Background: The clinical treatment of breast cancer frequently includes highly cytotoxic agents such as radiation or cytostatic drugs, aiming to inhibit tumor cell proliferation and/or induce tumor cell death. The cytotoxic effects of those agents are partly achieved by the increase in concentration of oxygen free radicals (ROS), which cause massive oxidative damage of tissue DNA, proteins and lipids above the limits of cell repair capacity. Radiotherapy is of great value in the treatment of a number of malignant tumours, but its potential utilization and efficacy is limited by the necessity of avoiding the excessive late damage to normal tissues. The incidence of radiogenic damage to soft tissue has been reported as being up to 40%. To protect against toxic effects of ROS, and to modulate its physiological effects, cells have evolved the antioxidant defense system. Superoxide dismutase is an enzyme that plays an important role in biological defense against activated oxygen and/or free radicals. SOD is highly efficient in scavenging superoxide ($O_2^-$) radical by catalyzing the dismutation of super-oxide radicals into hydrogen peroxide ($H_2O_2$) and molecular oxygen ($O_2$). The aim of this study was to test Cu/Zn SOD as potential biomarker of individual sensitivity to cytotoxic treatment.

Methods: The intracellular Cu/Zn SOD concentration was determined in peripheral blood of patients with locally advanced breast cancer prior to any clinical treatment. The assay was performed in two groups of patients with locally advanced breast cancer, the age group 30-45 (normal cycle, n=7, stage II or III), and 45-60 (perimenopausal women, n=12, stage III or IV). The respective healthy women: age group 30-45 (n=12) and age group 45-60 (n=12) were used as controls. The concentration of Cu/Zn SOD was also assayed after in vitro radiation challenge.

Results: The results showed that the intracellular Cu/Zn SOD concentration in 30-45 age and 45-60 age control groups, were cca. 12.89±0.87 arbitrary mass units/ml (AmU/ml), and cca. 10.46±0.72 AmU/ml of blood, respectively. In the two groups of patients with locally advanced breast cancer, the age group 30-45 and age group 45-60 (n=12) were used as controls. The concentration of Cu/Zn SOD was also assayed after in vitro radiation challenge. Thus the intracellular Cu/Zn SOD concentration did not vary significantly within the age groups of either control or patients. However, the Cu/Zn SOD concentration was significantly different between patient groups and the respective controls. The in vitro 2Gy and 9Gy $^{60}$Co $\gamma$-radiation challenge of blood cells did not lead to significant changes in Cu/Zn SOD concentrations within the age groups of either control or patients.

Conclusion: It is concluded that the Cu/Zn SOD concentration is not a relevant biomarker for prediction of radiotherapy induced changes in healthy tissue antioxidative defense. However, the enzyme concentration in blood cells correlated well with the presence of locally advanced breast cancer.