

8. SUMMARY

All the time the human organism is exposed to oxidative stress and reactive oxygen species. The oxidative stress, arising in the organism, is an imbalance between the production of oxygen-based free radicals and the ability to neutralise them through natural defence mechanisms. The said imbalance can be caused by physiological and pathological metabolic processes of the organism, as well as by outside factors. An improper diet and lifestyle also play a significant role.

Reactive oxygen species result in numerous diseases, including diseases called civilisation diseases, such as e.g. cardiovascular system diseases, atherosclerosis, diabetes type 2 or cancers, as well as many others.

Sets of enzymatic antioxidants, as well as low-molecular antioxidants, including vitamin C, vitamin A, vitamin E or plant phenols, which are compounds that delay or impede the oxidation processes in the organism, are the defence against the reactive metabolites. Microelements, such as selenium, zinc and copper, which also build antioxidants, are also of importance in the neutralisation of oxygen-based free radicals.

The antioxidant status defines the ability of an organism to neutralise the oxygen-based free radicals, which initiate the oxidation damage.

The proper diet is one of the most important factors, which influence the well-being of a human, and also, as research indicates, it can prevent the development of many diseases, including radical-caused diseases.

The aim of the following paper is to evaluate the total antioxidant status and the concentration of selenium in serum of children in pre-school age in relation to their diet and nutritional condition.

Apart from physical examination, pre-school children were subject to a measurement of body weight and height. BMI (Body Mass Index) was calculated from the resulting measurements. The evaluation of nutritional condition was performed in relation to percentile norms (The WHO Child Growth Standards 2007), which define the value of BMI according to the age, for boys and girls. The research tool to evaluate the children's diet was a dietary survey, based on 24-hour interview, performed three times together with a parent (guardian) of every tested child, while the evaluation of frequency of the intake of selenium rich food products was performed with Food Frequency Questionnaire (FFQ). A blood sample of 2 ml

was taken from every child in order to evaluate the concentration of the total antioxidant status and selenium in the serum.

The research included 81 healthy children between 2,5 and 6 years of age (the average age was 4.6 ± 1.20 years). The group consisted of 27 girls and 54 boys. From the group a group of children between 2.5 and 3 years of age (29 children, which amounted to 35.8%) and a group of children between 4 and 6 years of age (52 children, which amounted to 64,2%) were distinguished.

The nutritional condition analysis has shown, that the majority of the surveyed girls (61.5%) and boys (68.5%) between 2.5 and 3 years of age characterised with a healthy nutritional condition (BMI 15-85 centile). In the group of children between 4 and 6 the percentage of children classified as eutrophic was 50.0 for girls and 63.2 for boys.

Among the children between 2.5 and 3 years 38.5% of girls and 37.3% of boys were found to be overweight or obese (BMI > 85 centile), while among the children between 4 and 6 years the excessive nutritional condition concerned 23.7% of boys and 42.9% of girls.

In the group of children between 2.5 and 3 years there were no girls nor boys, whose BMI amounted to <15 centile, while among the children between 4 and 6 years the percentage of undernourished children amounted to 7.1 for girls and 13.1 for boys.

In pre-school children's nutrition it is very important to serve the proper number of meals a day, as well as to consume them regularly. By evaluating the diet it was found, that the majority of children both in 2.5-3 years and 4-6 years groups ate regularly, while only a little over half of the surveyed children in both age groups ate a proper number of meals a day.

The analysis if the nutrition of children in pre-school age, both groups were found to have an excessive supply of: calories, proteins, carbohydrates in their diet, and in addition the children between 2.5 and 3 years of age have an excessive supply of fats. Meanwhile, the supply of fats in the diet of children between 4 and 6 years of age was realised in 97.6% of the daily supply.

The analysis of antioxidant vitamins supply found both age groups to have an excessive supply of: vitamin C and vitamin A in their diet. An insufficient supply for both age groups concerned only vitamin E.

The analysis of antioxidant microelements supply in the diet of the surveyed children found an excessive supply of both zinc and copper for both age groups.

The total antioxidant status values in the serum, which define the ability to neutralise the oxygen-based free radicals were reduced both for the children between 2.5 and 3 years of

age (55.2% of the children) and for the children between 4-6 years (63.5% of the children) in relation to the total antioxidant status reference value for healthy children. No correlation between the total antioxidant status and the nutritional condition of the children, nor between the intake of nutritional components of proven antioxidant characteristics, i.e. vitamin C, vitamin A, beta-Carotene, vitamin E as well as zinc and copper, and the total antioxidant status value in the serum, was found.

In relation to most of the Western Europe and the United States, the average selenium concentration in serum among the children between 2.5 and 3 years of age, which amounts to $41.3 \pm 12.6 \mu\text{g/L}$ and $38.3 \pm 11.4 \mu\text{g/L}$ for the children between 4 and 6 years of age, indicates a significant lack of this element among the children in pre-school age in Podlaskie voivodship. The correlation between the concentration of selenium in the serum and the nutritional condition of the surveyed pre-school children was not confirmed. Selenium shows a synergetic effect with antioxidant vitamins, especially with vitamin E, which was confirmed by a correlation between the concentration of selenium in the serum and the daily supply of vitamin E in the diet of children between 4 and 6 years of age.

Selenium is a very important component of antioxidants, and thus of the defense system against the oxidation and may influence the value of the total antioxidant status. A statistically significant correlation between the total antioxidant status concentration in the serum and the concentration of selenium in the serum of the children from the group of 2.5-3 years of age and the correlation of selenium of the whole group surveyed (no statistical significance), was found. Such correlation was not found among children between 4 and 6 years of age.

A properly balanced diet, including antioxidant vitamins and microelements, has a positive influence on the defence of the organism and contributes to reducing the risk of the development of numerous civilisation diseases, especially radical-dependent diseases, however further research is necessary.