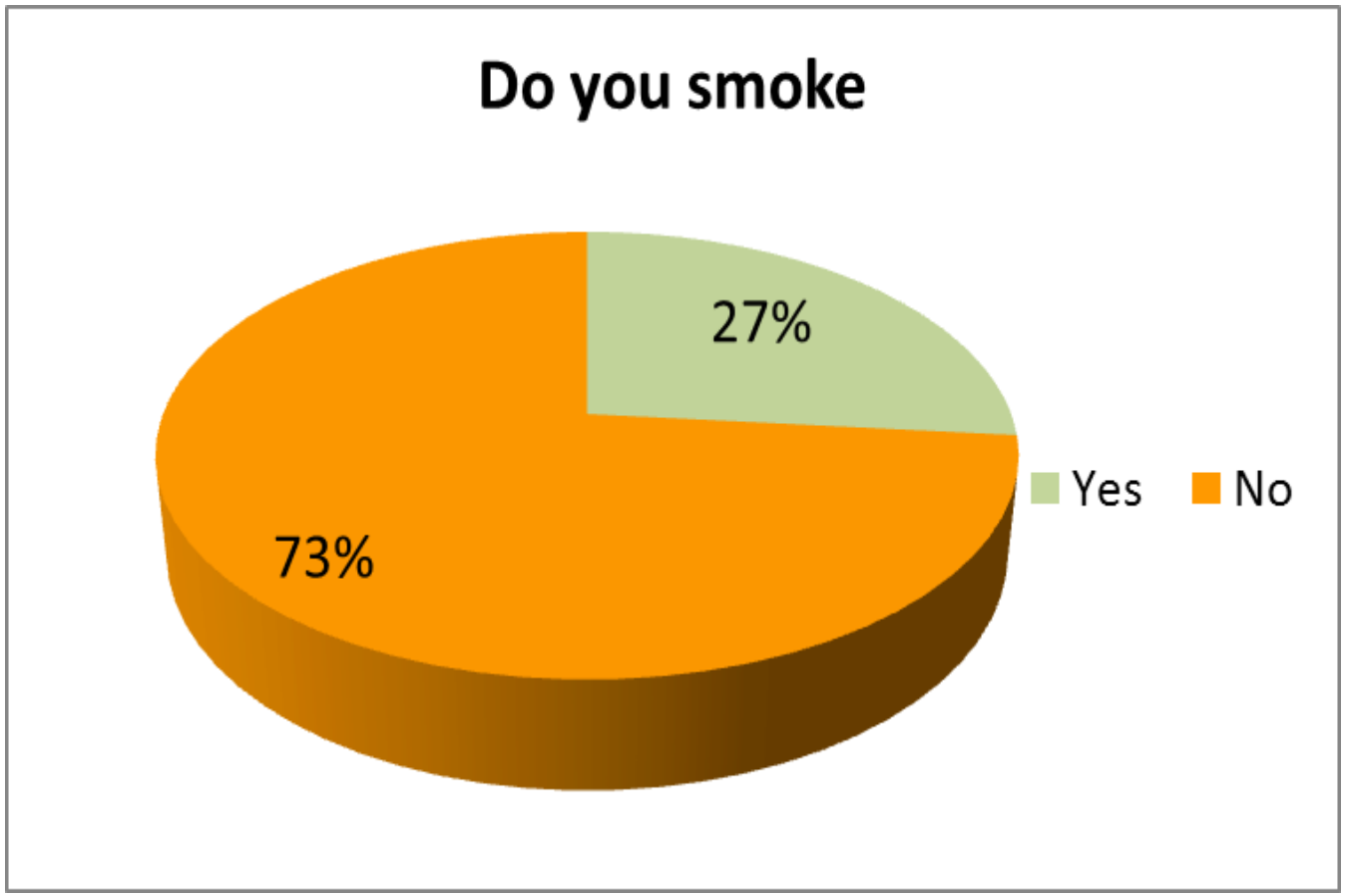

Chart 5. Division of participants by consuming cigarettes.

Most of the female population uses colors for hair. In many colors of hair contained mercury as a heavy metal and thus coloring the hair can contribute to demonstrating the mercury in the chemical analysis of hair. Of the 36 participants, 78% use hair color, and 22% do not use hair color.

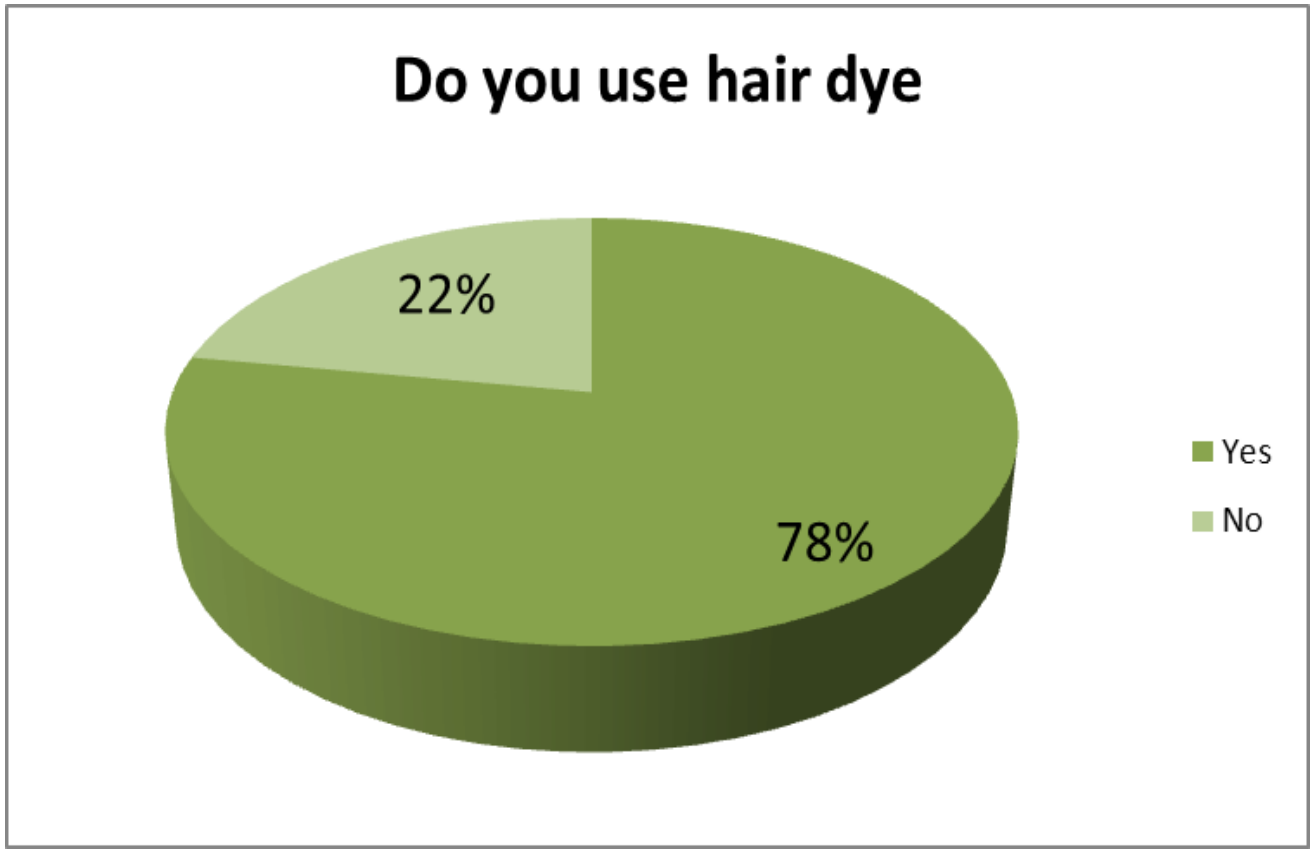

Chart 6. Separation of participants by using hair color

Awareness input of mercury by consuming marine products in Macedonia is very low. Only 10% of the total number of participants are aware of the way of mercury up to their body and consciously consume less fish. Most participants did not take care of intake of fish. Intake of fish contributes to the increased content of mercury, because marine fish accumulate elemental mercury, which then turned into methyl mercury, a form of mercury that is most toxic the body.

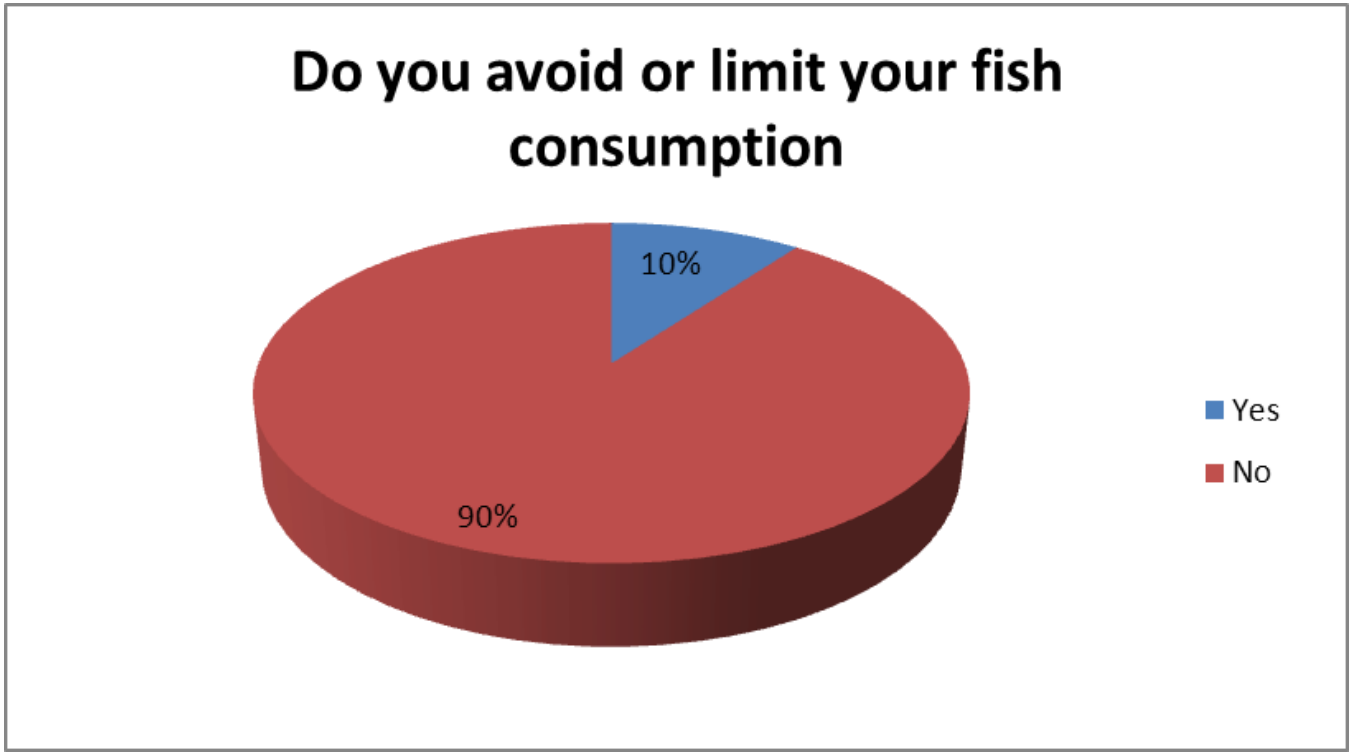

Chart 7.Division of participants according to awareness of eating fish

Awareness of different ways of exposure to mercury is significantly better than raising input fish, but not satisfactory. 37% of the participants were informed about different exposures to mercury, and 63% were not.

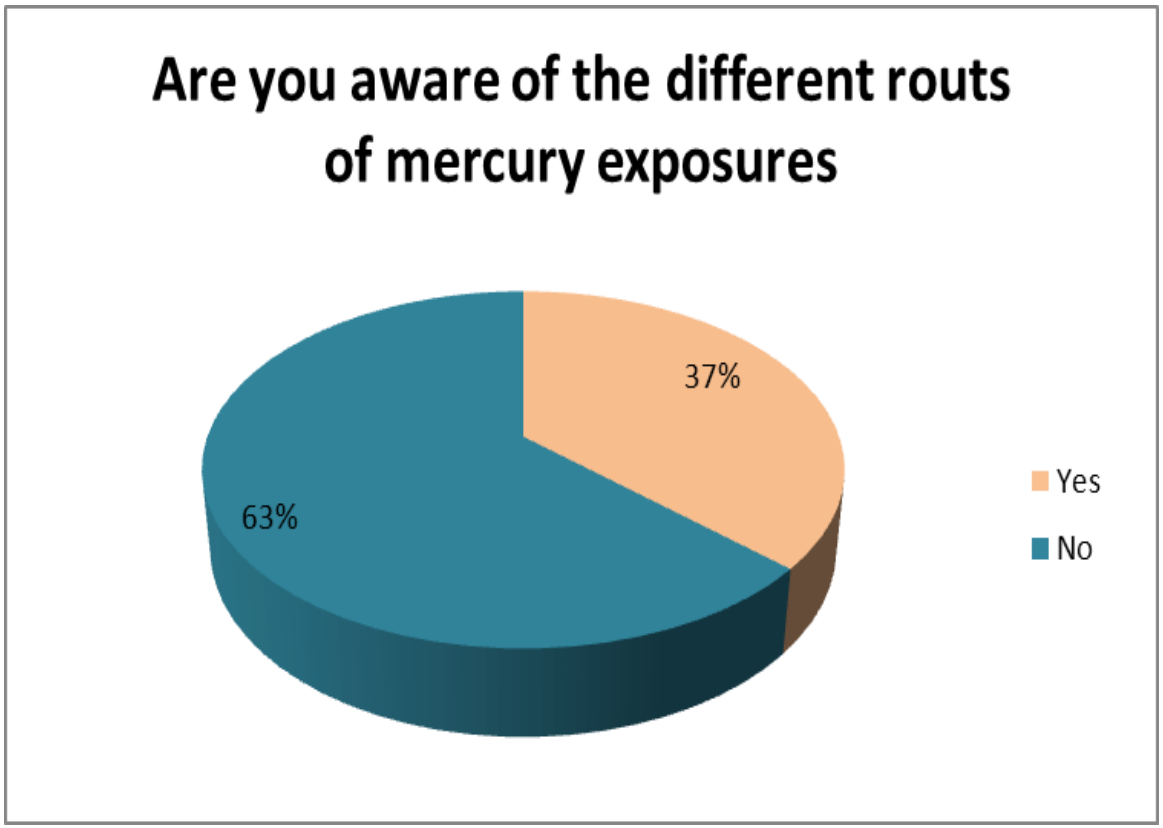

Chart 8. Division of participants per information on different ways of exposure mercury

Of all participants, most were born in Skopje. Here are average values amount of mercury in samples of hair, by the places of birth of participants.

Table 1. Average values of mercury by place of birth of participants.

City	Number of samples	Average values of mercury
Skopje	38	0,2
Veles	2	0,15
Bitola	1	0,19
Prilep	2	0,22
Kumanovo	2	0,1
Kratovo	1	0,08
Stip	1	0,1
Demir Hisar	1	0,08

In some studies is indicated that smokers have elevated levels of mercury in the body. In our study when comparing averages of mercury in smokers and nonsmokers, we didn't come to this conclusion. On the other hand, there are distinctive differences among nonsmokers who eat fish and those who do not eat fish. In this case one can see large difference in the presence of mercury in hair. Namely, in non-smokers who do not eat fish, mercury content was almost twice lower than in nonsmokers who eat fish. In this case is clearly visible impact of eating fish on the value of mercury.

Here are the values for non-smokers who eat and nonsmokers who do not eat fish.

Table 2. Average values of mercury in non-smokers

Average values mg/kg	
Nonsmokers who eat sea fish	**Nonsmokers who do not eat sea fish**
0,215	0,185

Table 3. Average values of mercury in women who do not use hair color

Average values mg/kg	
Women who eat sea fish and **do not use hair color**	Women who do not eat sea fish and **do not use hair color**
0,164	0

Table 4. Comparison of average values alive in participants who use and do not use hair color

Average values mg/kg	
Women who eat sea fish and **use hair color**	Women who do not eat sea fish and **use hair color**
0,138	0,180

When we made a comparison of all participants who use hair color (including men) who consumed fish with those who consumed fish, we came to the same conclusion, that consumption of fish is clearly associated with the amount of mercury in the body.

Table 5. Comparison of average values of mercury in all participants who do not use color hair

Average values mg/kg	
Participants who eat sea fish	Participants who do not eat sea fish
0,260	0,183

Generally speaking, people who consume fish have higher values than those who not consume fish. This is because fish accumulate elemental mercury which then turned into methyl mercury, a form of mercury that is most toxic to the body.

Table 6. Comparison of average mercury values in participants who consume and do not consume fish

Average values mg/kg	
Participants who eat sea fish	Participants who do not eat sea fish
0,192	0,181

Also, the age plays a role in the presence of mercury in the body. Below you can see that persons under 40 have higher values of mercury then persons over 40 years.

Table 7. Comparison of average mercury values in participants 40 years and over 40 years old

Average values mg/kg	
Participants 40 years and under	*Participants over 40 years*
0,200	0,174

Conclusions

The Survey that was conducted of 50 participants gave the following conclusions:

- The Institute of Chemistry, reference values for the presence of mercury in hair from 0, 2-2 mg / kg. Europe has not yet adopted reference values for mercury in human organism. In the USA, reference values for mercury values are considered to 1mg/kg.
- In all 50 samples of hair participants was found mercury.
- Only one participant had a higher value than the limit established in the U.S. (1.61 mg / kg).
- Of the participants, 73% were female and 27% male.
- Of the 50 participants, only 6% did not consume fish, while the remaining 94% commonly consumed fish once a week.
- Of 50 people interviewed, 27% were smokers, and the remaining 73% were nonsmokers.
- Of the 35 participants, 78% use hair color, and 22% do not use hair color.
- Only 10% of the total number of participants are aware of the way of living up to their

body and consciously consume less fish.

- 37% of the participants were informed about the different ways of exposure to mercury, and 63% were not.
- The survey included participants from 8 cities in Macedonia, and most participants were from Skopje.
- Although some studies suggest that smokers have higher amounts of mercury in their organism, this study did not come to that conclusion.
- In non-smokers who do not eat fish, mercury content is almost twice smaller than that of nonsmokers who eat fish.
- When comparing the participants who use and do not use hair color, average values do not differ greatly.

- However, when comparing the participants who use hair color (including men) who consume fish with those who consumed fish came to the same conclusion, that consumption of fish is clearly associated with the amount of mercury in the body.
- Age plays a role in the presence of mercury in the body. You can see that the people under 40 years have higher values of mercury then persons over 40 years.