WG has an amazing ability to concentrate nutrients from the soil. Some studies suggest that the WG is harvested at the “jointing” stage, when the chlorophyll content, enzymatic activity and nutrient content are at peak. Extracts of WG have been shown to inhibit ascorbate-Fe$^{2+}$ induced lipid peroxidation in rat liver mitochondria and have shown higher ORAC values than other vegetables (Shermer, 2008). WG supplementation provides better protection against LP by reducing the oxidative stress (Shyam et al., 2007) and in the therapy of anaemia (Sri Jaya and Gayathri, 2009). It controls myelotoxicity (Bar-Sela et al., 2007). WG juice as a good supplement for blood transfusion patients reduces the frequency of required transfusion (Marawaha et al., 2004) and gives supportive care to cancer patients (Dey et al., 2006).

WG is a nutritional supplement rich in flavonoids and phenolic compounds and shows good pharmacological property (Ashok, 2011). Epidemiological and pharmacological studies have indicated that consumption of flavonoids is associated with many beneficial effects, including antioxidative, antiviral, anti-cancer, anti-inflammatory as well as cardio protective effects (Chen et al., 2012; Mekhora et al., 2012; Khalil et al., 2011; Li et al., 2008).

In our study, our focus was to understand the potential of WG as an oxidative stress quencher and a hepatoprotective agent. Information on the qualitative and quantitative compositions, antioxidant property and the efficacy of WG in various aspects on Alcohol + ΔPUFA induced hepatotoxicity would provide a scientific basis to justify the therapeutic use of WG.

**Rationale for choosing wheatgrass for the study**

The search for plant derived newer hepatoprotective drugs is going on relentlessly throughout the world. No drug has been proved to be cheap and safe without any contraindications. Hence, the study was focused on WG for the reasons mentioned below.

1. Increased presence of antioxidant components.
2. Easy availability of WG throughout India
3. Relatively non-toxic nature of WG

Hence, our study investigates the effect of WG on Alcohol + ΔPUFA induced hepatotoxicity in experimental animals.

**OBJECTIVES OF THE STUDY**
In recent years there has been an escalation in alcohol abuse and inevitably alcohol related liver disease is becoming an increasingly important cause of morbidity and mortality. Alcohol, which itself is a direct toxin is also known to enhance the acute toxicity when taken along with a variety of other agents, especially with high fat diet. Alcoholics usually after a heavy binge of alcohol take fried food items normally made up of polyunsaturated fatty acids. Various nutritional and biochemical studies have suggested that the combined ingestion of Alcohol + ∆PUFA causes excessive oxidative stress resulting in toxic pathological conditions.

At present there is a resurgence of interest in natural principles for the treatment of various ailments, chiefly because of the prohibitive cost of allopathic drugs, their unavailability in remote areas and the popular belief that naturally occurring products are without any adverse side effects. Among natural products, phenolics and flavonoids are attracting increasing interest because of the beneficial effects in human health.

Due to the presence of potent antioxidant agents in plants, there are number of herbal medicines in Ayurveda which are being increasingly used to treat liver diseases. Wheat (Triticumaestivum) germinated over a period of 6 to 10 days is known as wheatgrass (WG). WG is also known as ‘complete food’ as it contains vitamin C and E, β carotene, ferulic acid, vanilic acid and phenols especially flavonoids. WG extract is a rich source of chlorophyll, which is found to be responsible for inhibiting the metabolic activation of carcinogens. WG juice is found to have healing properties in various degenerative diseases and it benefits the blood cell, bone, glands, kidney and other parts of the body. WG, a natural food supplement has received lot of attention in the research world recently because of its health beneficial aspects. This prompted us to investigate on the biological activity of WG against Alcohol + ∆PUFA induced liver toxicity.
We applied five different strategies to evaluate the impact of WG on alcohol and ∆PUFA induced toxicity.

1. **The chemical approach** – This involves measuring the chemical end products of oxidative damage within biological samples.
   - Under this, we evaluated the levels of TBARS and hydroperoxides, the main products of lipid peroxidation in plasma, liver, heart and kidney

2. **The balance approach** – This involves measuring the antioxidant defense status to analyse the balance between prooxidant and antioxidant status.
   - In this approach, we measured the levels of non-enzymatic antioxidants, vitamins C and E in plasma, liver and kidney
   - The levels of reduced glutathione in plasma, liver, heart and kidney
   - The activities of enzymatic antioxidants SOD, CAT, GPx in hemolysate, liver, heart and kidney

3. **The potential approach** – This involves comparing the vulnerability of biological sample to oxidation after external prooxidant stress.
   - Under this, we measured the activities of ALP, GGT, AST, ALT, the potential markers of liver damage in hemolysate.
   - Histopathological changes in liver and kidney.

4. **The clinical approach** – This involves measuring the outcomes of oxidative stress.
   - Hence we analyzed the levels of lipids such as cholesterol, triglycerides, FFA and phospholipids, whose levels directly reflect on the extent of lipid peroxidation.
   - The levels of cytokine markers IL-1, IL-6, TNF-α and TGF-β were analyzed to understand the extent of inflammation

5. **The cellular approach** – This involves detection of changes in cellular components.
   - Under this, we carried out the assay of PLA and PLC, the major membrane remodeling enzymes in liver
• The phospholipid fatty acid composition in liver, an indicator of membrane damage
• The activities of matrix metalloproteinase, the major tissue repair enzymes
• The levels of tissue inhibitors of matrix metalloproteinase, a factor responsible for extracellular matrix homeostasis
• The levels of collagen, an indicator of the extent of fibrosis

6. The molecular approach- This involves identification of changes in gene protein expression
• Under this we analyzed the extent of DNA damage
• The induction of apoptosis to analyze the damage/ recovery due to treatment
• The changes in the signaling pathways PPAR-α, NFκB, STAT-3,Bcl-2,Bax and Caspase-3 that are related to either fatty liver or liver inflammation/ damage/Apoptosis