

## 6. SUMMARY

During diabetes, persistent hyperglycemia causes increased production of free radicals especially reactive oxygen species, for all tissues from glucose auto-oxidation and protein glycosylation. Abnormal high levels of free radicals and simultaneous decline of antioxidant defense systems can lead to the damage of cellular organelles and enzymes, increased lipid peroxidation and development of complications of diabetes mellitus.

The high polyunsaturated fatty acids content of RBC membrane and the continuous exposure to high concentrations of oxygen and iron in hemoglobin are factors which make RBCs very sensitive to oxidative injury, making them an appropriate model to study oxidative stress. Oxidative stress produces profound alterations to cellular membrane lipids, proteins and nucleic acids, impairing cell metabolism and viability. In general the overall effect of lipid peroxidation is to decrease membrane fluidity, deformability, visco-elasticity and life span of erythrocyte which may causes complications in diabetes mellitus.

Supplementation of omega-3 fatty acids is very effective in reducing the oxidative stress through an improvement in antioxidant enzymes activities. Fish oil and flaxseed oil are nutritional supplements have a high concentration of  $\omega$ -3 fatty acids. Flaxseed is rich in  $\alpha$ -linolenic acid, an omega-3 fat that is a precursor to the form of  $\omega$ -3 found in fish oil called eicosapentaenoic acid and docosahexanoic acid.

Thus, the main objective of this study was to compare the effects of flaxseed oil and fish oil administration in reducing oxidative stress and improving cell permeability in diabetic rats. 90 male albino rats were divided into six groups 15 rats each. Group I (control group): healthy rats received corn oil, 1.2 ml/Kg body weight /day orally. Group II (flaxseed oil group): healthy rats received flaxseed oil, 1.2 ml/Kg body weight /day orally. Group III (fish oil group): healthy rats received fish oil, 1.2 ml/Kg body weight /day orally. Group IV (diabetic group): diabetic rats received corn oil, 1.2 ml/Kg body weight /day

orally. Group V (treated flaxseed oil group): diabetic rats received flaxseed oil, 1.2 ml/Kg body weight /day orally. Group VI (treated fish oil group): diabetic rats received fish oil, 1.2 ml/Kg body weight /day orally. After 8 weeks animals were kept individually in metabolic cages for 24 hours urine collection then animals were kept fasting for 12 hours before blood sampling

The following parameters were estimated: blood glucose, plasma insulin, erythrocyte membrane total cholesterol, triglycerides, total phospholipids and total lipids, phospholipids fractionation, ATPase, total proteins, SOD, urinary 8-hydroxyguanosine (8-OHdG) and isoprostanes.

The results obtained were summarized as follows:

The mean values of fasting blood sugar and insulin resistance in diabetic was significantly increased compared to control group, while these values were significantly decreased in treated flaxseed and fish oils groups when compared to diabetic group.

The mean value of plasma insulin was significantly decreased in diabetic group compared to control group, while these values were significantly increased in treated flaxseed and fish oils groups compared to diabetic group.

The mean values of erythrocyte membrane SOD and ATPase were significantly decreased in diabetic group compared to control group, while these values were significantly increased in treated flaxseed and fish oils groups when compared to diabetic group.

The mean values of isoprostanes and 8- OHdG in diabetic group were significantly increased compared to control group, while the mean values of 8- OHdG was significantly decreased in treated flaxseed and fish oils groups when compared to diabetic group, but no changes in isoprostanes level were observed in treated groups compared to diabetic group.

The mean values of erythrocyte membrane total lipids, cholesterol, triglycerides and total phospholipids in diabetic group were significantly increased compared to control group, while these values were significantly

decreased in treated flaxseed and fish oils groups when compared to diabetic group.

The mean values of erythrocyte membrane phospholipids fractions (PE, PC and SM) in diabetic group were significantly increased compared to control group, while these values were significantly decreased in treated flaxseed and fish oils groups when compared to diabetic group. The mean value of PS was not changed during the experimental period.

There was a positive correlation between IR and each of glucose, 8-OHdG, isoprostanes, total lipids, cholesterol, TG, total phospholipids, PC, PE and SM in all studied groups, while negative correlation was observed between IR and each of insulin, total proteins, SOD and total ATPase in all studied groups.

This study concluded that, flaxseed and fish oils administration has a beneficial effect on decreasing insulin resistance in diabetic rats through the scavenging of free radicals and increasing in superoxide dismutase. This study also concluded that, fish oil more effective than flaxseed oil.