Discussion
5. **DISCUSSION**

**Macroscopic and microscopic evaluation**

Macroscopical characters like shape, size and colour of the plant parts observed were consistent with the description of the taxon given in “The Wealth of India” (Sastri, 1962). Standardization of drugs from medicinal plants is very important for maintaining the quality and purity. In the present study, *Gmelina asiatica* Linn. is evaluated through macroscopic and microscopic study. The macroscopic study revealed that the plant showed diversified habit structure (Nadkarni, 1976) and rare distribution condition (Sastri, 1962).

The microscopic work of the plant showed the root bark consisted of lignified walls. The wood of root was made up many layers of thick walled fibers. The mature stem showed degenerated hollow pith. The palisade parenchyma was typical with rectangular columnar cells and arc shaped vascular bundle. Microscopic method is one of the simplest and cheapest methods for the evaluation of the plant drug though modern tools are available for evaluation (Singh *et al*., 2010).

The acicular crystals were present in the epidermal tissues. The vascular bundles showed xylem elements with prominent oval or hexagonal shaped parenchymatous cells. The vessels were numerous and occupied the major portion of the xylem elements. The phloem elements with bastfibres were distinct. Analyzing the plants by their anatomical characters often yields information that cannot be obtained by any other method. The anatomical structure of root, stem and leaf possesses similar characters to that of the family Verbenaceae (Metcalfe and Chalk, 1957). The microscopic study of *G.asiatica* is identical to the earlier work of (Chellappan *et al*., 2014) in *Gmelina arborea*.

**Pharmacognostic evaluation**

For pharmacognostical evaluation of the plant, the organoleptic and physico-chemical (Mukherjee, 2002), histochemical (Krishnamurthy, 1988) and powder analysis were carried out. The stem bark was brown in colour. Fragments of non-lignified fibres showed septate and aseptate fibres with wide lumen. The stone cells were seen in groups with pitted and striated lumen. The starch grains were oval. The scleroids were cone shaped. The prismatic crystals were reported to be present. The stem powder was acrid, bitter and woody odour, pinkish brown in colour. The fibre content was high. The stem powder due to high fibre content is believed to be a good laxative (Nadkarni, 1976).
The root bark was yellowish brown in colour. The stone cells and cone shaped scleroids were noted. The presence of stone cells is one of the distinguishing characters of the genus from its adulterant drugs. Acicular or rod shaped prismatic crystals of calcium oxalate were seen. The root powder was bitter, astringent and sweet in taste, dark blackish brown in colour, no specific odour, pungent in the post digestive effect and had hot potency, and heavy attribute. The roots alleviate vata and kapha dosas (Nadkarni, 1976).

The leaf was reported to be slightly darker to pale chlorophyllous green in colour. The leaf powder was astringent, fibrous and mucilaginous, greenish yellow colour, when fresh normal leafy odour. The fruits were sweet in taste, sweet in the post digestive effect and had cold potency. The fruit alleviates the pitta dosa (Nadkarni, 1976).

The powdered crude drugs can be identified based on the form, cytomorphological characters or by cell inclusions. The root and stem showed the presence of lignin, tannins, cutin, suberin and phenolic compounds. The physico-chemical characters such as loss on drying, ash values, extractive values are very useful to identify and authenticate the drug from the crushed or powdered plant material. In the present study, *Gmelina asiatica* in its dried form is expected to have a long shelf-life with reduced chance of microbial growth due to its low moisture content of 5.2%. Mean ash values (%) was found to be 5.0 (total ash), 1.02 (acid insoluble ash) and 3.0 (water soluble ash). Total ash value was relatively low, which may be due to low inorganic components. Ash value is useful in determining authenticity and purity of the drug and also these values are important for quantitative standards. Acid insoluble ash value indicates high digestibility when the plant is consumed.

This is the first time in *Gmelina asiatica* Linn. the vegetative parts like root, stem and leaf were physico-chemically evaluated. Use of plant extracts is considered to be therapeutically active than the consumption of whole plants. The selection of such solvent with good extractive value is most important to acquire more active components. The best solvents for extraction for root and stem was alcohol (16.7% and 11.2% respectively) in comparison with water (15.6% and 10.1% respectively), whereas, the leaf had higher extraction in water (14.2%) in comparison to alcohol (11.3%).

The histochemical study of *G. asiatica* exhibited the presence of phytochemicals such as lignin, starch, proteins, phenolics and tannins. The sections of stem, root and leaf showed the presence of phytochemicals. The histochemical study is an important tool to help in deciding the methods for phytochemical analysis. Pharmacognostical study of *G.asiatica*
revealed similar findings like the earlier study of *Persea macrantha* by Kulkarni *et al.*, (2011).

**Qualitative evaluation**

**Extraction analysis**

Activities of medicinal plants are safe in comparison with costly synthetic drugs that have adverse effects. This is possible because of the presence of potent chemical components in the plants, which are usually extracted using suitable solvents. The extractive values of the root, stem and leaf were comparatively higher in ethanol, methanol and water than other solvents. This result was quite deviating from the study made on the aerial parts of *Gmelina asiatica* Linn. by Merlin and Parthasarathy (2009), which showed a higher extractive percent in chloroform extract than the other solvents like ethanol and ethyl acetate.

**Phytochemical analysis**

The qualitative analysis of phytochemicals was performed for further confirmation of effective solvents among the five solvents extracted. Hence the root, stem and leaf were analysed for the presence of phytochemicals.

In root sample the alcoholic extracts and aqueous extracts were positive to flavonoids, whereas the ethyl acetate and chloroform extracts did not answer positively. The coumarin compounds answered for methanol and chloroform extracts but the other extracts like ethanol, ethyl acetate and aqueous did not show the sign of coumarins. The steroids, triterpenes, furan, quinine, tannin and phenol were positive in all the extracts, whereas alkaloid, sugar, acid and saponin were negative altogether.

In stem sample, the steroids were positive only in methanolic extract, in other extracts steroid was negative. The furan, tannin, and phenol were present in all the extracts, whereas triterpene, flavonoid, sugar, alkaloid, acid and saponin were absent. Similar to the root, the stem sample was also positive for coumarins only in methanolic and chloroform extracts. The quinine compound was positive only in stem alcoholic, ethyl acetate and chloroform extracts, but not present in aqueous extract.

In leaf sample triterpene, flavonoid, furan, tannin and phenol were present in all the extracts, whereas sugar, acid, saponin and alkaloid were absent. The steroid and quinone were positive only in methanolic extracts. The coumarin compound was positive only in methanolic and chloroform extracts.
In the work of Parekh, (2007), the methanolic extract of *Gmelina asiatica* Linn. reported the presence of saponins, steroids, cardiac glycosides and alkaloids (Meyer's reagent). In the present work, all the tested extracts of the root, stem and leaf for saponins (foam test) and alkaloids (Dragendorff’s reagent, Meyer's reagent and Wagner's reagent) was found to be negative. The phytochemicals like flavonoids, tannins, coumarins, phenol, furan and triterpenes were present in methanol and aqueous extract of root and leaf, but these phytochemicals except flavonoids were present in stem. Steroids were positive in all tested root extracts, whereas they were absent in leaf and stem extracts.

From these results it is confirmed that root and leaf possessed active constituents more than stem. Hence, for the first time the report of *Gmelina asiatica* Linn. was identified that the whole extract need not be necessary for pharmaceutical preparation, instead the root or leaf powder could be efficient as a medicinal drug. This result is comparable with the earlier work on *Gmelina arborea* root extracts by Satyanarayana *et al.*, (1985).

**Quantitative evaluation**

The metabolites which were positive in methanol and aqueous extracts were quantified. The estimation of phenol, flavonoid, protein, amino acid, carbohydrate and photosynthetic pigments were carried out. It is the first time the quantitative analysis of these phytochemicals analysed for individual vegetative parts of *Centella asiatica*. The quantity of phenol, flavonoid, protein, amino acid, carbohydrate was high in root than leaf, and stem had the lowest content. The phenol and tannin contents of the plants are essential for pharmaceutical preparations (Singh *et al.*, 2012).

**Analytical evaluation**

Phytochemistry or plant chemistry is a distinct discipline covering organic chemistry and plant biochemistry. It is concerned with the enormous variety of organic substances that are accumulated in plants and deals with the chemical structures of these substances, their biosynthesis, metabolism and their biological function. In all these operations, methods are needed for separation, purification and identification of the many different constituents present in plant parts.

**Thin Layer Chromatography**

Thin Layer Chromatography (TLC) of methanolic extract of root and leaf had 11 spots while stem had 6 spots. Aqueous extract of root showed 7 spots, leaf 6 spots and stem had
spots. *Gmelina asiatica* was analysed through TLC for first time. The number of spots corresponds to the presence of that many numbers of phytochemicals.

**High Performance Thin Layer Chromatography**

In recent years, advancement of chromatographic and spectral fingerprints plays an important role in the quality control of complex herbal medicines (Gong *et al*., 2005). The two prominent uses of HPTLC in the standardization of plant materials include fingerprint profiling for the assessment of chemical constituents of a drug and quantitative analysis of markers in plant drugs. Hence HPTLC method has been standardized for analysis of *Gmelina asiatica*.

The methanolic extract of root by HPTLC revealed 9 spots at Rf 0.01 to 0.96 quenched fluorescence at 366 nm. All spots quenched fluorescence at 254 nm, showed pale blue, blue and violet fluorescence at 366 nm. From the peaks and Rf values the results of TLC was confirmed to be correct.

The methanolic extract of stem revealed 8 spots at Rf 0.01 to 0.85 quenched fluorescence at 366 nm, whereas all spots quenched fluorescence at 254 nm, showed pale blue, blue and violet fluorescence at 366 nm. From the peaks and Rf values the results of TLC was confirmed to be correct.

The methanolic extract of leaf revealed 9 spots at Rf 0.16 to 0.90 quenched fluorescence at 366 nm. All spots quenched fluorescence at 254 nm, showed pale blue, blue and violet fluorescence at 366 nm. From the peaks and Rf values the results of TLC was confirmed to be correct.

In this study, aqueous extract of root revealed 7 phyto constituents at Rf 0.06 to 0.68 quenched fluorescence at 366 nm. The stem aqueous extract revealed 3 phyto constituents at Rf 0.83 to 0.58 and the leaf aqueous extract revealed 6 phyto constituents at Rf 0.68 to 0.09 which were less pronounced comparatively.

In the previous work of Akhilesh, *et al*., (2008), *Gmelina arborea* aerial parts were analysed through HPTLC for Iridoid glycosides. The present work results of *G.asiatica* could be comparable with HPTLC fingerprint analysis.

Isolation and estimation of β-sitosterol using HPTLC in roots of *Gmelina arborea* Roxb. were reported by Niyati, *et al*., (2012). The sitosterol like compounds was not reported
in *Gmelina asiatica*. The TLC and HPTLC work was not performed earlier in *Gmelina asiatica*.

**GC-MS analysis**

Gas chromatography has a very wide field of applications. The principle of gas chromatography is adsorption and partition. Within the family of chromatography-based methods, gas chromatography (GC) is one of the most widely used techniques. It was first described by James and Martin in 1952 and has become one of the most important tools for the separation of volatile compounds.

Mass spectrometry is the most sensitive and selective method for molecular analysis and can yield information on the molecular weight as well as the structure of the molecule. Combining chromatography with mass spectrometry (GC-MS) provides the advantage of both chromatography as a separation method and mass spectrometry as an identification method.

In the present study, eight compounds were identified in methanolic extract of root, four compounds in methanolic extract of stem and six compounds in methanolic extract of leaf. The prevailing compounds in methanolic extract of root were 3-O-ethyl-d-glucose, Tetradecanoic acid-ethyl ester, Phytol, 9,12,15-Octadecatrienoic acid, 1,2-Benzene dicarboxylic acid - diisooctyl ester, Hexanediolic acid bis (2 – ethyl hexyl) ester, Squalene and Vitamin-E.

Four compounds were identified in methanolic extract of the stem, the prevailing compounds were 3-O-Methyl-d-glucose, Tetradeconic acid-ethyl ester, Hexanediolic acid bis (2-ethylhexyl) ester and 1,2, benzene dicarboxylic acid diisooctyl ester. Six compounds of leaf methanolic extract was showing 3-O-Methyl-d-glucose, Phytol, 9,12,15-Octadecatrienoic acid, Hexanediolic acid bis (2-ethylhexyl) ester, 1,2-Benzene dicarboxylic acid- diisooctyl ester, Squalene and Vitamin E.

The presence of various bioactive compounds confirms the application of *Gmelina asiatica* Linn. for various ailments by traditional practitioners. However, isolation of individual phytochemical constituents may proceed to find a novel drug.

In GC-MS analysis the existence of various compounds with different chemical structures for chloroform and ethanolic extract of whole plant was reported by Merlin and Parthasarathy in the year 2009. As per their report, the chloroform extract revealed twenty two different compounds and the ethanolic extract showed 12 compounds. The compounds like 1, 2-Benzene-di-carboxylic acid, di-iso octyl ester (31.22 %) was the prevailing
compound in chloroform extract and Monolinoleoyl glycerol trimethyl silyl ether (38.51%) was the major constituent of ethanolic extract. The present work revealed similar ester compounds in methanol extracts. The root and leaf methanol extracts were showing more number of compounds than stem. Hence this work can authenticate that root and leaf have potent drugs than stem. In *Gmelina arborea* (Kulkarni *et al*., 2013) coumarin compounds was identified as active drugs responsible for anti-inflammatory, antidiabetic drug. In the present work the ester compounds and phytol reported through GC-MS study could be responsible for the activity.

**Biological evaluation**

**Antimicrobial activity**

The potential for developing antimicrobials from higher plants appears rewarding as it will lead to the development of a phytomedicine to act against microbes. Plant-based antimicrobials have enormous therapeutic potential as they can serve the purpose with lesser side effects that are often associated with synthetic antimicrobials (Iwu *et al*., 1999). Continued further exploration of plant-derived antimicrobials is needed today. Further research is necessary to determine the identity of the antibacterial compounds from within these plants and also to determine their full spectrum of efficacy. However, the present study of *in vitro* antimicrobial evaluation of *Gmelina asiatica* Linn. formed a primary platform for pharmacological studies.

The root methanolic extract showed inhibitory activity for all the tested concentrations for two bacterial strains of *Vibrio cholera* and *Salmonella typhimurium* and the zone of inhibition was 10 mm and 14 mm respectively for 1000 µg concentration. The bacterial strains like *Citrobacter freundii, Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris, Salmonella typhi* and *Staphylococcus aureus* were inhibited in 1000 µg and 500 µg concentrations with the highest zone of inhibition of 13 mm. The root methanolic extract was least active on *Bacillus cereus* and *Pseudomonas aeruginosa*.

The stem methanolic extract was active against *Salmonella typhi* in all concentrations with the maximum zone of inhibition of 9 mm. The bacterial strains such as *Salmonella typhimurium, Proteus vulgaris, Staphylococcus aureus, Vibrio cholera* and *Pseudomonas aeruginosa* were inhibited in 1000 µg and 500 µg concentrations with the highest zone of inhibition of 13 mm. The least inhibition was observed on *Bacillus cereus, Escherichia coli*,
Klebsiella pneumoniae and Citrobacter freundii with the zone of inhibition range of 10 mm to 11 mm.

The leaf methanolic extract was active against Salmonella typhi in all concentrations with a zone of inhibition of 10 mm. The bacterial strains such as Salmonella typhimurium, Proteus vulgaris, Staphylococcus aureus, Vibrio cholera and Pseudomonas aeruginosa were inhibited in 1000 µg and 500 µg concentrations and the zone of inhibition was 13 mm. Minumum inhibition was observed on Bacillus cereus, Escherichia coli, Klebsiella pneumoniae and Citrobacter freundii with inhibition zone in the range of 9 mm to 10 mm.

The aqueous extract was positive only for root extracts. The root aqueous extract answered for two bacterial strains only (Salmonella typhimurium and Escherichia coli) with a maximum zone of inhibition of 7 mm in 1000 µg concentration.

Among the tested extracts, methanol extract of root inhibited the growth of C. aureus and C. albicans whereas leaf and stem did not inhibit any of the tested fungal strains. Aqueous extracts (root, stem and leaf) had no detectable antifungal activity against the fungal pathogens.

Amongst aqueous and methanol extracts of the studied plant samples, methanol extracts were found to be more active against the tested microbial strains than the aqueous extracts. The root sample was more active than leaf and stem methanolic extracts.

The antimicrobial activity of Gmelina asiatica Linn.was performed earlier in aqueous and methanolic extracts of whole plant by Parekh (2009). The test results did not show significant activity against Staphylococcus aureus, Escherichia coli and Klebsiella pneumoniae, whereas in the present study root and leaf methanolic extract showed strong antibacterial activity. The aqueous plant part extracts except root extract were not active for all tested bacterial strains. The root aqueous extract was found to be effective against Escherichia coli and Klebsiella pneumoniae.

Hence the present study helps to identify the active vegetative parts of the plant, as well as the concentration of the specific vegetative part against the tested microbes.

**In vitro antioxidant activity**

Antioxidants may offer resistance against oxidative stress by scavenging the free radicals and by inhibiting lipid peroxidation. Present study showed that a number of scavenging activity exert potent antioxidant actions. Superoxide radicals (O₂⁻) and peroxyl
radicals (ROO’), have been associated with heart disease and carcinogenesis (Steer et al., 2002). Potential sources of antioxidants have been found in leaves, stem and roots of *G. asiatica* plant.

The nitric oxide scavenging activity of methanolic root extract of *G. asiatica* was reported to be highly active with 55% to 51% activity in 0.8 mg concentration. The aqueous extract of root showed 40% to 31% activity and the higher percentage of activity was reported in 0.4 mg. In stem nitric oxide activity was more in methanol extract than in aqueous extract. The highly active concentration was 0.4 mg in both the extracts. The highest percentage was 53% and least was 42%. The leaf extracts showed 60% highest range and 42% lowest range of antioxidant activity overall in methanolic extract and 42% to 34% range was reported in aqueous extract. In both extracts maximum activity was observed in 0.4 mg concentration.

Nitric oxide (NO) is a reactive free radical produced by phagocytes and endothelial cells, to yield more reactive species such as peroxynitrite which can be decomposed to form OH radical. The level of nitric oxide was significantly reduced in this study by the crude extract. Since NO plays a crucial role in the pathogenesis of inflammation, this may explain the use of *G. asiatica* for the treatment of inflammation and for wound healing.

The superoxide scavenging activity was reported to be positive in three vegetative parts for both extracts (methanol and aqueous). The leaf showed highest range 89% to 62% in methanolic extract, 1.5 mg was the highly active concentration overall. In aqueous extract the antioxidant range was 64% to 50% and 1mg was the effective concentration. The root was showing 72% to 68% activity with active concentration as 1mg and in stem 66% to 62% was the range of activity and active concentration was 1.5 mg in methanolic extract. The activity of aqueous extract of root was high in 1mg (60%), whereas in stem 1.5 mg was effective concentration showing 48%.

Superoxide anion radical is one of the strongest reactive oxygen species among the free radicals that are generated. The scavenging activity of this radical by the plant extract compared favourably with the standard reagent such as gallic acid suggesting that the plant is also a potent scavenger of superoxide radical.

The reducing power activity of *G. asiatica* extracts was found to be more in leaf when compared to stem and root. The reducing power was reported to be highest in 2.5mg in methanol extract and aqueous extract.
Iron chelating activity in methanol extract was reported in higher concentrations of leaf (1 mg-3% and 2 mg-13%) and root (2 mg-1%), whereas stem did not show any activity. Aqueous extract of the plant parts did not show any chelating activity.

Plants with antioxidant activities have been reported to possess free radical scavenging activity. Free radicals are known as major contributors to several clinical disorders such as diabetes mellitus, cancer, liver diseases, renal failure and degenerative diseases as a result of deficient natural antioxidant defense mechanism. The results of the present study indicate that the extracts presented high radical scavenging activities, which could be related to the inherent nature of phenolic and flavonoid compounds, thus contributing to their electron transfer/ hydrogen donating ability. High correlation between radical scavenging and phenolic content has been reported in cereal (Peterson et al., 2001), fruits (Gao et al., 2000; Jimenez-Escrig et al., 2001), beverages (Fogliano et al., 1999), and culinary herbs (Zheng and Wang, 2001). From the results of present study, methanol solvent for the extraction of radical scavenging compounds had higher activity.

In general, methanol extracts exhibited the highest reducing capability than water extracts. This confirms that methanol was the most efficient solvent for the extraction of reducing agents from the selected plants, which is in agreement with previous studies (Amensour et al., 2009; Arabshahi-Delouee and Urooj, 2007). The methanol extracts containing high amounts of total phenolics displayed the highest reducing power, whereas water extracts containing the lowest amounts of total phenolics were the weakest. This is similar to the previously reported work on the correlation between reducing power and total phenolic content (Benzeie et al., 1999; Gao et al., 2000; Zhu et al., 2002; Amarowicz et al., 2004; Arabshahi-Delouee and Urooj 2007).

**In-vivo study**

**Acute toxic study**

The kidney function test of the control animal (Urea-12.23 mg/dl, Uric acid-9.843 mg/dl, Creatinine-0.5833 mg/dl), was compared with the test animals which were fed with aerial parts (Urea-14.15 mg/dl, Uric acid-10.18 mg/dl, Creatinine-0.5933 mg/dl) and fed with sub-aerial parts (Urea-14.33 mg/dl, Uric acid-10.5 mg/dl, Creatinine-0.483 mg/dl). The kidney function test did not show any adverse changes.

The liver function test of the control animal (SGPT-34.05 IU/L, SGOT-41.4 IU/L and AP-333.7 IU/L), was comparable to the test animals, which were fed with aerial parts (SGPT-
33.37 IU/L, SGOT-42.05 IU/L and AP-347.3 IU/L) and fed with sub-aerial parts (SGPT-31.18 IU/L, SGOT-47.3 IU/L and AP-366.3 IU/L).

The body weight of the control animal on 1st day (151g), 15th day (150.2 g) and 29th day (149.2 g); the aerial parts fed mouse was (1st day166 g), (15th day166.2 g) and (29th day 166.2 g); sub aerial parts fed (1st day154.4 g), (15th day154.2 g) and (29th day 154.2 g). There was no significant change noticed in body weight. The study of acute toxicity revealed that root, stem and leaf of *Gmelina asiatica* are not toxic in tested (50 mg/kg to 2000 mg/kg) dosages.

As there is no death even after 2 g dose to the mice (which is equal to the single dose for human) estimation of LD$_{50}$ was terminated as the drugs being proved innocuous. Drug *Gmelina asiatica* Linn.is a traditionally used Siddha Medicine. The various literature evidences proved the safety and common use by human subjects from time unknown. The present results from toxicity studies reconfirmed the safety of the traditional herbal medicine.

All substances are poisons but the right dose differentiates a poison from remedy. (Paracelsus 1493-1541). This concept is the fundamental principle of toxicology and hazard assessment. Medicinal plants play a key role in the human health care because of their efficacy, safety and lesser adverse effects. When herbal drugs are used as a therapeutic substance for treating various ailments, it becomes an essential requirement to fulfil the guidelines formulated by World Health Organization (WHO).

The earlier study of *Gmelina asiatica* by Merlin and Parthasarathy, (2011) revealed that the chloroform and ethanol extracts were not toxic in 2 g of aerial parts, the similar results were reported in the present study with methanol and aqueous extracts of aerial and underground parts.

**Anti-ulcer activity**

In the pylorus ligation induced ulcer, the peak inhibition percentages of ulcer have been analysed. The root showed higher ulcer inhibition in the range of 53% to 68% than that of leaf (range of 44 to 48%) with stem at the lowest level (range of 11 to 21%). It was also visible that the aqueous extracts were showing more inhibition (root 68%, stem 22% and leaf 48%) than that of methanolic extracts (root 53%, stem 21% and leaf 44%) and powdered samples (root 53%, stem 11% and leaf 44%).
It was also visible that peak percentage of ulcer inhibition in cold stress induced model, the aqueous extracts (root 48%, stem 20% and leaf 38%) and methanolic extracts (root 48%, stem 19% and leaf 30%) were showing more inhibition than powdered samples (root 39%, stem 9% and leaf 21%). The mean gastric volume and acidity level were controlled in all samples of root and leaf than that of stem.

In aspirin induced ulcers, the peak inhibition percentage of ulcer in methanolic extract of root was 64%, the stem 23% and the leaf was 39%. The peak inhibition percentage of ulcer in aqueous extract of root was 64%, stem 13% and leaf was 39%. The peak inhibition percentage of ulcer of powdered sample of root was 61%, stem 23% and leaf was 37%. The root showed higher ulcer inhibition than that of leaf with stem at the lowest level. It was also noticed that the aqueous extracts, methanolic extracts and powdered sample were showing comparable inhibition. Similar to standard Ranitidine (10mg/kg) administered mice, the root and leaf had reduced the gastric volume secretion, free and total acidity in powdered as well as extracted samples.

The root and leaf drugs rendered a dose-dependent protection from all the three induced models of ulceration. On the whole, methanolic extract of plant parts showed marginally higher inhibition than aqueous extract and powdered drug.

It is known that excess acid formation is among many factors increasing risk of gastric ulcer formation due to stress, use of steroids and non-steroidal anti-inflammatory drugs (NSAIDS) (Ray et al., 1990). Ulcerative lesions of the gastrointestinal tract are one of the major side effects associated with the use of NSAIDS. Oxygen derived free radicals, primarily super oxide anions, hydroxyl radicals and lipid peroxides play an important role in treating acute experimental gastric lesions (Body et al., 1981; Das and Banerjee 1993). NSAIDS are commonly used to treat pain and inflammation (Ivey, 1988). Hence, it is the utmost necessity of natural drugs which provide wound healing property, acid control property and hinder excess acid secretion.

In earlier work of Giri et al., (2009), the hydroalcoholic extract of leaves of Gmelina arborea were tested against ulcer activity through three models (pylorous ligation, cold stress & aspirin induced) and the results were discussed. The similar type of results was observed in the present study on vegetative part powders (root, stem & leaf), methanolic and aqueous extracts of Gmelina asiatica. The report of the plant is not only first hand information given to pharmaceutical industry but also the safety of drug against ulcerogenesis.