

## INTRODUCTION

Women in period of menopause lose their estrogenic protection from arteriosclerosis. This equalizes their risk from arteriosclerosis with men. Also that period of life of women is characterized with frequent occurrence of anemia, benign and malign processes. Arteriosclerosis has rapid development in patients with uncontrolled diabetes mellitus. All these factors clearly point that prevention during menopause is necessary.

## FREE RADICALS AND ANTIOXIDANTS

Toxic effect of free radicals is registered in more than 100 diseases (malign diseases, arteriosclerosis, hemoragic shock, arthritis...) Free radicals are atoms and molecules with one or more unpaired electrons. They generate in cells during physiological processes (REDOX), phagocytosis, during UV radiation, smoking etc. Generation of free radicals starts chain reaction that produces new free radicals. Free radicals are superoxide, peroxide, oxidized LDL and many others.

Free radicals are highly reactive with tendency to react with oxygen atoms of other molecules in cell. Most of all, they react and damage unsaturated fatty acids of cellular and subcellular membranes, cell proteins, enzymes and DNA.

Antioxidants are molecules with different structure able to decrease or completely neutralize reactivity of free radicals. Organism synthesizes many of them and are found in extracellular liquids (bilirubin, uric acid, ceruloplasmin etc.) and intracellular (SOD, GPx, etc.).

*Spirulina pacifica* is an alga product that contains many antioxidants like  $\beta$ -carotene, zeaxanthin, phycocyanin and amino acids, vitamins B1, B6, B12, iron, minerals, enzyme SOD and unsaturated fatty acids (omega 3).

## MATERIAL AND METHODS

Our study includes 23 women on age of 47-54 years with NIDDM. After determination of increased concentrations of total cholesterol, triglycerides and LDL-cholesterol in blood of these women, we determined total antioxidant status, concentration of total bilirubin, uric acid and albumin. Then we started with application of "Spirulina pacifica" by NUTREX, inc. Kailua-Kona, Hawaii, USA.

For determination of glucose we used end-point method with hexocinase with reagents of HERBOS, Croatia ; for concentrations of total cholesterol (CHOD-PAP method), triglycerides (GPO method), HDL-cholesterol (precipitating method); total bilirubin (Jendrassik-Groff method) and TAS (end-point) we used reagents of RANDOX, Great Britain. For uric acid and albumin ( end-point) reagents of HUMAN, Germany. For photometric measures we used analyzer COBAS MIRA PLUS (HOFMAN LA ROCHE, Switzerland).

After one-month treatment we determined same parameters.

Results are shown in table and on graphic

## DISCUSSION

Increased extra- and intracellular concentration with oxidative stress that can be defined as imbalance between prooxidants and antioxidants.

Autooxidation of glucose and glycosilation of proteins starts chain system of formation of free radicals. This disturbs the balance between free radicals and intracellular and extracellular antioxidants. Free radicals damage extracellular protein macromolecules of lipoproteins, cellular membranes and intracellular DNA especially mitochondrial DNA (with possibility of mutation). Mitochondrial DNA is more sensitive to mutagenic effects of free radicals because it is not protected with histones like nuclear DNA.

"*Spirulina pacifica*" is a product from algae consisting of antioxidants  $\beta$ -carotene, zeaxanthin, phycocyanin and enzyme SOD. Application of these antioxidants leads to rebalance between prooxidants and antioxidants. SOD catalyses the dismutation reaction of the toxic superoxide radical to molecular oxygen and hydrogen peroxide.  $\beta$ -Carotene and zeaxanthin inhibit hydrogen peroxide and stop the Fenton reaction between peroxide and protein bonding iron with consequent forming of reactive hydroxyl radical.

Polyunsaturated fatty acids, proteins, DNA and carbohydrates are all susceptible to free radical attack (superoxide anion and especially hydroxyl radical).

Phycocyanin protects erythrocytes against lytic effect of reactive hydroxyl radical.

Omega 3 polyunsaturated fatty acid-  $\gamma$  linolenic acid, takes part in decreasing the concentration of lipids in blood. Its building in phospholipids of cellular

membrane prevents building in the saturated fatty acids. That improves transport function of membrane and normal metabolism of cholesterol.

After one-month treatment with "Spirulina pacifica" concentrations of lipids in blood of patients were decreased.

Concentration of total cholesterol from  $7,20 \pm 1,01$  mmol/l to  $5,32 \pm 0,49$  mmol/l; Triglycerides from  $2,32 \pm 0,34$  mmol/l to  $1,81 \pm 0,21$  mmol/l; LDL-cholesterol from  $4,42 \pm 0,61$  mmol/l to  $3,41 \pm 0,48$  mmol/l.

Concentration of glucose was lower ( $M \pm SD$   $7,54 \pm 1,63$  mmol/l before therapy and  $6,61 \pm 0,62$  mmol/l after).

Total antioxidant status was  $1,21 \pm 0,23$  mmol/l before therapy and  $1,35 \pm 0,35$  mmol/l increased after therapy.