Inflammation is a major threat to human health and plays an important role in the development of various infectious and non-infectious diseases such as Alzheimer’s, heart disease, asthma, rheumatoid arthritis, etc. Depending on the intensity of this process, mediators generated in the inflammatory site can reach the circulation and cause fever. Clinical treatment of inflammatory diseases is dependent on drugs, which belong either to the non-steroidal or to the steroidal chemical groups. The use of non-steroidal anti-inflammatory drugs (NSAIDs) in the treatment of diseases associated with inflammatory reactions has potent activity, but long term uses of these drugs have various and severe adverse effects on liver, gastrointestinal tract, etc. Hence, new anti-inflammatory and analgesic drugs lacking such effects are being searched for as alternatives to NSAIDs.

Owing to safety concerns associated with the use of synthetic anti-inflammatory and analgesic agents, generally the people prefer to take natural anti-inflammatory and analgesic treatments from edible materials such as fruits, spices, herbs and vegetables. Therefore, the development and utilization of more effective anti-inflammatory and analgesic agents with fewer side effects from natural origin are desired.

Liver diseases are a serious health problem. In the absence of reliable liver protective drugs in allopathic medical practices, herbs play an important role in the management of various liver disorders. Numerous medicinal plants and their formulations are used for liver disorders in ethnomedical practices and in traditional system of medicine in India. Medicinal plants are believed to be an important source of new chemical substances with potential therapeutic effect. The research into plants with alleged folkloric use as pain relievers, anti-inflammatory and hepatoprotective agents, should therefore be viewed as a fruitful and logical research strategy in search for new drugs.

In the present study, the prime objective was to select a medicinal plant which can be used as anti-inflammatory and hepatoprotective agent with fewer/without side effects. On the basis of literature survey, medicinal uses and availability of the plant, Woodfordia fruticosa Kurz. flowers were selected for evaluation of anti-inflammatory and hepatoprotective property.
**Woodfordia fruticosa** Kurz. belongs to the family Lythraceae, is a much branched beautiful shrub. It is the plant of tropical and subtropical regions with a long history of medicinal use. English names of the plant are Fire Flame Bush and Shiranjitea. The plant is abundantly present throughout India. Locally (In Gujarat) it is known as Dhavdi. All parts of this plant possess valuable medicinal properties viz. anti-inflammatory, anti-tumor, hepatoprotective and free radicals scavenging activity, but flowers are in maximum demand. The flowers are being used in the preparation of Ayurvedic fermented drugs called ‘Aristha’s’ and ‘Asava’s’, and very popular in the Indian subcontinent as also in other South Asian countries.

For the identification of plant, macroscopic and microscopic study of *Woodfordia fruticosa* flowers was done by evaluating different characteristics from free hand sections of fresh flower and dried powder. The T.S of the pedicel showed single layered epidermis, with a fairly thick cuticle. The unicellular trichomes were present in this layer. The rosette and cluster crystals of calcium oxalate were found in pedicel and calyx. Anomocytic, actinocytic and anisocytic stromata were also found in calyx. The anther lobes were tetrasporangiate; the T.S of anther lobe showed large colourless cells followed by a fibrous layer. The dried powder of *Woodfordia fruticosa* flowers was light in colour, slightly bitter and astringent in taste. Microscopic observation of dried powder showed the presence of straight wall cells of epidermis, cluster crystals of calcium oxalate and unicellular trichomes. The pollen grains were present either singly or in a group.

*Woodfordia fruticosa* flowers were collected in March, 2008 from Girnar region, Junagadh, dried, powdered and stored in air tight bottles. The dried powder was defatted with petroleum ether and then extracted in methanol in soxhlet apparatus. In all further studies methanol extract was used (WFM).

The result of physicochemical analysis showed 8% loss on drying. It contained 5.45% total ash, 0.57% acid insoluble ash and 2.47% water soluble ash. The maximum percentage of extractive value was obtained in water (41.59%) followed by methanol (32.77%). The extract was acidic in nature and maximum solubility was in DMF, methanol and DMSO. Mercury and arsenic were present in very minor amount in crude powder and extract but they were within the permissible limits reported by The Ayurvedic Pharmacopoeia of India; lead, chromium and cadmium were not detected.
The preliminary qualitative phytochemical analysis of crude powder and WFM revealed the presence of alkaloids, flavonoids, phlobotannins, saponins, tannins and triterpenes. Tannins and alkaloids were present in more amount as compared to other phytoconstituents. Quantitatively estimated total phenol content was higher than that of flavonoid content in the methanol extract.

Anti-inflammatory studies of WFM was done using carrageenan, histamine, dextran, serotonin and formaldehyde induced rat paw edema acute models; cotton pellet induced granuloma chronic model and formaldehyde induced paw licking test as analgesic model. Among these models, carrageenan induced rat paw edema is most widely used for evaluation of anti-inflammatory properties of medicinal plants. WFM inhibited the carrageenan induced paw edema at both early and late phase. In histamine and dextran induced paw edema, dose dependent inhibition of paw volume was observed at both early and late phase. WFM also inhibited the increase in paw volume in serotonin and formaldehyde induced edema. In chronic inflammatory model, WFM dose dependently reduced the granuloma tissue formation. WFM effectively reduced the frequency of paw licking at both early and late phase in formaldehyde induced paw licking test. Thus, WFM showed promising activity in all the studied anti-inflammatory models, but it was more effective in acute models than in chronic model.

Hepatoprotective study of WFM was done by diclofenac, carbon tetrachloride and acetaminophen (APAP) induced hepatotoxicity in rats. In all the three models, different serum biochemical parameters (viz. total protein, albumin, blood urea nitrogen, alkaline phosphatase, aspartate aminotransferase and alanine aminotransferase), liver total protein, liver antioxidant glutathione reduced, and antioxidant enzymes viz. catalase and glutathione peroxidase and liver histopathological study were carried out.

Diclofenac, is one of the most widely used NSAID for the treatment of inflammatory diseases and analgesia. However, long term use of diclofenac causes hepatotoxicity. In the present study, administration of diclofenac to the animals caused significant changes in the serum biochemical parameters and liver antioxidants as compared to the normal control group. Treatment with WFM restored the level of serum
biochemical parameters and liver antioxidants towards normalization; and the effect of WFM on these parameters was comparable to that of standard silymarin.

CCl₄ induced hepatotoxicity is frequently used model for evaluating the hepatoprotective properties of medicinal plants. APAP has been widely used as a medicine for pain and fever relief. Since APAP can be purchased easily from any pharmaceutical outlet and even from supermarkets, without prescriptions from clinicians, it is commonly considered as a ‘‘safe drug’’ when taken within the suggested therapeutic dose. However, APAP can be hepatotoxic when an overdose is administered. The administration of CCl₄ and APAP to the animals caused the alteration in serum biochemical parameters and liver antioxidants as compared to the normal control group. Treatment with WFM restored the serum biochemical parameters and liver antioxidants towards normalization. The hepatoprotective effect of WFM was also confirmed by histopathological study. The severe hepatocytes necrosis, periportal mononuclear cell infiltration, cytoplasmic vacuolation were seen in diclofenac, CCl₄ and APAP intoxicated animals. Administration of WFM preserved the structural integrity of the hepatocellular membrane. The results of histopathological study supported the result obtained from serum biochemical and liver antioxidants parameters.

Any drug whether promising or more promising without toxicity evaluation, loses its importance because non toxic nature of the drug is more important than efficacy. Therefore, acute toxicity study was done to check toxicity profile of the WFM. No adverse reaction or mortality was observed in rats up to highest dose (3600 mg/kg, b.w.) studied. No significant change was observed in feed and water consumption and body weight of animals treated with WFM as compared to normal control group. No significant changes were recorded in organ weight of the animals. Hematological parameters were also not affected.

Overall it can be concluded that methanol extract of *Woodfordia fruticosa* flowers had good potential as anti-inflammatory, analgesic and hepatoprotective agent and so this plant can be used to discover bioactive natural products that may serve as leads for the development of new pharmaceuticals.