SUMMARY

Medicinal plants are of great importance to the health of individuals and communities. The medicinal value of the plants is because of various chemicals present in them that produce a definite physiological action on the human body. Plants have played a significant role in maintaining human health and improving the quality of human life for thousands of years and have served human beings as valuable components of medicines, seasonings, beverages, cosmetics, dyes, etc. Herbal drugs have demonstrated a broad spectrum of biological activities.

Recently human pathogenic microorganisms have developed resistance as a result of the indiscriminate use of commercial antimicrobial drugs commonly employed in the treatment of infectious diseases. This situation and the undesirable side effects of certain antibiotics, and the emergence of previously uncommon infections, has forced scientists to look for new antimicrobial substances from other sources, such as medicinal plants. The screening of plant extracts and plant products for antimicrobial activity has shown that plants represent a potential source of new antiinfective agents.

Antioxidants are the substances that are able to prevent or inhibit oxidation processes in human body as well as in food products. Many medicinal plants contain large amounts of antioxidants such as polyphenols which play an important role in adsorbing and neutralizing free radicals, quenching singlet and triplet oxygen or decomposing peroxides. There has been an increasing interest in the use of natural antioxidants such as tocopherols and flavonoids, because these natural antioxidants avoid the toxicity problems which arise from the use of synthetic antioxidants such as butylated hydroxy toluene (BHT), butylated hydroxy anisole (BHA), propyl gallate (PG) and tertbutyl hydroquinone (TBHQ).

Pharmacognosy basically deals with the standardization, authentication and study of natural drugs. Much of the research in pharmacognosy has been done in identifying controversial species of plants, authentication of commonly used traditional medicinal plants through morphological, histological, phytochemical and physicochemical parameters in plants, prescribed by an authoritative source.
Gastric hyperacidity and gastroduodenal ulcers are common global problems. Gastric ulcers, one of the most widespread diseases, are believed to be due to an imbalance between acid and pepsin along with weakness of the mucosal barrier. Hyperacidity (hyperchlorhydria) is a pathological condition due to hypersecretion of hydrochloric acid from the parietal cell of the gastric mucosa through the proton pumping H+/K+ATPase. There are three major causes of the ulcer: infection, certain type of medication and disorders that cause over secretion of stomach juices when balance between some gastroprotective and aggressive factors are lost. Major aggressive factors are acid, pepsin, *Helicobacter pylori* and bile salts. Defensive factors mainly involve mucus-bicarbonate secretion and prostaglandins. The rise in gastric acidity and peptic activity are usually a manifestation of a physiological disturbance affecting one or more mechanisms which normally regulate gastric secretion. Activity of the gastric secretary cells has been found to be stimulated by caffeine, alcohol, hydrochloric acid, sodium chloride, non-steroidal anti-inflammatory drugs (NSAIDS) and stress. Even the normal rate of acid secretion may cause ulceration in the breached mucosa when some gastroprotective factors are lost. Although there are many drugs used for the treatment of gastric ulcers, most of them produce several adverse reactions. Therefore, interest in the use of natural products as sources of new drugs for the treatment of ulcer has significantly increased.

Considering the above, in the present study, 16 different plants were screened for their antimicrobial and antioxidant properties. The selected plants were *Alstonia scholaris* R. Br. (Apocynaceae), *Ammannia baccifera* L. (Lythraceae), *Annona squamosa* Linn. (Annonaceae), *Aristolochia bracteolate* Lam. (Aristolochiaceae), *Cyperus rotundus* L. (Cyperaceae), *Digera muricata* (L.) Mart. (Amaranthaceae), *Enicostema hyssopifolium* (Willd.) Verdon (Gentianaceae) *Lagenaria siceraria* (Molina) Standl. (Cucurbitaceae), *Launaea procumbens* (Roxb.) Ram. & Raj. (Asteraceae), *Manilkara zapota* (L.) var Royen. (Sapotaceae), *Momordica charantia* L. (Cucurbitaceae), *Psidium guajava* L. (Myrtaceae), *Punica granatum* L. (Punicaceae), *Sapindus emarginatus* Vahl. (Sapindaceae), *Syzygium cumini* L. (Myrtaceae) and *Terminalia catappa* L. (Combretaceae). From the screening experiment, *P. guajava* was selected for further *in vivo* studies since it showed best antimicrobial and antioxidant properties. An attempt has also been made to isolate the fraction responsible for its antimicrobial and antioxidant property.
The plant materials were collected from Jam-Jodhpur, Jamnagar, Gujarat, India. The plant parts were washed thoroughly with tap water, shade dried, homogenized to fine powder and stored in airtight bottles. The dried powder of the plant part was extracted sequentially by soxhlet apparatus, using different solvents depending upon their polarities like petroleum ether, toluene, ethyl acetate, acetone and water and their extractive yield was measured. The dried extracts obtained from each solvent were used for estimation of antimicrobial and antioxidant activities.

Antimicrobial activity of different solvent extracts of 16 plants was studied by agar well diffusion method. Antimicrobial activity was evaluated by measuring the diameter of zone of inhibition against 5 Gram positive bacteria, 5 Gram negative bacteria and 5 fungi, obtained from National Chemical Laboratory (NCL), Pune. Antioxidant activity of different solvent extracts of 16 plants was measured by DPPH free radical and superoxide anion radical scavenging activity. Quantitative phytochemical analysis was done by measuring total phenol, flavonoid and alkaloid content.

In the pharmacognostic study of *P. guajava* leaf, macroscopic and microscopic characters of leaf and powder were studied. Physicochemical parameters analysed were loss on drying, total ash, water soluble ash, acid insoluble ash, petroleum ether soluble extractive value, methanol soluble extractive value, acetone soluble extractive value, aqueous soluble extractive value, heavy metal analysis, pH value and solubility. The qualitative phytochemical parameters analysed were alkaloids, flavonoids, tannins, phlobatannins, triterpenes, steroids, saponins and cardiac glycosides.

The acetone extract of *P. guajava* (PGA) was fractionated into two fractions (FS I and FS II) by solvent solvent partitioning method. Antimicrobial activity in isolated fractions was studied by agar well diffusion method against 10 Gram positive bacteria, 10 Gram negative bacteria and 5 fungi. Antioxidant activity in isolated fractions was evaluated by different assays like DPPH free radical, superoxide anion radical, hydroxyl radical, ABTS radical cation scavenging activity, reducing capacity and FRAP. Quantitative phytochemical analysis was done by measuring total phenol and flavonoid content.
Toxicity study of PGA was evaluated by acute toxicity study. Single dose of the extract was administrated orally to each animal at three different dose levels (540, 1080 and 2160 mg/kg b.w.). Body weight, feed and water consumption of each animal was measured daily for 14 days. Hematological parameters and relative organ weight analysis (viz. liver, heart, spleen, thymus, lung, kidney, adrenal, testes, ovary and uterus) was done on 15th day. Antiulcer activity of PGA was studied by ethanol induced gastric ulcer and ethanol/HCl induced gastric ulcer models. Ulcer index, volume of gastric juice, pH of gastric juice, free and total acidity of gastric juice were measured.

The antimicrobial screening showed that all the plants possess good antimicrobial activity. Bacteria were more susceptible than fungi, while Gram negative bacteria were more susceptible than Gram positive bacteria. Amongst the 16 plants screened Psidium guajava showed the best antimicrobial activity. Amongst 16 plants, acetone extract of M. zapota and P. guajava had highest amounts of phenol content. The polar solvents had more phenol content and non-polar solvents had more flavonoid content. The highest total alkaloid content was in A. scholaris followed by A. squamosa. Amongst all the different solvent extracts of 16 plants screened, acetone extracts of P. granatum, M. zapota and P. guajava showed best DPPH free radical scavenging activity even better than that of the standard ascorbic acid. Amongst different solvent extracts of 16 plants screened, acetone extracts of P. guajava, T. catappa, S. cumini, M. zapota and P. granatum showed better superoxide anion radical scavenging activity than that of the standard gallic acid. Amongst all the different solvent extracts, acetone extract of P. guajava showed best superoxide anion radical scavenging activity.

Amongst the 16 plants screened, Psidium guajava showed best antimicrobial and antioxidant activities. Amongst the 5 solvent extracts studied, acetone extract of Psidium guajava (PGA) showed best antimicrobial and antioxidant activities; hence it was selected for pharmacognostic study, fractionation, toxicity and antiulcer activity.

P. guajava leaf is simple, opposite, decussate, elliptic-oblong, entire, soft hair beneath, prominent below, densely tomentose below, apex acute. The transverse section of P. guajava leaf showed presence of oil glands, plenty of blunt and pointed
unicellular trichomes, prismatic and cluster type of crystals of calcium oxalate. The highest extractive value was obtained from methanol. The crude powder and acetone extract were free from heavy metal contamination. Qualitative phytochemical analysis of crude powder and acetone extract revealed higher amounts of alkaloids, tannins, saponins and cardiac glycosides. The solubility of acetone extract was maximum in DMF, methanol and DMSO; it was acidic in nature.

In antimicrobial studies of isolated fractions, both fractions showed remarkable antimicrobial activity against all the 25 microorganisms tested except *B. subtilis* and *C. epicola*. The isolated fractions showed activity against *C. freundii* and *E. aerogenes* which were not inhibited by crude acetone extract. In antioxidant activity study of different solvent extracts, acetone extract showed better DPPH free radical, superoxide anion radical, hydroxyl radical, ABTS radical cation scavenging activities, reducing capacity and FRAP than other solvent extracts. In some cases, PGA showed lower IC\textsubscript{50} values than that of the standard, indicating better antioxidant capacity than that of the standard. FS II showed better DPPH free radical, superoxide anion radical, hydroxyl radical, ABTS radical cation scavenging activities and reducing capacity than FS I. FS I and FS II had almost the same amount of total phenol content but flavonoid content was more in FS II. A strong direct correlation between total phenol content and antioxidant activity was observed.

No adverse reactions or mortality were observed during the entire period acute toxicity study, in male and female rats dosed up to 2160 mg/kg b.w. of the PGA orally. Administration of PGA at various dose levels produced no clinical signs or adverse effects and the tested animals showed no abnormal behaviour. In antiulcer studies, PGA efficiently inhibited gastric ulcer lesions induced by ethanol (100%) and ethanol/HCl (94.78%). PGA showed better antiulcer activity than the standard in both the models. Overall it can be concluded that the use of PGA is safe at a single dose and explains the extensive utilization of this plant in traditional medicine.

Overall, it can be concluded that *P. guajava* leaf possess remarkable antimicrobial and antioxidant properties. Also, it possesses significant antiulcer activity with non toxic nature. Further research needs to be carried out to identify the bioactive compounds and evaluation of their therapeutic significance in prevention of diseases.