Summary and Conclusion
"We are what we eat"

Intake of HFD leads to hyperlipidemia, a pathological condition, characterised by an imbalance between caloric value of food consumed and energy expended. To combat such an imbalance, diets rich in essential fatty acids are recommended from vegetable origin. Flaxseed oil is one such oil rich in EFA. Recently, there has been a moderate resurgence in the use of flaxseed oil in diet known for its lignan and ALA content.

However, the biochemical basis of the benefits of flaxseed oil consumption in hyperlipidemic conditions is not known. The present study is aimed at assessing the protective effect of flaxseed oil in high fat diet fed rats.

The study made the following observations.

- A dose of 1000 mg of flaxseed oil/kg body weight/day for 60 days was found to be effective in reducing the body weight, organ weights and plasma lipid profile in high fat diet fed rats and hence further biochemical changes were analyzed with this dose.

- Histopathological and ECG studies revealed changes related to hyperlipidemia in HFD rats. Flaxseed oil administration showed protection against HFD. No significant changes were observed for FO rats which shows its protective nature.
Alterations in serum pathophysiological enzymes and general biochemical parameters were assessed in high fat diet induced rats. These changes were maintained at near normalcy in HFD+FO rats indicating the nontoxic effect of flaxseed oil.

Haematological parameters – RBC count, platelet count, Hb content, hematocrit value, prothrombin time and the levels of fibrinogen were increased in HFD rats, but were maintained at near normal levels upon treatment with flaxseed oil.

The membrane bound Na\(^+\)K\(^+\)ATPase, Ca\(^{2+}\)ATPase, and Mg\(^{2+}\)ATPase were significantly decreased in erythrocytes, heart and liver of HFD fed rats. Flaxseed oil administration significantly increased these membrane bound ATPase levels, thus maintaining its normal function.

A significant elevation in the levels of Na\(^+\), Ca\(^{2+}\) and a decrease in the levels of K\(^+\) and Mg\(^{2+}\) were observed in HFD rats. On treatment with flaxseed oil these altered levels were retained to near normal levels.

The increased level of lipid peroxides in serum, heart, liver and decreased levels of GSH and activities of SOD, CAT, GPx and GST were observed in erythrocytes, heart and liver of HFD rats. Upon flaxseed oil treatment the levels of TBARS were significantly decreased with an increase in the activity of antioxidant enzymes which reveals the antioxidant potential of flaxseed oil.
The elevated levels of lipid profile in heart, aorta and liver of HFD rats were significantly decreased upon flaxseed oil administration. Plasma lipoprotein profile revealed significant increase in LDL lipoprotein fraction, VLDL, HDL : LDL, TC : HDL and decrease in HDL cholesterol levels were noted in HFD rats. Treatment with flaxseed oil decreased the levels of LDL, VLDL, LDL : HDL, TC : HDL with an increase in HDL levels.

The altered lipid metabolizing enzyme levels in HFD fed rats were maintained at near normal levels upon flax seed oil administration showing its hypolipidemic effect.

Increased hepatic, fecal bile acids and sterol levels in HFD rats were noted when compared to normal control and further excretion of fecal bile acids and sterols were observed in flaxseed oil treated HFD rats.

LDH isoenzyme pattern showed more prominent bands in HFD rats whereas, less prominent bands were observed upon flaxseed oil treatment.

Lipoprotein profile revealed a prominent pre β fraction in HFD rats, whereas in HFD + FO rats a significant reduction in the pre β fraction showing the hypolipidemic effect of FO.
Scanning electron microscopic studies revealed minimal morphological changes in aortic tissues of flaxseed oil treated rats than HFD rats.

The present work focussed light on the prophylactic effect of flaxseed oil on HFD. These findings will perhaps boost up the extensive use of this oil in diet. From the data presented, it could be added that flaxseed oil can be included as a dietary oil just like other oils. Further studies on clinical trials are warranted to establish its protective effect in improving the standard of health care.